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Supply chain risk management and companies' competitive advantage: a contingency perspective

by

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Supply chain risk management and companies' competitive advantage: a contingency perspective

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Abstract: During the last decades companies have seen an increased in their dependence from suppliers. As a result, companies' competitive advantage strictly depends on suppliers' reliability and performance. For this reason, Supply Chain Risk Management (SCRM) has become a major topic for both researchers and practitioners. Anyway, despite the effort put in place by previous authors, no framework has been developed that can help companies to develop SCRM effectively. In an attempt to fill this gap, the study proposes a model of congruence between SCRM practices and risk conditions, and carried out its empirical test. Specifically, this study aims to empirically investigate the existence of a negative relationship between misfit - i.e. the incongruence between the adoption of SCRM practices and the potential riskiness faced by companies - and competitive advantage. To achieve our objective we mixed inductive and deductive logics: literature and case studies were used to develop our proposition, while we tested it through a survey analysis on a sample of 54 companies. Results suggest that misfit to a risk profile is negatively related to companies' competitive advantage.

Keywords: supply chain risk management, supply risk, competitive advantage, misfit model.

1. Introduction

In the last decades industrial sectors have been characterized by the spread of initiatives such as outsourcing, delocalization and increase in product variety, leading to a significant rise in firms' supply chain vulnerability (Thun and Hoenig, 2009). According to the literature (e.g., Svennson, 2000; Jüttner et al., 2003; Christopher and Peck, 2004; Tang, 2006), supply chain vulnerability is conceptualized as the exposure of network to different disturbances that can lead to obstruction of flows and to breakdown of supply chain operations. Specifically, the different disturbances affecting the network are also defined as supply chain risks (i.e., supply risk, process risk, demand risk, natural hazard risk).

During the last decades, companies have seen an increase in the dependence from external parties (i.e., suppliers) in managing their operations (Wagner et al., 2009). For this reason, supply risk management has become a top priority for managers. According to Zsidisin (2003), supply risk can be defined as "the potential occurrence of an incident associated with inbound supply from supplier failure or the supply market, in which its outcomes result in the inability of the purchasing firm to meet customer demand or cause threats to customer life and safety". By evaluating 827 disruptions that are announced by publicly traded firms during 1989-2000, Hendricks and Singhal (2005) demonstrate that when supply risk occurs companies will experience a production and/or shipment delay, an increased in their equity risk, an increased in their asset risk and an increased in their financial leverage. In other terms, companies that are not able to manage supply risk can see a significant reduction in their ability to satisfy customer's needs and stay profitably on the market, thus reducing their competitive advantage. Accordingly, the ability to manage these risks has become a fundamental concern, allowing companies to assure the continuity of supply operations and to achieve strong market positions (e.g., Jüttner et al., 2003; Lee, 2004; Tang, 2006). To this end, supply chain risk management (SCRM) has been proposed as the management of supply chain risks through coordination or collaboration among supply chain partners so as to ensure profitability and continuity (Tang, 2006).

Previous contributions on SCRM can be divided into two main groups: on the one hand many researchers studied ways to effectively reduce companies' supply vulnerability (e.g., Harland et al., 2003; Christopher and Peck, 2004; Sodhi and Chopra, 2004; Micheli et al., 2009) while on the other we find works focused on the identification/evaluation of specific risk conditions – i.e., sources or antecedents that influence the companies' exposition to supply risk (e.g., Svennson, 2000; Zsidisin, 2003; Chen and Paulraj, 2004; Wagner and Bode, 2006; Wagner et al., 2009; Ellis et al., 2010). Anyway, no framework has been developed that takes a contingency perspective and allows understanding whether SCRM practices are always good or their adoption must be tailored accordingly to the environment. Furthermore, current literature lacks of empirical evidence: some works are purely theoretical, while others are based on examples of reactions to past events, but just few investigate the current corporate response to supply chain risks (e.g., Thun and Hoenig, 2009).

This study proposes a model of congruence between SCRM practices and risk conditions, and carries out its empirical test. Figure 1 shows our conceptual framework.

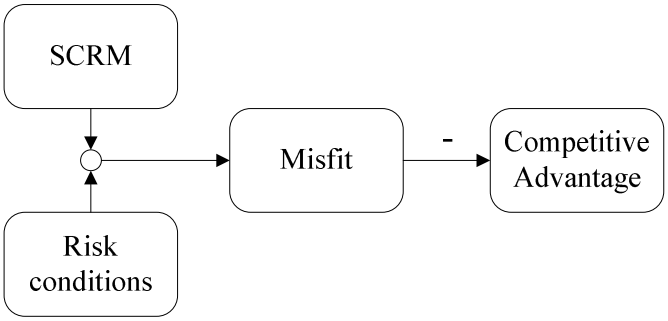

Figure 1: *The misfit between SCRM and risk conditions and its effect on companies' competitive advantage.*

The model considers that the misalignment between SCRM practices and risk conditions harms companies' competitive advantage. Indeed, high adoption of SCRM practices for companies that operate in a quite stable environment could be unfruitful or inefficient, as well as a low adoption of practices could lead to dangerous circumstances when companies operate in a risky environment.
The reminder of the paper is structured as follows. The next section discusses the research methodology. Then, the background and the development of our research proposition are discussed. Section 4 presents variables and measures. Section 5 and 6 show empirical results and their discussion. In the end conclusions are presented.

2. Methodology

In order to develop and test our model we adopted an approach that combines both deductive and inductive logics.

First, based on an extensive literature review a conceptual model was designed and operationalized within a questionnaire. Literature review allows us to identify and (re)use constructs and measurement scales that have been previously used, enhancing the reliability of our research instruments. The search for interesting publications was mainly conducted as a structured keyword search. Major database are used to search for related articles, such as those provided by major publishers, Elsevier (www.sciencedirect.com), Emerald (www.emeraldinsight.com), Wiley (www.wiley.com) or library services (e.g., Ebsco www.ebsco.com , Jstor www.jstor.org). The keywords that are used can be categorized into three groups: risks/uncertainty; supply chains/supply relationships, strategies/practices. Different combinations of these groups of keywords are used to search for literature published in the years 2000-2011. Cited references were used as secondary source.

Then, case studies were managed to collect data about the variables composing the model. This offered the possibility to refine the conceptual framework and verify completeness, clarity and

thoroughness of the operationalized questionnaire. Most importantly, case studies were very useful in order to understand the relationships among the model's variables and define our specific research proposition. Case studies were also used to analyze the reasons why companies were over-investing or under-investing in SCRM practices and the consequences of these behaviors. Secondly, case studies gave the possibility to verify the thoroughness of the questionnaire and refine measurement scales and instruments. Case studies were conducted by means of interviews with the purchasing managers of selected firms. The interviews were conducted according to the designed questionnaire. Anyway, discussions with purchasing managers went beyond the questionnaire. Attention was paid to how supply risk management practices and risk conditions can influence the company' exposition to supply risks and how the company's ability to stay on the market depends on supply disruptions. The selection of the case studies follows Voss et al. (2002). The cases were chosen as a convenience sample of medium-sized manufacturing companies able to provide a complete range of perspective. All companies are located in Northern Italy and operate in global markets. The selected cases show a level of dissimilarity that helps us in limiting the risk of selection bias. Table 1 provides descriptive information of the analyzed cases.

