Collaboration and Risk Mitigation Capability in Supply Chains: A Conceptual Framework

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ABSTRACT

The process of identification, assessment and mitigation of risks is of strategic importance to supply chain profitability and continuity. Researchers have strived to propose diverse set of quantitative and qualitative models for supply chain risk management. Many of the strategies and approaches discussed in literature are based on relationship management. Collaboration, as a type of relationship, provides a better context for risk management and mitigation in supply chain. Although, the notion of collaborative relationships is highly advocated in literature, nevertheless, no explication on collaboration-risk mitigation interaction has been identified. The framework presented in this paper is anticipated to conceptualise collaboration-risk mitigation interactions.

Keywords
Supply chain, Risk mitigation, Collaboration, Agility, Flexibility, Visibility

SUPPLY CHAIN: RISKS AND RELATIONSHIPS

Mason-Jones and Towill (1997, 1998, 1999, 2000) have shown that every organisation in the supply chain (SC) has the responsibility to efficiently transform its customers’ demand information into products and services. The attributes of quality, speed and cost to successfully undertake this transformation are intertwined and subject to uncertainty (Norman & Jansson 2004). Business management philosophies such as supply chain management suggest the collective effort of SC partners in order to achieve this transformation by integrating and managing key inter- and intra-organisational business processes (Ho, Au & Newton 2002; Mentzer et al. 2001). However, the inherent uncertainty in SC activities (Mason-Jones & Towill 1998) and the impact of globalisation and trends such as outsourcing have been moving both practitioner and academic attention towards the investigation of how risk might manifest itself in the SC.

Risk is a relative and multidimensional concept (Zsidisin 2003a). Kaplan and Garrick (1981) for instance, when defining risk highlighted that it involves both uncertainty and damage. From their perspective uncertainty is a lack of knowledge about existing state or future outcome and damage is some form of loss (e.g. financial). March and Shapira define risk as: ‘the variance in the probability distribution of outcomes, their likelihoods and their subjective values’ (1987: 1404). In this study, based on Zsidisin (2003b) and Neiger (2009), risk in the context of the SC has been defined as: Any adverse event that negatively impacts the achievement of operational, tactical, or strategic objectives of supply chain members and is predominantly caused by supply, demand, market or product sources.
It is well-established that failure to manage risks across the SC can be very costly and have significant negative consequences for all parties (Hendricks & Singhal 2005). These consequences can range from financial and reputational loss right across to a loss of life and threat to individual safety (Cousins, Lamming & Bowen 2004; Zsidisin 2003a). This in turn signifies the importance of managing risks across the SC. Within the literature, risk management responses tend to focus on either relationship management or strategic/proactive purchasing (Khan & Burnes 2007). For instance, supplier development and certification are among risk-handling strategies discussed in the literature (Krause 1999; Matook, Lasch & Tamaschke 2009; Smeltzer & Siferd 1998; Zsidisin & Ellram 2003).

The initial motivation for this research has come from the lack of research in the explication of the interactions between collaboration and risk mitigation in SC. Although the supply chain relationships literature places considerable emphasis on collaborative relationships, as a means of effective management of SC activities (see for example Barratt 2004; Kampstra, Ashayeri & Gattorna 2006; Min et al. 2005; Singh & Power 2009), there are only few instances where the dynamics of collaboration for supply chain risk management (SCRM) have been discussed (see Harland, Brenchley & Walker 2003; Hallikas, Karvonen, Pulkkinen, Virolainen & Tuominen 2004; Hallikas, Puumalainen, Vesterinen & Virolainen 2005). Paradoxically, when it comes to defining the concept of SCRM, there appears to be a general consensus among researchers that the role of collaboration and coordination among SC partners for effective management of risks is extremely important (see for example definitions by Faisal, Banwet & Shankar 2007b; Jüttner, Peck & Christopher 2003; Norrman & Jansson 2004; Tang 2006a).

As a consequence the literature points towards SCRM as a developing area of research (Jüttner 2005; Paulsson 2007), and this paper therefore seeks to explore one of the more poorly researched areas in SCRM, the interplay between supply chain collaboration and its resiliency against risk events. Particularly, the objective of this study is two-fold. First, to shed light on the relationships between supply chain collaboration and risk mitigation capability based on reviewing the literature and, second, to develop and present a conceptual framework (see Figure 2) that assists in understanding of the complex relationship between collaboration and risk mitigation in SC.
It is to be noted that the framework presented in this paper is our first step towards addressing the identified gap in the literature and can direct the future research towards the development of collaborative risk management and mitigation research model. In developing the framework, we have utilised the empirically tested instrument for measuring supply chain collaboration (collaboration index) proposed by Simatupang and Sridharan (2005a). Furthermore, the risk mitigation capability is conceptualised as the agility-flexibility-visibility triangle.

The paper proceeds by discussion on the SCRM and major studies in this area. In addition, the description of the dimensions of risk mitigation capability is presented. Then, we look at major supply chain collaboration literature and elaborate on collaboration elements. Next, we describe our framework followed by an explication of the interactions among components of the framework. Finally, few practical implications and possible future researches are discussed in a concluding section.

**SUPPLY CHAIN RISK MANAGEMENT**

Faisal et al. define SCRM as ‘the process of risk mitigation achieved through collaboration, coordination and application of risk management tools among the partners, to ensure continuity coupled with long term profitability of the supply chain’ (2007b: 23). Studies by, for example, Smeltzer and Siferd (1998), Sheffi and Rice (2005), and Knemeyer, Zinn and Eroglu (2009) have shown that a proactive approach to SCRM will make organisations and their supply chains more resilient against unexpected events. Broadly the research in SCRM can be categorised into three groups. First, studies that generally address risk management in supply chains and try to give a better understanding about the subject matter (see for example Christopher & Lee 2004; Jüttner et al. 2003; Khan & Burnes 2007; Peck 2006; Zsidisin 2003a). The second group incorporates those studies that address the risk management issues in specific industries and supply chains (see Norman & Lindroth 2004 (Telecome); Sinha, Whitman & Malzahn 2004 (Aerospace); van Der Vorst, Beulens, De Wit & van Beek 1998 (Food)). Studies that propose quantitative models and frameworks for the management and analysis of risk in supply chains and networks (see Faisal, Banwet & Shankar 2006; Hallikas et al. 2004; Knemeyer et al. 2009; Ritchie, Brindley & Armstrong 2008) make up the final group.
In an effort to clarify the concept of SCRM, Jüttner et al. (2003) have distinguished between four basic constructs of SCRM namely risk sources, risk consequences, risk drivers and risk mitigation strategies (see Figure 1). Succinctly, their framework demonstrates that sources of risk (i.e. environmental, organisational or SC-related) can cause adverse consequences of risk (e.g. financial loss, reputation damage). The sources of risk can be further instigated by risk drivers, such as, globalisation and outsourcing whilst potentially being offset by certain mitigation strategies (e.g. postponement, multiple sourcing).

Each of the constructs in Figure 1 and their interactions can be seen as a stream of research in SCRM literature. For instance, Zsidisin and Ellram (2003) drawing on multiple case studies consider risk mitigation practices of purchasing organisations in two forms: buffer-based (e.g. multiple sourcing) and behaviour-based (e.g. supplier development). Furthermore, Tang (2006a) states that approaches used to mitigate SC risks centre on: supply management, demand management, product management, and information management.

**Dimensions of Supply Chain Risk Mitigation Capability**

There are various tools and initiatives discussed in the literature for the analysis, management and mitigation of risks in SC, such as, FMEA (failure mode and effect analysis), scenario analysis, multiple souring, relationship development and supplier certification (Blome & Henke 2008; Zsidisin & Ellram 2003). Based on the literature, major dimensions of risk mitigation capability in supply chains can be conceptually classified into three elements of agility, flexibility and visibility. When these elements are present and operationalised it allows an organisation to cope with operational disruptions whilst also making it resilient against disasters. Consequently, practitioners efforts targeted towards reducing risk exposure in the SC have tended to focus on managing these three elements.

**Agility** refers to the use of market knowledge and integrated processes to respond to the unpredictable short-term supply and demand changes quickly to handle the external disruptions smoothly (Christopher 2000; Lee 2004; Naylor, Naim & Berry 1999; Swafford, Ghosh & Murthy 2006). Van Hoek et al. (2001) highlight the importance of understanding the SC operating environment and its capabilities in order to better implement agile strategies. The operating environment can be conceived
as the impact of product types (functional/innovative) and economic trade-offs. The operating capabilities can be considered as four factors of market sensitivity (understanding the market), virtual integration (leveraging information), process integration (managing change and uncertainty) and network integration (cooperating to compete) (Christopher 2000; van Hoek et al. 2001).