Cases	Employees	Total Sales	Purchasing / Revenues	Disruption experiences	ATECO and product description
A	398	65 mln €	42%	No	ATECO 28490. Produces circular saw blades and other accessories.
B	326	91 mln €	62%	Yes	ATECO 28000. Produces various types of injection molding machine.
C	361	177 mln €	61%	No	ATECO 28140. Produces various types of hydraulic valve.
D	392	88 mln €	57%	No	ATECO 22290. Produces plastic components for automotive batteries.
E	221	104 mln €	66%	No	ATECO 28130. Produces various types of compressors and pumps.

Table 1: *Case studies description*

Finally, we conducted a survey analysis on a sample of Italian companies. At a first step, a population of 300 Italian companies was selected by relying on the Aida data base (www.aida.bvdep.com) and according to the following criteria:

i. Manufacturing companies. We focused on the machinery manufacturing industry.

ii. Upstream supply chain relevance. We selected firms by considering the importance of the supply chain to their operations in order to obtain a heterogeneous sample. This selection was made based on the purchasing costs.

About the selection process, decisions regarding sample design and dimension are particularly relevant (Forza, 2002). For what concerns sample design, a stratified random sampling was performed. Stratified random sampling is a very useful type of sampling since it provides more information for a given sample size. Stratified random sampling involves the division of the population into strata and a

random selection of subjects from each stratum. Strata were identified on the basis of the above criteria and considering the organizational size of firms. Stratified random sampling ensures high homogeneity within each stratum and heterogeneity between strata.

Companies were contacted by phone calls in order to identify a reference person (i.e., purchasing manager, plant manager or who are in charge to manage the supply chain network) and to describe the research. Participants were provided with an electronic version of the questionnaire and support was given in order to guarantee full understanding of the questionnaire. In appendix the specific questions that have been used for the purpose of this paper are provided.

Finally, 54 companies provided useful and complete information for this research (thus with a response rate of 18%). Data were collected between the beginning of May and the end of August 2010. Anyway, 72% of data were collected in July (i.e., 39 companies on a total of 54). Although late respondent bias in these circumstances is not likely to characterize data, we checked for significant difference along time for all the questionnaire's items. Specifically, we divided companies into four groups according to the month in which the questionnaire was received and we run ANOVA. No significant differences were found among groups (i.e., p-values always greater than 0.49), confirming the absence of bias.

The sample is described in table 2. Companies are mainly medium sized (48.2% of the sample) but also small and large are represented. Different industrial sectors from the assembly industry are considered, mainly from the manufacturing of machinery and equipment. Concerning the incidence of the purchasing cost on revenues, the sample is rather heterogeneous.

(a)

Size*	**N**	**%**
Small	22	40.7
Medium	26	48.2
Large	6	11.1
Total	**54**	**100**

(b)

Ateco**	**N**	**%**
22	10	18.5
26	3	5.6
27	6	11.1
28	29	53.7
29	5	9.3
31	1	1.8
Total	**54**	**100**

(c)

Purchasing / Revenues	**N**	**%**
>= 70%	9	16.7
60% - 69%	16	29.6
50% - 59%	11	20.4
40% - 49%	8	14.8
<40%	10	18.5
Total	**54**	**100**

* Size: Small: less than 250 employees, Medium: 251-500 employees, Large: over 501 employees.
** ATECO 2007 Code: 22: manufacture of rubber and plastics; 26: manufacture of computers and electronic products, optical, medical electrical equipment, apparatus for measuring and watches; 27: manufacture of electrical appliances and electrical equipment for non-domestic; 28: Manufacture of machinery and equipment

Table 2: *Descriptive statistics in terms of (a) size, (b) industrial sector (ATECO 2007), (c) purchasing cost.*

3. Background and proposition development through cases

3.1 Supply chain risk management

Companies that aim to reduce their exposition to supply risk and boost their presence on final markets should rely on SCRM practices. More specifically, focal firms can leverage on three main approaches (Harland et al., 2001; Harland et al., 2003), improving the stability of their upstream:

- Be proactive. Firms can increase the reliability of their upstream network by employing two (or more) suppliers, one of which may dominate the others in terms of business share, reliability, delivery performance and price (Yu et al., 2009). By leveraging on dual sourcing, companies reduce vendors' moral hazard risk and, in case of chain disruptions, can effectively react supporting minor switching costs (Pochard, 2003; Tang and Tomlin, 2008; Wang et al., 2010);
- Be selective. By developing vendor rating programs, companies become able to identify reliable suppliers with superior capabilities and to preventively assess negative trends in their performance (de Boer et al., 2001). Specifically, by leveraging on both operational and financial criteria companies can avoid adverse selection, anticipate undesirable events (e.g., suppliers' failure), and motivate suppliers to a parsimonious conduct (Swift, 1995; Choi and Hartley, 1996);
- Be collaborative. Companies should increase coordination with suppliers and build the basis for the implementation of robust and value-added relationships. According to the literature, firms should mainly rely on supplier development programs and revenue sharing contracts (Handfield et al., 2000; Wen-li et al., 2003; Cachon and Lariviere, 2005). Indeed, investing in the coordination with suppliers can have profound positive impact on supply chain performance by creating a win-win situation (Aviv, 2001; Chen et al., 2004) and by accruing tangible benefits such as reduced costs, greater quality and flexibility, and more reliable deliveries (Krause et al., 2007; Tang and Deo, 2008).

By leveraging on practices reported above, companies manage supply risks effectively, enhancing the reliability of supply processes (e.g., Kraljic, 1983; Cohen and Agrawal, 1999; Wagner and Johnson, 2004; Tang, 2006; Wagner et al., 2009).

Albeit SCRM practices can be considered very effective in managing risks, their adoption can be costly and imply relevant investments. For example, dual sourcing typically involves additional costs compared to both single and multiple sourcing: on the one hand, focal firms face higher transaction costs due to the duplication of procurement processes; on the other, they buy at higher purchase price (back-up suppliers have to support specific investments that rise price and focal firms cannot obtain discounts cause of the little ordered quantities). Companies adopting dual sourcing see that potential benefits counterbalance additional costs, thus making it a viable solution. Hence, it is true that these practices come at a cost, making it not the best solution for all companies. Similarly, developing vendor rating programs and increasing suppliers development and coordination can lead to develop robust and value-added relationships (Dyer and Singh, 1998; Krause et al., 2007) but require focal

firms to allocate large amounts of resources. Consequently, the above approaches should lead to the creation of competitive advantage whether are consistently tailored to risk conditions characterizing the specific context in which focal firms operate. For this reason we argue that the impact of SCRM practices is context dependent.

Among the most studied antecedents of supply risk we have the criticality of purchases, the difficulty of supply markets, the environmental turbulence and the degree of global sourcing. Several publications (e.g., Zsidisin and Ellram, 2003; Peck, 2005; Wagner and Bode, 2006; Trkman and McCormack, 2009; Ellis et al., 2010) mention that the more critical these conditions are, the higher the relevance of supply risks become. For instance, when purchases' complexity and specificity are high, companies strongly depend on suppliers and the occurrence of a supplier's failure to delivery results in the firms' temporarily inability to continuously satisfy customers (Kraljic, 1983; Giunipero and Eltantawy, 2004). Then, in case of high supply market concentration and capacity constraints supply risk became more relevant because suppliers' opportunism is more likely to occur and firm's room for maneuver is reduced (e.g., Wagner et al., 2009). Third, literature relates the endogenous uncertainty coming from both technology and market changes to both supply risks' probability and detrimental effects on companies' costs and competitiveness (Zsidisin, 2003; Zsidisin and Ellram, 2003; Ellis et al., 2010): on one hand, by causing changes in the market and by requiring a greater companies' agility, exogenous uncertainty increases the likelihood of a supply disruption; on the other, because of turbulence requires increased interaction between buyer and supplier, disruptions in supply cannot be easily managed (e.g., by turning to another vendor) thus increasing their negative impact on organizations (p. 37, Ellis et al., 2010). Finally, previous contributions point out how global sourcing, in comparison to local sourcing, is usually associated with increased uncertainty as well as poorer transparency and visibility (Wagner and Bode, 2006). In this sense, global sourcing contributes to the structural complexity of the supply chain and to companies' vulnerability (Hendricks and Singhal, 2005).

Although risk conditions do not imply higher supply risk per se (e.g., increased customization or complexity of a product produce high supplier dependency that is not necessarily risky, indeed one could argue that high dependency implies longevity, commitment and trust between the buyer and supplier), they represent sources of risk whether not adequately managed. Consider for example global sourcing: on one hand it can contribute to the companies' competitive advantage (i.e., it allow to acquire best resources, knowledge and technologies that are not available locally, it allow to reduce purchases unavailability by operating with responsive suppliers) (Porter, 1990; Monczka and Trent, 1991; Herbig and O'Hara, 1996; Trent and Monczka, 2003). But, when companies do not strategically approach global sourcing by leveraging on selective and collaborative practices, it implies higher costs, opportunism in supply relationships and higher exposition to natural hazard risk (i.e., exposition to unexpected environmental, political and economic events that can produce supply disruptions).

In this vein, one could argue that SCRM adoptions should be precisely tailored to risk conditions in order to avoid unpleasant consequences (e.g., production and/or shipment delays, increased financial leverage, negative abnormal returns on stocks, reduced market share and brand value, etc.) and exploit the opportunity offered by the specific environment in which companies operate. Anyway, literature lacks of both conceptual and empirical studies approaching SCRM from a contingency perspective.

3.2 The contingency perspective

From a theoretical point of view, the issue we face can be well analyzed by adopting a contingency perspective. Contingency theory argues that the best way to organize depends on the nature of the environment to which the organization must relate (Donaldson, 2001). Specifically, it posits that the relationship between the relevant independent variable and the dependent variable will not be simply linear but will be different for different levels of the critical contingency variable. Here, relevant independent variables are the SCRM practices' adoptions, the dependent variable is the firm' competitive advantage and risk conditions are considered to be contingency factors.

According to the contingency perspective, in order to be effective, SCRM adoptions must be consistent with risk conditions characterizing the environment in which companies operate. As a consequence, companies that operate in risky conditions are those that more likely will implement SCRM practices, or, if they don't, they will suffer from potential disruptions. On the other side, we can expect that companies operating in a rather stable environment will tend to limit the application of SCRM practices since benefits from an extent use of them would probably not pay off.

The concept of achieving fit between practices adoptions and risk conditions relates to the general idea that companies will gain better results if they organize coherently with the external context. The relationship between fit and performance is not a new topic and several contributions have been provided in different fields of research such as organization theory and design (e.g. Donaldson, 2001), strategic management (e.g., Venkatraman, 1989) and manufacturing strategy (e.g., da Silveira, 2005). Anyway, no framework has been yet proposed to consider explicitly this perspective in the analysis of SCRM practices

Different definitions of fit have been proposed in literature, mainly referring to two main concepts: fit as iso-performance in the reductionist perspective and fit as congruence or profile deviation in the holistic perspective. Table 3 summarizes and compares the two perspectives.

Characteristics	*Fit as iso-performance*	*Fit as congruence or profile deviation*
Dominant approach to the specification of fit	Fit between a few characteristics of environment and a few characteristics of strategy	A broader conceptualization of co-alignment between several characteristics of environment and several characteristics of SCRM
Strengths	Ability to isolate precisely specified theoretical links and impacts; systematic replication and extensions could lead to cumulative knowledge	Ability to retain the complex, interrelated nature of linkages; systemic view is maintained
Weaknesses	Specification errors due to invoking ceteris paribus conditions; inability to isolate conflicting contingencies – high likelihood of logical typing error due to disaggregation	Complex nature of co-alignment makes it difficult to hypothesize the nature of co-alignment
Common analytical methods	Multiple regression analysis with interaction terms; ANOVA subgroup analysis	Pattern analysis (i.e., profile deviation), canonical correlation analysis, second-order analysis

Table 3*. A comparison of reductionist and holistic perspective of co-alignment (venkatraman and Prescott, 1990).*

The reductionistic perspective of co-alignment is based on a central assumption that the fit between two constructs (such as SCRM and environment) can be understood in terms of pairwise co-alignment among the individual dimensions that represent the two constructs. In other words, fit as iso-performance refers to the idea that for each value of the contingency variable there is a value of the structural variable that is a fit, producing the highest performance for that value of the contingency (Woodward, 1980). In this perspective, all fits are equally good and companies willing to improve their performance need to focus on reducing the misfit of structural and contingency variables.

In contrast, fit as congruence perspective is based on a central premise that it is important to retain the holistic nature of the strategy-environment co-alignment. Accordingly to Venkatraman and Prescott (1990), this follows Van de Ven and Drazin (1985) articulation of fit as “that characteristics of environmental niches and organizational forms [that] must be joined together in a particular configuration to achieve completeness in a description of a social system – like pieces of a puzzle must be put together in a certain way to obtain a complete image” (p. 323). Thus, tests of the performance effects of congruence should reflect the simultaneous and holistic pattern of inter-linkages between SCRM practices and risk conditions. According to previous works (Miles et al., 1978; Andrews, 1987), this perspective allows the researcher to specify a profile (i.e., given by external conditions and representing the needed levels of practices’ adoption) and to demonstrate that adherence to such a profile has systematic implications for effectiveness. Pfeffer (1982) refers to this concept as the "consonance hypothesis", i.e., "those organizations that have structures that more closely match the requirements of the context will be more effective than those that do not" (p. 158).