Over the last decade several notable events have had a major impact on SC agility, for example, the 9/11 attacks where many supply chains had to reinvent themselves when borders were closed and transportation companies had restricted movements, or the SARS epidemic where cross border movements were restricted and transportation was carefully monitored. During each incident, the concept of SC agility gained critical importance as businesses struggled with changes in the operating environment (Lee 2004). The characteristics and requirements of SC agility has given rise to many strategies and initiatives in supply chain management, such as the rapid replenishment and postponed fulfilment (Christopher & Towill 2001). The often-cited case of Nokia and Ericsson demonstrates how agile supply chains can quickly recover from sudden setbacks (Craighead, Blackhurst, Rungtusanatham & Handfield 2007; Lee 2004; Norrman & Jansson 2004; Tang 2006b). Both Scandinavian companies were sourcing a key component for their mobile telephones from a Philips facility in Albuquerque, which suddenly caught on fire. Nokia implementing a postponement strategy was able to quickly locate other suppliers whilst Ericsson being unable to sense the threat faced a huge loss (Lee 2004; Norrman & Jansson 2004). It was only after this accident that Ericsson took on a proactive approach towards managing its SC risks (see Norrman & Jansson 2004 for further details).

The ability of organisation to adapt to unexpected circumstances with limited changes and without severe disorganisation is called **flexibility** (Skipper & Hanna 2009; Zhang, Vonderembse & Lim 2002). Flexibility enhances SC resiliency and creates a competitive advantage for organisations (Sheffi & Rice 2005; Tang & Tomlin 2008). Duclos et al. (2003) maintain that components of SC flexibility are operations, organisational, information systems, logistics, supply, and market flexibility. According to Skipper and Hanna (2009) strategic tools, such as contingency planning can significantly reduce the risk exposure of SC against disruptions through enhancing its flexibility. Their research highlights the importance of top management support, intra- and inter-organisational resource
alignment, information technology usage and collaboration among trading partners. Multiple/localised sourcing, flexible manufacturing, postponement and responsive pricing are among other strategies that can be used to help to mitigate SC risks through increasing its flexibility (Blome & Henke 2008; Tang & Tomlin 2008). Cisco, for instance, uses flexible design and standardised processes which allow them to easily switch its manufacturing process from one supply network to another (Lee 2004).

**Visibility** is a function of accessibility and the availability of relevant information about various SC entities and their operations to the relevant SC parties (Christopher & Lee 2004; Goh, Souza, Zhang, He & Tan 2009). Visibility enables SC members to foresee movements in inventory, product and demand to be able to plan ahead and function as part of a well-orchestrated effort (Rao 2004). Unpredictable events such as disruption in a production process of a manufacturer, if visible, allow timely remedial actions by the chain members (Rao 2004). In some cases however, the problem may be further compounded by the very real issue that the SC lacks sufficient transparency and, for example, one member of chain is not able to visualise, or comprehend the full extent of the supply chain dynamics in terms of inventory planning, work flows, production scheduling, sales, demand forecasts and order status. This has the effect of creating, what O'Loughlin and Clements (2007) have termed as ‘Supply Chain Myopia’, where information passing through the SC may be interrupted or misaligned through participant activities and interests.

Information sharing is a key to SC visibility and increases its operational performance (Barratt & Oke 2007; Childerhouse, Hermiz, Mason-Jones, Popp & Towill 2003; Lee & Whang 2000; Mason-Jones & Towill 1997). Christopher and Lee (2004) explain that lack of visibility and control over SC processes, either upstream or downstream, reduces confidence and adds to the uncertainty which in turn can exacerbate risk taking behaviour in the SC. Companies such as Dell have strived to improve their responsiveness and reduce their cost by sharing information with their suppliers (e.g. via supplier hubs) and customers (e.g. through joint replenishment and planning) in order to reduce the uncertainty and risk (Fawcett, Osterhaus, Magnan, Brau & McCarter 2007; Lee 2002).

For the purpose of this paper, based on preceding discussion the risk mitigation capability of SC is considered in terms of its agility, flexibility, and visibility dimensions.
SUPPLY CHAIN COLLABORATION

Managing relationships is one of the major aspects of effective supply chain management (Childerhouse 2002). Similar sentiments were echoed by Böhme (2009) who considered relationship management as an integral part of supply chain integration practices. Managing inter-organisational relationships has been widely discussed as an important risk-handling strategy in supply chains (Khan & Burnes 2007; Zsidisin, Panelli & Upton 2000). Loyalty to existing suppliers, developing new suppliers and building long-term partnerships with suppliers and customers are examples of the relationship-based risk-handling strategies (Khan & Burnes 2007; Mitchell 1995; Puto, Wesley & King 1985; Zsidisin et al. 2000; Zsidisin & Ellram 2003).