Fit as congruence appears to be the dominant approach within operations management literature (e.g., Bozarth and Berry, 1997; Smith and Reece, 1999; da Silveira, 2005) and it's the one we develop in this work. Specifically, we implement a procedure to measure the incongruence between SCRM practices and risk conditions as misfit or the deviation of independent variables (i.e., levels of SCRM practices' adoption) from the company's risk profile (i.e., the potential riskiness faced by companies that can be evaluated on risk conditions) in a n-dimensional space (Venkatraman, 1989; Venkatraman and Prescott, 1990). We propose a model of congruence adopting the holistic perspective for the two main reasons. First of all, this scheme retains the systematic nature of the strategy-environment co-alignment, thus it overcomes the subjectivity that underlies the interpretation of clusters. Secondly, this scheme is flexible and allows incorporating the relative importance of the constituent SCRM strategy dimensions (i.e., SCRM practices) and the relative importance of the constituent environmental dimensions (i.e., risk conditions) into the measure of co-alignment based on theoretical and empirical reasoning. In this way, a multivariate measure of co-alignment is obtained that can be used to examine relationships with a variety of criterion measures, which differs from the cluster-analytic approach that treats co-alignment in categorical terms.

3.3 Case studies and proposition development

The previous analysis of current literature provides clear explanation of the relationship that may exist between SCRM–environment incongruence and firms' competitive advantage. However, case studies and their comparison allowed us to better define this relationship and develop a specific proposition.

In all case studies, purchasing managers perceived risk management as very critical for the company's success. Indeed, managers are conscious that supply disruptions do not exclusively lead to higher purchasing costs but directly influence the company ability to continuously satisfy market and take advantage on competitors. Consequently, SCRM practices represent indispensable levers to build robust and value-added supply relationships able to contribute to the company's competitive advantage.

The purchasing manager of company C pointed out that, as any other managerial practice, SCRM tactics absorb significant resources. Most importantly, the manager suggested that an extensive implementation of practices may sometimes be inappropriate. Specifically, he argues about his ability to understand the context and to effectively tailor the SCRM configuration. He stated that his company (a) operates in a context where market and technological changes are not on the agenda and (b) purchases complex and customized goods from few global suppliers operating in a quite mature market. As a consequence, he decided for a pondered adoption of SCRM levers: he focuses on the adoption of mechanisms that reduce suppliers' opportunism (i.e., dual sourcing) but does not rely so much on rating and development programs because its suppliers are leading firms with quite stable performance.

In this vein, the comparison between company A and company D helped us to understand the effect of an over-adoption of SCRM practices. While company A relies on risk management moderately, company D is characterized by an extensive adoption of SCRM practices that absorbs large amounts of resources but that, at the same time, is unable to significantly increase the company's ability to stay on the market. Specifically, company A and D face similar risk conditions (i.e., low risk): they both purchase raw materials with standard quality certifications (e.g., ISO 2859 and Acceptable Quality Levels standards), they both operate in a quite stable environment (i.e., technology and customers' needs are predictable) and they both rely exclusively on local suppliers. However, company D appears to have over invested in SCRM practices. Specifically, the company declares to rely on back-up sources for the largest part of its supplies (i.e., more than 50% of purchases are managed through dual sourcing) and to monitor all its vendors on a monthly frequency by assessing both their operational reliability (i.e., assessing safety levels and maintenance programs characterizing suppliers' plant) and their financial stability. Company D shows good business performance (i.e., 11% of EBITDA margin that is in line with its direct competitors), but the over-adoption of practices is unfruitful: on one hand dual sourcing and monitoring practices have boosted the supply base complexity whose management absorbs lots of internal resources, on the other these practices did not generate concrete benefits (e.g., higher suppliers responsiveness, higher goods availability, higher supplies reliability). The company SCRM configuration results from the fact that firm D produces plastic components for the automotive industry. Car manufacturers, by strictly monitoring their entire supply networks and by requiring greater quality and higher levels of service, are pushing partners to increase their reliability. This pressure results in higher adoptions of SCRM practices along the chain that is an optimum for car manufacturers but probably not for the other companies. Differently, firm A appears to be more congruent than company D: for instance, it relies pretty less on dual sourcing and on monitoring (e.g., it focuses exclusively on key supply relationships that represent less than 10% of the total). As highlighted by its purchasing director, risk conditions describe a stable environment and additional investments in SCRM practices would not contribute to further reduce companies exposition to risk or achieve others benefits.

Finally, the comparison between company B and company E showed how the under-adoption of SCRM practices can harm companies' competitive advantage. While company E reinforces its ability to stay on the market by tailoring risk management practices consistently to the environment, company B is penalized by its under-adoption of SCRM practices. Company E and company B face a similar risk scenario in terms of risk conditions (i.e., high risk): they both face frequently changes in product's underlying technologies and in customers' needs, they both purchase customized sub-assemblies with numerous sub-parts, and they both extensively rely on vendors that operate outside Europe (i.e., both purchase more than 30% of goods outside continent). The two companies, however, show a different adoption of SCRM practices. Unlike company E, firm B does not define and review formally its supply strategy. This leads company B to take inappropriate purchasing decisions (i.e., the company

manages only sole sourcing relationships to benefit from quantity discounts), thus limiting the exploitation of its supply markets characteristics (i.e., supply markets of company B are very fragmented) and increasing its exposition to supply risks (i.e., sole sourcing generally implies high dependency on suppliers and lacks of strategic benefits). Moreover, company B rarely analyses the operational stability and the financial performance of its vendors, with consequent high exposition to the adverse selection risk. Last but not least, company B scarcely invests in suppliers development programs: it exclusively cares of upstream' logistics performance without exploiting suppliers' innovativeness and technological potential. During the last few years the company lost its market leadership, partially because suppliers' failures and opportunistic behaviors have harmed its ability to continuously satisfy its customers. Conversely, company E has significantly invested on several SCRM practices to mitigate the negative effect exerted by risk conditions: first, it has gained higher flexibility and ability to respond to unexpected demand by relying on back-up suppliers that can provide additional productive capacity; second, it has been able to increase its ability to innovate by collaborating with best suppliers well selected and developed. Thus, company E declared that its ability to understand the environment and configure SCRM practices significantly contributed to its competitive advantage by strengthening its supply processes and its market position.

The analyzed cases highlight the importance of contingent factors in determining what companies do in terms of SCRM practices. We aim at testing whether the existence of misfit (i.e., the lack of congruence) between SCRM practices and risk conditions reduces companies' competitive advantage. Based on our empirical observations and theoretical contemplations we propose the following research proposition:

> **RP1.** Misfit between the adoption of SCRM practices and the risk profile estimated on risk conditions is negatively related to competitive advantage.

The research proposition is illustrated in figure 2. Two hypothetical organizations are represented in terms of fit to the risk profile. The risk profile is derived by contingency variables (i.e. risk conditions) coherently with contingency theory and the misfit of each organization can be evaluated as deviation of SCRM practices from this risk profile.

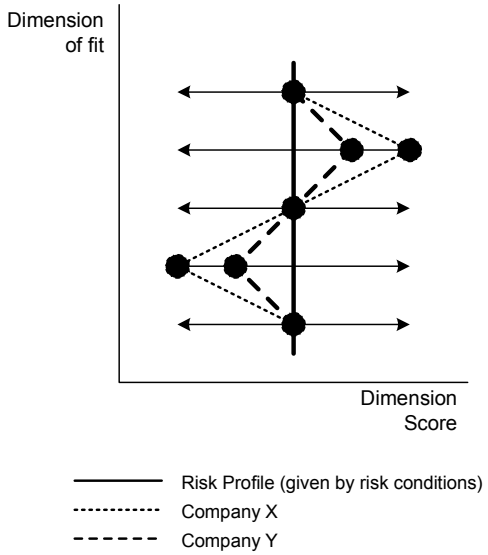

Figure 2: *An illustrative example of the misfit model*

The straight line at the center of the diagram represents the theoretical risk profile for both company X and Y i.e., two generic firms operating in similar context. Despite they share the same risk conditions, companies are characterized by a different adoption of SCRM practices. In this illustrative example both firms are misaligned, although company Y is more congruent than company X.

4 Measures

Measures of SCRM practices, risk conditions, misfit and competitive advantage are discussed below. In order to measure some of our variables, we used exploratory factor analysis (principal component with varimax rotation) on items available from the questionnaire. Questionnaire's metrics were derived from the literature (Choi and Harley, 1996; Krause et al., 1998; de Boer et al., 2001; Droge et al., 2003; Chen and Paulraj, 2004; Chow et al., 2008; Ellis et al., 2010) and adapted for the specific purposes of this research. Details on factor analysis and validity of constructs are presented into the first paragraph of the fifth section.

4.1 SCRM practices

We considered four SCRM levers in our framework: dual sourcing (DS), vendor rating (VR), supplier integration and development programs (SID) and the adoption of revenue-sharing contracts (RSC). Consistently with literature (e.g., Harland et al., 2003; Jüttner et al., 2003; Tang, 2006), we focused on these four practices because they represents effective sources of supply networks stability (Harland et al., 2003). Referring at the examples mentioned in the previous sub-section, a company that faces supply markets' capacity constraints can preventively develop relationships with back-up suppliers in order to reduce switching costs occurring when the unique supply source became unavailable (Yu et

al., 2009; Wang et al., 2010).Thus, we measure the percentage of purchases for which companies manage back-up sourcing. Then, firms can preventively reduce risks by better selecting and monitoring suppliers. Indeed, companies that rely on both operational and financial criteria demonstrate high supply management capabilities and should be able to identify robust suppliers with high strategic capabilities (i.e., quality, financial stability and technological capabilities) (Choi and Hartley, 1996; de Boer et al., 2001). Accordingly, we measure the extent to which company use operational and financial criteria to select and monitor its suppliers. Third, according to Krause et al. (1998), supplier integration and development has been defined as "any effort by an industrial buying firm to improve the performance or capabilities of its suppliers". By measuring the extent to which companies invest in sharing information, knowledge and resources with vendors, we are able to evaluate whether firms are capable to enhance suppliers' potential, prescribe commitment and foster cooperation (Wen-li et al., 2003; Krause et al., 2007). Finally, the extent to which companies rely on revenue-sharing contracts relates to the companies' ability to align suppliers' goals, share risk and manage long-term relationships (Cachon and Lariviere, 2005).

Table 4 summarizes variables used, the methods employed to measure them and the reference from which questionnaire's metrics were taken.

Risk conditions	*Variable*	*Description of measurements*	*References*
Dual Sourcing	DS	One item measuring the percentage of purchases for which the company managed two suppliers (i.e., a primary source plus a back-up vendor).	-
Vendor rating	VR	A Construct is built on 3 five point likert-scale items that measures the companies' adoption of criteria useful to select and monitor best suppliers	Choi and Harley (1996); de Boer et al. (2001)
Supplier integration and development	SID	A Construct is built on 3 five point likert-scale items that measures the effort that companies spend in building collaborative relationships with suppliers, e.g. sharing knowledge and resources	Wen-li et al. (2003); Krause et al. (2007);
Adoption of Revenue-sharing contracts	RSC	One item on a five point Likert-scale that measures the companies' adoption of supply contract that allow to build long-term relationship and motivate suppliers by share market risks.	-

Table 4. *Summary of measurements of SCRM practices*

4.2 Risk Conditions

In this study we focused on four risk conditions: difficulty of supply markets (DSM), environmental turbulence (ET), purchases' criticality (PC) and global sourcing (GS). As discussed before, we focus on these four risk conditions because they represent all the contingent factors able increase companies vulnerability to supply risks and mine firms' longevity. For example, high supply market

concentration and capacity constraints enhance the likelihood of the purchases' unavailability risk and, contemporarily, represent a significant barrier when companies have to substitute an unreliable supplier with a new source (Wagner and Bode, 2006). Thus, we asked companies to provide an evaluation of the concentration and the capacity constraints of their supply markets. Then, when technology innovate very frequently and customers' needs change very quickly, environmental turbulence is high and suppliers may be not able to effectively react, leading to lower levels of service (Paulraj and Chen, 2007). Accordingly, companies provided us an evaluation of two specific characteristic of their final market: the frequency of product/process innovation (i.e., it can be considered a proxy for the technological turbulence) and the level of variability in customers' needs during time (as a proxy for market turbulence). Finally, companies that buy high complex and specific goods or that manage relationships with foreign vendors face an increased supply chain complexity. This in turn produces undesirable and costly consequences e.g., lack of visibility, moral hazard risks, and natural hazard risks (Wagner et al., 2009; Ellis et al., 2010). Hence, we ask companies to define the degree of complexity and specificity of their strategic purchases as well as the percentage of suppliers operating outside Europe.

As explained, the presence of these contingencies puts companies at risk and, if not adequately mitigated, can erode companies' competitive advantage.

Table 5 summarizes variables used, the methods employed to measure them and the reference from which questionnaire's metrics were taken.