Much of the literature in supply chain relationships has tended to focus on the different types and stages of relationships (Knoppen & Christiaanse 2007; Skjoett-Larsen, Thernøe & Andresen 2003), their relation to SC strategies (Cousins & Spekman 2003), and their theoretical foundations (Svahn & Westerlund 2009). Among different types of relationships (e.g. transactional, relational, and collaborative), the ways to model, explain, plan, and measure collaboration has been of interest to many researchers (Barratt 2004; Kampstra et al. 2006; Simatupang & Sridharan 2005b). Correspondingly, issues such as power and dependency, trust and commitment, and risk and reward have gain critical important in supply chain collaboration literature (Barratt 2004; Humphries & Wilding 2004; Min et al. 2005; Simatupang & Sridharan 2002). Fawcett and Magnan (2002), while explaining the realities of supply chain integration, position the collaboration as a more appropriate descriptor for supply chain integration as their findings reveal that SC practices seldom result in the theoretical ideals of integration (ideals in terms of goal congruence, communication, information sharing, risk and reward sharing). In a collaborative relationship, SC members work closely together, make joint decisions and share risk, reward and information in high levels so as to improve their performance (Barratt 2004; Hoyt & Huq 2000; Simatupang & Sridharan 2002).

Collaboration Elements

Simatupang and Sridharan (2005a) proposed a collaboration index to measure the extent of collaboration between SC members. The index is based on collaborative practices in information
sharing, decision synchronization, and incentive alignment and they had used these three dimensions in their study on benchmarking supply chain collaboration (Simatupang & Sridharan 2004).

One of the essential features of collaborative relationships is information sharing between buyers and suppliers (Whipple, Lynch & Nyaga 2009). From a SC perspective, this is not merely desirable but mandatory (Towill 1997). If the foundation of replenishment, forecasting and planning decisions is based on accurate and current information, SC partners will be able to reduce uncertainty and risk in their mutual transactions (Christopher & Lee 2004; Lee 2002). Researchers have shown that information-enriched supply chains perform better (Lee & Whang 2000; Mason-Jones & Towill 1997). Generally, when buyers and suppliers have incomplete or inaccurate information about demand forecasts, order status, and production schedule there is an information asymmetry in their relationship which may result in sub-optimal decision making (e.g. decisions based on an educated guess) (Simatupang & Sridharan 2002).

Joint decision making by SC partners with regards to the planning and operating context is called decision synchronization (Simatupang & Sridharan 2005a). It is also referred to as a form of non-equity governance agreed by involved partners in order to pursue certain super-ordinate objectives which, if attained, can benefit all of them (Joshi & Stump 1999; Jap 2001; Lejeune & Yakova 2005). Decision synchronization can be within different areas of supply chain management such as procurement, order entry procedures, delivery schedules, product/service design, and quality monitoring/improvements (Biehl, Cook & Johnston 2006; Simatupang & Sridharan 2005a). Joint planning and resolution (through the formation of cross-functional and organisational teams) allow SC partners, for instance, to jointly develop process improvement strategies in face of SC problems (e.g. delay in lead-time). This joint effort may result in better commitment of partners towards the implementation of these strategies as they are collectively discussed and agreed upon. The empirical study by Biehl et al. (2006) shows the positive role of joint decision making (as a key attribute of collaborative SC relationships) on the better SC performance.

Incentive alignment is a mechanism for realigning benefits and costs when there is a process change in the SC (Simatupang & Sridharan 2002). Imbalances in benefits and costs of SC partners may
potentially undermine the stability of relationships and cause it to break down, or worse still become adversarial (Simatupang & Sridharan 2005b). Therefore, sharing costs, risks and benefits can enhance the commitment of SC partners and motivate joint resolution among them which eventually direct partners towards total profit belief (Simatupang & Sridharan 2004). It is also important to note that opportunistic behaviours such as forward buying and diverting are among outcomes of misaligned incentives among SC members (Simatupang & Sridharan 2002, 2005a).