Risk conditions	*Variable*	*Description of measurements*	*References*
Difficulty of supply markets	DSM	A construct is built on 2 five point likert-scale items measuring the degree of concentration and capacity constraints characterizing firms' supply markets.	Wagner et al. (2009); Ellis et al. (2010)
Environmental turbulence	ET	A construct is built on 3 five point likert-scale items measuring the unpredictability of products/processes technological trajectories and the turbulence characterizing final market's needs.	Chen and Paulraj (2004)
Purchases criticality	PC	A construct is built on 2 five point likert-scale items measuring the degree of complexity and specificity of companies' key purchases.	Ellis et al. (2010)
Global Sourcing	GS	One item measuring the percentage of goods that companies purchase from suppliers that operate outside Europe	Cohen and Mallik (1997)

Table 5. *Summary of measurements for risk conditions*

4.3 Misfit measure of congruence

As discussed earlier, congruence is conceptualized in terms of SCRM adherence to the risk profile evaluated on different risk conditions that characterizes a specific environment. The implication is that

a deviation from such a risk profile reflects a misalignment, and should have corresponding negative relationship with competitive advantage. The analysis of misfit as profile deviation is often operationalized as the weighted Euclidean distance between the experimental unit and an ideal profile (in our case it is named risk profile) along the variables considered significant in the fit equation (Venkatraman, 1989; Venkatraman and Prescott, 1990). Accordingly to literature (Venkatraman and Prescott, 1990; da Silveira, 2005), for this study the measure of misalignment is specified as:

$$MISFIT_i = \sqrt{\frac{D_i}{j-1}} = \sqrt{\frac{\sum_{j=1}^{4} \left(W_j * \left(X_{ij} - \tilde{X}_i \right) \right)^2}{4}} \qquad (1)$$

where D_i is the weighted distance between organization *i* and its risk profile, W_j is the weight of practice *j*, X_{ij} is the standardized degree of adoption of practice *j* in organization *i*, and $\tilde{X}_i$ is the risk profile score of organization *i*, which is given by the weighted sum of its *k* risk conditions. In this study, *i* varies from 1 to 54, *j* varies from 1 to 4, and *k* varies from 1 to 4. All the considered variables were standardized due to different response scales used in the survey. Equation (1) provides scores that are closer to a normal distribution, which is an assumption in regression analysis. Hence, equation (1) is used in the subsequent stages of the analysis.

The risk profile of organization *i* is calculated by the weighted mean of its four risk conditions, where W_k represents the weight of the k risk condition:

$$\tilde{X}_i = \frac{\sum_{\mathrm{k}=1}^{4} (W_k * \mathrm{X_{ik}})}{\sum_{\mathrm{k}=1}^{4} W_k} \qquad (2)$$

Intuitively, the risk profile $\tilde{X}_i$ represents both the exogenous riskiness faced by organization *i* and the ideal adoption of SCRM practices that *i* should implement to properly manage that turbulence.

Equation (1) builds on Venkatraman and Prescott (1990), Ahmad and Schroeder (2003) and da Silveira (2005) but has been adapted to reflect the differential weights of SCRM practices on companies' ability to manage risk and the differential weight of risk conditions on companies potential exposition to that risk. Indeed, assuming equal weights for the underlying dimensions of the model is inadvisable because an effective package of resource deployments (i.e., adoptions of SCRM practices) should reflect differential emphasis, which depends on (a) the importance of each particular SCRM practice to the company's ability to manage risk and (b) the relevance of each particular risk condition to the potential companies' exposition to that risk (Venkatraman, 1989). Nevertheless, literature doesn't provide clear guidance about the relative importance of SCRM practices to the company ability to manage risk or about the relative contribution of each risk condition on the companies' potential exposition to supply risk. Additionally, we are unable to estimate W_j and W_k through the procedure applied by Venkatraman and Prescott (1990): we don't have a calibration sample and any

measures of the companies' exposition to risk that can be used as dependent variables in a regression equation. Moreover, we cannot estimate W_j and W_k by regressing our measure of competitive advantage (i.e., market share described in the following section) on both SCRM practices and risk conditions: according to our conceptual framework, considering direct relationships between SCRM and competitive advantage would be a great mistake. Thus, in the subsequent analysis, we set W_j and W_k equal to one. We will discuss the limitations of this assumption in the conclusions.

4.4 Competitive advantage

According to Hendricks and Singhal (2005) manufacturing companies should manage supply chain risks in order to sustain performance and maintain (or improve) competitive advantage over time. Hence, companies aiming to achieve a sustainable competitive advantage should appropriately manage supply relationships, mitigating risks as effectively as possible. With specific concern on supply risk management, in this work we hypothesize that the success of manufacturing companies is directly influenced by the incongruence between risk management practices and risk conditions. Indeed, companies able to evaluate their vulnerabilities and appropriately adopt SCRM levers will increase their competitive advantage through two pathways: as a consequence of reliable supply operations that allows companies to continuously satisfy customers' needs as well as from fruitful collaborations difficult to be imitated by competitors that contribute to the companies' ability to stay on the market (Dyer and Singh, 1998).

Previous literature that empirically investigate competitive advantage have adopted two main kind of dependent variable: certain authors relied on business performance such as market share or return on total assets (e.g., Powell, 1992; Dreyer and Gronhaug, 2004; da Silveira, 2005), while other employed operational performance e.g., external flexibility, fast delivery, manufacturing costs (e.g., Flynn et al., 1995). Accordingly, one measure of companies' competitive advantage was used as dependent variable in the analysis: market share (MKTS). This was assessed using the question, "please indicate the current performance for your business on a 1-5 likert scale where 1 represents lower than your competitors and 5 higher than your competitors". We decided to use this measure for two specific reasons: first, this measure allows us to take into account all the positive effects exerted by a SCRM-environment alignment on company competitiveness. Indeed, we assume that market leaders (i.e., who hold the largest share in a specific market) are organizations that (a) continually satisfy customers' needs, (b) manage internal resources efficiently and (c) develop value-added supply relationships that are difficult to be imitated by competitors. Second, similar kinds of subjective measure are widely used within literature that studies companies' performance and competitive advantage (Dess, 1987; Powell, 1992; Vachon and Klassen, 2008).

5 Analysis and results

The procedure for testing our research proposition involves two sequential steps. First, we ran factor analysis to build the instruments needed for the purpose of our study. At this first step, we also checked for reliability and validity of measures. Second, we evaluated correlations among variables constituting our model and finally we carried out the testing of our proposition.

5.1 Factor analysis

Exploratory factor analysis (principal component with varimax rotation) was performed and unbiased latent factors were predicted by means of the Bartlett's method. In our case, the one factor solution explains only 25% of the total variance and the analysis suggests a solution with at least four factors (considering eigenvalues above 1). Thus, we can conclude that common method bias is not a cause of concern in this data. Table 6 shows factors loadings, Cronbach's alpha and items' uniqueness.