FRAMEWORK

From our perspective the more collaborative links a company can develop with its suppliers, distributors and customers the better they are able to manage their internal and external risks. As mentioned earlier there are many diverse strategies, approaches and tools to manage risks in the SC. Nonetheless, a gap exists in the literature with respect to the impact of collaboration on the risk mitigation capabilities of the SC participants. Figure 2 presents our conceptual framework that will pave the first step to bridge this gap.

The framework is composed of three collaboration axes (elements) and an equilateral triangle of agility-flexibility-visibility which has its center matched upon the origin of collaboration axes. This assumption helps to better explain dynamics of the framework. Currently, each edge of the triangle is shown to be limited by two collaboration axes which in turn creates a corresponding plane. For instance, the agility edge is limited by incentive alignment and information sharing axes and results in agility plane. This highlights our contention that agility, flexibility, and visibility dimensions are not equally affected by three elements of collaboration. For instance, agility is shown to be mostly influenced by incentive alignment and information sharing. The dotted lines show the permeability of collaboration elements for two reasons, firstly, their uneven impact on agility, flexibility, and visibility dimensions and, secondly, their own interrelationships. The interrelationship among collaboration elements means that efforts on one element may facilitate and enhance another one. For instance, incentive alignment can motivate joint decision making by SC partners (Simatupang & Sridharan 2004).
The risk mitigation capability of a SC is shown at the core of the triangle. As the SC partners efforts in collaborative practices of information sharing, decision synchronization, and incentive alignment increases the area of envelope covering the agility, flexibility, and visibility planes also increases which implies the improvement in risk mitigation capability through improvement in its three basic dimensions. We therefore postulate that collaboration practices in terms of information sharing, decision synchronization and incentive alignment will improve the risk mitigation capability of SC.

**The Impact of Collaboration Elements on Agility-Flexibility-Visibility**

In Figure 3a we draw attention to the agility dynamic. Four main constructs of an agile SC are virtual integration, process alignment, network integration, and market sensitivity (Christopher 2000; Christopher & Towill 2000). Faisal et al. (2007a) in their study of measuring SC agility listed the key attributes for each of these constructs. Their work also supports our contention concerning the importance of information sharing, decision synchronization and incentive alignment as the main elements underpinning SC agility. In effect, agile supply chains tend to be more information-based rather than inventory-based (Christopher 2000). Moreover, collaborative decision-making and problem solving within planning and operational contexts, allow SC partners to better respond to the changes as a group or team, rather than having to manage the issues in isolation. Thus, we hypothesise that:

*Hypothesis 1. Collaboration in terms of information sharing will positively impact the risk mitigation capability of supply chain by improving its agility.*

*Hypothesis 2. Collaboration in terms of decision synchronization will positively impact the risk mitigation capability of supply chain by improving its agility.*

The flexibility process has been highlighted in Figure 3b. Organisations in order to select and develop certain capabilities to cope with risk and uncertainty require information about their environment, operational accidents and possible disasters (Fawcett, Calantone & Roath 2000). Therefore, flexibility within the SC is heavily dependent on effective and consistent information sharing. Moreover, decision synchronization across SC functions such as procurement, manufacturing, and distribution
would help trading partners to enhance their flexibility by providing an environment where alignment of resources and capabilities (for an agreed-upon decision) among SC partners can be achieved. Thus, we hypothesise that:

**Hypothesis 3.** **Collaboration in terms of information sharing will positively impact the risk mitigation capability of supply chain by improving its flexibility.**

**Hypothesis 4.** **Collaboration in terms of decision synchronization will positively impact the risk mitigation capability of supply chain by improving its flexibility.**

In Figure 3c we draw attention to the visibility issues. Pipeline transparency and visibility cannot be achieved unless trading partners share the relevant information across SC (Barratt & Oke 2007). One of the benefits of visibility would be reduction in the so-called *Bullwhip Effect* across SC as decisions (e.g. order decisions) can be made upon real-time information (Mason-Jones & Towill 2000). Mutual understanding of collaborative decision making and problem solving may also assist SC members to share more information (including information that is both sensitive and/or critical), as the parties learn to trust each other (O'Loughlin & Clements 2007). Thus, we hypothesise that:

**Hypothesis 5.** **Collaboration in terms of information sharing will positively impact the risk mitigation capability of supply chain by improving its visibility.**

**Hypothesis 6.** **Collaboration in terms of decision synchronization will positively impact the risk mitigation capability of supply chain by improving its visibility.**

Incentive alignment may also directly or indirectly (through facilitating information sharing and decision synchronization) impact the risk mitigation capability dimensions. It can act as an engine for the smooth implementation of any collaborative action formulated by trading partners. In an ideal scenario from our perspective the three elements of collaboration act as complimentary loops which constantly nurture agility-flexibility-visibility triangle. Therefore, the relevant hypotheses are:

**Hypothesis 7.** **Collaboration in terms of incentive alignment will positively impact the risk mitigation capability of supply chain by improving its agility.**
Hypothesis 8. Collaboration in terms of incentive alignment will positively impact the risk mitigation capability of supply chain by improving its flexibility.