Item	*DSM*	*ET*	*PC*	*VR*	*SID*	*Uniqueness*
DSM1. Supply markets concentration	0.88					0.20
DSM2. Capacity constraints of supply markets	0.87					0.21
ET1. Product technology innovation		0.82				0.22
ET2. Process technology innovation		0.67				0.29
ET3. Turbulence of customers' needs		0.70				0.35
PC1. Purchases complexity			0.90			0.15
PC2. Purchases specificity			0.88			0.18
VR1. Technological characteristic of supplier's plant				0.73		0.25
VR2. Operational safety and maintenance programs				0.80		0.23
VR3. Cash flows (past and expected)				0.62		0.37
SID1. Shared Human Resources					0.74	0.33
SID2. Shared know-how and competences					0.80	0.31
SID3. Others improvement programs					0.71	0.34
Cronbach's Alpha	0.78	0.73	0.79	0.71	0.67	
Eigenvalues	1.70	2.00	1.92	1.74	2.01	
Explained Variance	0.13	0.15	0.15	0.13	0.16	
Explained Variance (cumulative)	0.13	0.28	0.43	0.56	0.72	

Table 6. *Factor loadings, Cronbach's Alpha, and items' uniqueness.*

Factor analysis shows good results in terms of eigenvalues, explained variance and reliability of constructs. Although alpha of the supplier integration and development construct is below the threshold suggested by Nunnally et al. (1967), it can be considered sufficient to demonstrate the reliability of a moderately broad construct build on three items (Van de Ven and Ferry, 1980). Moreover, according to the literature (pp. 86, MacCallum et al., 1999), given the scarce uniqueness characterizing items, our sample size may be considered adequate for a 13-items factor analysis.

To additionally test the quality of our measures, we checked for discriminant and convergent validity of constructs. First, correlation analysis demonstrates how measures of constructs that theoretically should be related to each other are, in fact, observed to be strongly related to each other (see bold estimates shown by table 8 in appendix): this demonstrate the convergent validity of our factors. Second, correlation analysis demonstrates how measures of constructs that theoretically should not be related to each other are, in fact, observed to not be strongly related to each other (see table 8 in appendix): this demonstrate the discriminant validity of our factors. Then, for measures involved in the above factor analysis, we evaluated the determinant of the inter-items correlation matrix (0.008), the Bartlett's test of sphericity (chi-square = 185.091; Degrees of freedom = 78; p-value = 0.000) and the Kaiser-Meyer-Olkin measure of sampling adequacy (individual KMO always greater than 0.51; overall KMO = 0.60). According to the literature (Dziuban and Shirkey, 1974), these results demonstrate the validity of our instruments.

5.2 Regression analysis

We performed pairwise correlations among questionnaire's items (see table 8 in appendix). Our analysis identified many significant correlations among model's variables, all consistent with our conceptual framework (see italic estimates shown by table 8 in appendix). Positive correlations among DS' items and SID's items confirm the existence of a positive relationship between the different SCRM practices. Then, correlations among SID' items and TT' items confirm that companies that operate in riskier conditions usually rely more on SCRM practices. In the same vein, we found positive correlations between VR's items and TT's items, and between VR's items and DSM' items. Positive correlations are also identified between PC' items and ET' items, highlighting how higher component complexity and specificity usually appear when technology and customers' needs are turbulent. Finally, accordingly to Frear et al. (1992), correlations between ET' items and GS suggests that companies facing high market and technological turbulences usually rely on local suppliers. The absence of significant correlations involving MKTS is finally expected: according to our proposition, SCRM practices and risk conditions don't have direct relationships to companies' competitive advantage.

The research proposition was tested with OLS regression analyses using MISFIT as independent variable and MKTS as dependent variable. Previous contributions (e.g., Naman and Slevin, 1993; Ahmad and Schroeder, 2003; da Silveira, 2005) have used regression analysis to test relationships between misfit and similar performance measures. We considered company size and industry as control variables. Size was measured considering the number of employees of the company. Industry

was measured by means of dummy variables, one for each ATECO sector. The analysis didn't show any significant estimate for control variables. Furthermore, as the inclusion of these control variables did not improve fit or change the other coefficients significantly in the regression, we removed these control variables to improve the power of the estimation. Table 7 provides results of the regression analysis on our measure of competitive advantage.

	MKTS
(Constant)	0.97
p-value	*(0.093)*
MISFIT	-0.91
Std. Err.	*0.272*
p-value	***(0.002)***
R^2	*0.25*
Adj - R^2	*0.23*

Table 7. *Regression analysis of MISFIT with MKTS as dependent variables*

The analysis shows that MISFIT relates significantly to MKTS. The negative sign of the regression coefficient is consistent with the research proposition: an increased level of MISFIT leads to a reduction in companies' competitive advantage. The explained variance is acceptable and higher than the one of previous works adopting similar approaches (e.g. da Silveira, 2005).

4. Discussion and conclusion

Our empirical results suggest that misfit to a risk profile is negatively related to market share. This finding is consistent with contingency perspective arguments: the best way to organize depends on the nature of the environment to which the organization must relate (Donaldson, 2001). In this sense, companies that have achieved strong market positions and are able to continuously satisfy their customers, are the ones that achieve fit between risk conditions and the adoption of proactive, selective and collaborative practices. These findings reinforce the importance of achieving fit in SCRM strategy and have direct implications for supply chain companies that aim to maintain or increase their competitive advantage. These organizations must evaluate their potential upstream vulnerability (i.e., by assessing risk conditions) and identify which parts of their SCRM strategy are incongruent. This comparison should guide investments to reduce deviation and consequently overcame competitors.

From a managerial perspective, our results show evidence of the importance of properly measuring the external environment. In order to be able to properly fit the context, companies need to have proper measures of how the environment is changing. This puts emphasis on introducing proper measures of external risks so to highlight if new investments are needed. Similarly these results highlight the potential positive effects of benchmarking with other companies. Our cases in fact show that comparing what companies are doing in similar contexts allows identifying potential areas of

improvement. Companies should thus devote some attention also to what similar firms (either direct competitors or referral companies) are doing.

Another important issue refers to investments effectiveness. In our work we highlight that SCRM investments should be aligned with the external context. However companies can invest in different practices (e.g., dual sourcing, vendor rating, etc.) which can lead to different results. In our work we didn't analyze the relative effectiveness of different investments nor the potential costs these imply. We argue that future works should evaluate under which conditions different practices are more or less effective so to provided proper guidance to companies in deciding where and how to invest.

So, this study provides two major contributions to SCRM research and practice.

First, we developed a methodology for measuring fit as profile deviation in the context of SCRM. No similar models have been yet proposed in this field of research. Starting with the Euclidean distance scheme proposed by Venkatraman and Prescott (1990), this study develops a measurement procedure using deviation measures, PCA and regression analysis that might be used by other researchers aiming at investigating the empirical effects of fit in the SCRM discipline. We also argue that empirical application of the methodology is a rather important contribution; SCRM literature is in fact characterized by limited empirical evidence.

Second, this work has provided evidence that designing properly a SCRM configuration is an important issue for companies. In fact, results point out that firms showing dominant market positions (i.e., higher market share) are those that operate coherently with risk conditions characterizing the environment in which they are active. Our hybrid research approach (i.e., both inductive and deductive logics were applied) allowed to highlight that companies that fit the external environment can benefit from this in terms of competitive advantage.

In the end we would like also to address some of the limitations of this work. First of all the sample is limited to only 54 Italian companies. The limited sample forced us to assume risk conditions as equally relevant in defining the context companies are facing. Thus, future works should refer to wider datasets so to ensure statistical validity of the analyzed relationships.

Second, attention here was paid only to supply risk while other SCRM practices and risk conditions could be operationalized and empirically studied. Hence, future works should extend the model, for instance taking in consideration demand risks and others risk management practices. Moreover, the relative effectiveness of the different practices was not assessed and researching this aspect could be an important contribution to companies so provide them guidance in managing SCRM investments.

We didn't address explicitly the relative cost of the different investments. Companies may accept some misfit since SCRM imply costs that can limit the economical convenience of specific investments. Specifically companies may face a trade-off between costs for SCRM investments and costs due to supply chain risks. Moreover while SCRM investments imply costs that directly impacts on balance sheets, supply risks have potential costs that may influence economical results. Thus

companies may consider acceptable some degree of misfit. Future works addressing explicitly this trade-off would significantly improve the knowledge on this issue.

Finally, we recommend future works to investigate more the relationship between the over-adoption of SCRM practices and the efficiency performance of companies in order to accept or reject our previous argumentation.

Appendix

Items	MKTS	DSM1	DSM2	ET1	ET2	ET3	PC1	PC2	GS	DS	VR1	VR2	VR3	SID1	SID2	SID3	RSC
MKTS	1																
DSM1	0.00	1															
DSM2	-0.00	**0.63*** **	1														
ET1	-0.09	0.05	0.11	1													
ET2	-0.23	-0.13	0.05	**0.52*** **	1												
ET3	-0.24	0.03	0.02	**0.52*** **	**0.36** **	1											
PC1	-0.11	0.09	-0.15	*0.29***	0.23	*0.39****	1										
PC2	-0.06	0.07	0.02	0.16	0.19	*0.28***	**0.66*** **	1									
GS	-0.20	0.17	0.12	-0.20	-0.06	*-0.36****	-0.07	-0.10									
DS	0.11	0.00	0.03	0.07	0.18	0.16	0.19	0.19	-0.16								
VR1	0.01	0.09	0.08	0.22	0.02	*0.35***	*0.33***	0.21	0.05	-0.02	1						
VR2	0.11	0.19	0.15	0.17	0.06	0.23	0.07	0.15	0.04	-0.10	**0.65*** **	1					
VR3	0.08	0.15	*0.28***	0.17	0.16	0.22	0.06	0.10	0.01	0.16	**0.35** **	**0.33** **	1				
SID1	0.03	-0.06	0.03	0.23	*0.32***	0.15	0.17	0.06	-0.04	0.17	0.11	0.08	*0.34***	1			
SID2	0.16	-0.17	-0.17	0.00	0.17	0.22	0.02	-0.01	-0.14	*0.26***	-0.07	0.01	0.13	**0.48*** **	1		
SID3	0.03	-0.20	-0.21	0.01	*0.31***	0.13	*0.24**	0.04	-0.12	*0.26***	0.07	0.19	0.00	**0.40** **	**0.37** **	1	
RSC	0.00	0.02	0.01	0.14	0.17	-0.06	-0.02	0.08	-0.18	-0.13	0.17	0.21	-0.03	**0.18**	**-0.23**	0.09	1

* p < .10 - ** p < .05 - *** p < .01

Bold correlations demonstrate stronger relationships among items belonging to the same construct. Italic estimates demonstrate significant relationships among model's variables.

Table 8. *Correlation matrix. Pairwise correlation among the items considered in this research. Market share (MKTS), difficulty of supply market (DSM), environmental turbulence (ET), purchases criticality (PC), global sourcing (GS), dual sourcing (DS), vendor rating programs (VR), supplier integration and development (SID), revenue-sharing contracts (RSC).*

1. How would you describe the following characteristic of your purchases portfolio?					
	Poor				high
Concentration of supply markets	1	2	3	4	5
Capacity constraints of supply markets (Suppliers' capacity utilization and suppliers' breakeven stability)	1	2	3	4	5

Table 9. *Items that relate to the difficulty of supply markets*

2. How would you describe the following characteristics of your business context?					
	Poor				high
Frequency of product technology switch	1	2	3	4	5
Frequency of process technology switch	1	2	3	4	5
Speed of change of customer and market needs	1	2	3	4	5

Table 10. *Environmental turbulence's items*

3. How would you describe the following characteristic of your key purchases?					
	Poor				high
Degree of purchases complexity (i.e., N° of subparts; N° of interfaces, etc.)	1	2	3	4	5
Degree of purchases specificity (i.e., customized parts, specific treatments, etc.)	1	2	3	4	5

Table 11. *Purchases criticality's items*

4. Please, provide an evaluation of the percentage of goods purchased in Italy, in Europe (but outside Italy), and outside Europe:	
Italy	_____ %
Europe	_____ %
Outside Europe	_____ %
Total	**100 %**

Table 12. *Global Sourcing*

5. Please, provide an evaluation of the percentage of supply relationship manage by the dual sourcing practice:	
Dual Sourcing	_____ %

Table 13. *Dual Sourcing adoption*

6. How frequently do you use the following criteria in selecting and monitoring your suppliers?	Never				For each kind of good
Technological characteristic of supplier's plants	1	2	3	4	5
Operational safety and maintenance programs within supplier's plants	1	2	3	4	5
Cash flows (past and expected) and financial strength of each supplier	1	2	3	4	5

Table 14. *Vendor rating adoption*

7. How much do you rely on the following suppliers integration and development practices?	No use				High level of adoption
Shared Human Resources	1	2	3	4	5
Shared know-how, competences and information	1	2	3	4	5
Others improvement programs (i.e., technical support and training)	1	2	3	4	5

Table 15. *Items describing companies' adoption of Supplier integration and development programs*

8. How frequently do you rely on the following supply contracts' scheme?	never				always
Revenue-sharing scheme	1	2	3	4	5

Table 16. *Collaborative contracts' item*

9. Please indicate the current performance for your business on the following scale (where 1 equals to "much worse than competitors" and 5 represents "much better than competitors):	lower				higher
Market share	1	2	3	4	5

Table 17. *Competitive advantage's item*

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