Hypothesis 9. Collaboration in terms of incentive alignment will positively impact the risk mitigation capability of supply chain by improving its visibility.

To explain the impact of collaboration elements on risk mitigation capability let us consider a hypothetical example. In this scenario a government suddenly introduces a new regulatory requirement that has a direct impact on importing certain items into the country. The manufacturer in this country is highly depended on a particular item that has to be sourced by an overseas supplier. The supplier of this manufacturer is affected by the new regulation and this new requirement can potentially close down the whole production line and the SC processes.

The conceptual framework illuminates the role of collaboration between manufacturer and supplier in order to enable them to better manage the impact of such incidents (regulatory risk). In this example the collaborative practices in information sharing, decision synchronization and incentive alignment may improve the visibility across the relationships between the two parties and facilitate their quick response and adaptation and in due course improve their collective risk mitigation capability. Swift acquisition and dissemination of information should save time and allow them to reach to an equally beneficial decision. Further, the significance of risk sharing manifests itself in the presented scenario. If the partners do not have a commitment to their obligations they would not stick to their collaboration responsibilities. This example reinforces the issue of trust within the collaboration which is out of the scope of this paper.

CONCLUSION AND FUTURE RESEARCH

In this paper we have highlighted gap in SCRM research by explaining the impact of collaboration on risk mitigation capability of SC members and accordingly presented a conceptual framework (see Figure 2) as our first step toward closing this gap. The framework illustrates how collaboration elements can impact the risk mitigation capability dimensions of SC: agility, flexibility, and visibility and the interrelationships amongst collaboration elements.
Understanding the link between supply chain collaboration and organizational risk mitigation capability has a number of important practical implications for SC managers. Our framework emphasises the necessity for thorough risk profile assessment of potential, for instance, suppliers in the supplier selection process (Micheli, Cagno & Zorzini 2008; Trkman & McCormack 2009). From our point of view, managers should look at their prospective suppliers as collaborative partners who are competent in collaborative practices as this would help them to strengthen their risk mitigation capability. It is important to state that meticulous selection of suppliers can assure organisations that adding the new supplier into their supplier portfolio would contribute to their risk mitigation capability improvement. Moreover, the framework encourages SC managers towards establishment of more collaborative links as it can positively impact trading partners’ risk mitigation capability. This is in line with Hallikas et al. (2005) who state that the risks of collaboration must be counterbalanced by the benefits of collaboration such as mutual relationship-related learning and joint forms of risk management. Therefore, we contend that the more collaborative links an organisation can establish across its SC the better it can safeguard the SC processes against potential disruptions.

This paper, apart from its overarching objective, aimed at paving the way for development of collaborative risk management research model of different SC environments (Vanany, Zailani & Pujawan 2009). Future research will need to focus on the evolving nature of collaborative relationships (Kampstra et al. 2006), the issue of trust and commitment as a hallmark of collaborative relationships (Humphries & Wilding 2004), and the various levels of collaboration in terms of scope and scale (e.g. operational, tactical, strategic or internal and external) (Barratt 2004; Skjoett-Larsen et al. 2003). The next step of this study will be to identify and explore the collaborative relationships and risk mitigation practices in a particular industry SC (Jüttner et al. 2003) with reference to the presented framework and then test the hypotheses and provide some empirical validation. This approach will provide a better focus and reliability to discussions and findings in SCRM research as the multidimensionality of risk (Zsidisin 2003a) and complexity of SC (Surana, Kumara, Greaves & Raghavan 2005) call for more specificity in their investigations.
References


Figures

Figure 1: Basic Constructs of Supply Chain Risk Management (From Jüttner et al. 2003: 201)

Figure 2: Conceptual Framework

\[ RMC = \text{Risk Mitigation Capability} \]
Figure 3: The Impact of Collaboration Elements on Agility-Flexibility-Visibility

a) IS = Information Sharing
b) DS = Decision Synchronization
c) IA = Incentive Alignment