

RISK MANAGEMENT STRATEGIES FOR INTERNATIONAL LOGISTICS: CONCEPTUALISATION AND VALIDATION

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Introduction

Globalisation has provided firms with abundant opportunities to exploit cheap labour and raw materials, large product markets and a package of benefits a host government may offer to induce foreign capital (Manuj and Mentzer, 2008a). Nevertheless, the globalised business environment symbolised by long lead times and complexity often results in a high level of supply chain risks, particularly when it is coupled with the business emphasis on efficiency. In general, a global supply chain is considered to be riskier than its domestic counterpart, mainly due to the multitude of interconnections with a wide network of organisations which is prone to a higher chance of disruptions, bankruptcies, breakdowns and disasters (Manuj and Mentzer, 2008b). As globalisation inevitably generates tightly coupled and complex inter-organisational networks where a disruption at one link easily transmits through the chain, the disruptions to material, information and financial flows of a firm's supply chain became a norm (Bode et al., 2011).

Global supply chain risk management is thus critical to many companies, considering that supply chain risk management (hereafter, SCRM) has been developed in recognition of increasing supply chain risks and of the needs for responses to manage them (Ritchie and Brindley, 2007). International logistics risk management plays a central role in this global SCRM. This is because logistics risks that disturb material, information and financial flows are the most prevalent type of risks, which many companies experience on a regular basis (Ellegaard, 2008). In particular, outsourcing of logistics functions is so inevitable and predominant in international logistics that firms are often exposed to uncertainties stemming from loss of control and relationship issues (Zsidisin et al., 2000). Moreover, many companies tend to overlook low-likelihood but high-impact risks from international logistics whereas most have developed practices to curb the recurrent and low-impact risks in daily supply chain operations (Chopra and Sodhi, 2004). Although there have been studies which addressed global supply chain risks, they focused more on supply chain risks than on international logistics risks.

This study, therefore, aims to address the research gap by investigating firm strategies to manage risks in international logistics. The strategies will be conceptualised by information processing theory, which then be populated by SCRM literature and interviews with industry practitioners. The conceptualised research model will then be validated by a large-scale survey of firms involved in international logistics.

Literature Review

SCRM strategies that respond to disruptive events have been explored by researchers with diverse theoretical frameworks. For instance, Jüttner et al. (2003) derived four risk mitigating strategies,

valid to supply chain contexts, from Miller (1992), which are (1) avoidance, (2) control, (3) co-operation and (4) flexibility. Ellegaard (2008) conceptualised risk management strategies based on three risk components, namely strategies (1) to lower the probability of a loss-making events; (2) to reduce the significance of the event; and (3) to increase the knowledge of loss-making-events. Blackhurst et al. (2011) considered risk management strategies as supply chain resilience enhancers, and divided them into investment in (1) human capital resources, (2) organisational and inter-organisational capital resources and (3) physical capital resources.

Despite the diversity in SCRM strategies, there exist several strategies that are commonly argued. Some researchers asserted that risk management activities within a supply chain can be segregated into buffer strategies and other risk management strategies (Zsidisin et al., 2000; Giunipero and Eltantawy, 2004). Buffer strategies such as safety stock and alternative sources are measures which can absorb the shock from disruptions and buy time for responses, but are criticised in that the extra costs incurred by these measures limit the efficiency and performance of a firm. In addition, extant literature distinguished singlehanded and collaborative risk management strategies (Bode et al., 2011; Lavastre et al., 2012). It was reported that there was a progression in risk management strategies from the individual responses within a firm to the more co-operative responses (Ritchie and Brindley, 2007).

SCRM studies show several distinctive research approaches to investigating risk mitigating strategies. According to Ritchie and Brindley (2007), the decisions on the measures can be differentiated by the operational, tactical and strategic levels. From this perspective, the first approach in Figure 1 is completely limited to operational and tactical measures that are effective to mitigating individual risks (see Chopra and Sodhi, 2004; Pujawan and Geraldin, 2009). This focuses on identification and measurement of individual risks, thereby generating direct solutions rather than overarching corporate strategies. Although the second approach starts from analysis of risks similar to the first approach, its holistic risk analysis to find out the risk sources, loss types and root causes may lead the risk mitigation to the strategic level (see Ellegaard, 2008) as well as the operational/tactical levels. Compared to the previous approaches, the third approach focuses solely on the strategic measures by applying theories and research frameworks in the SCM or other management disciplines (see Bode et al., 2011; Christopher et al., 2011).

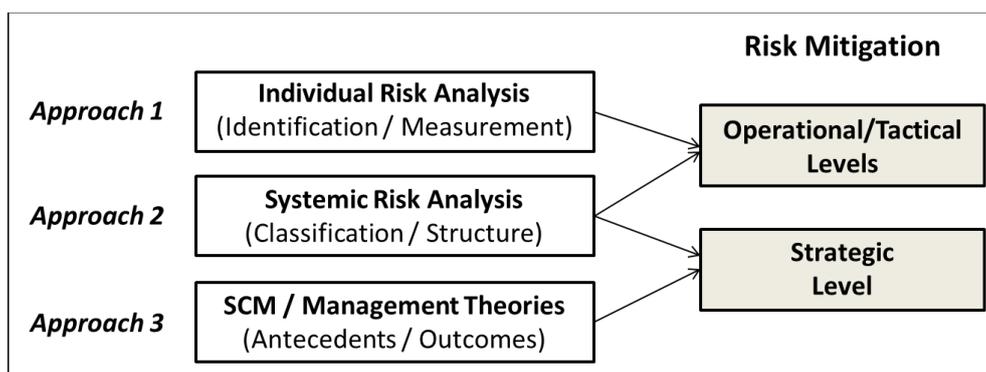


Figure 1: Three research approaches to risk mitigation

Among these three research approaches to exploring supply chain risk mitigation, the first approach prevails in SCRM research, which often provides a lengthy list of tactics that a firm cannot implement at the same time. On the contrary, the strategic level of SCRM measures has drawn less attention from researchers. Also, the majority of existing models are more conceptual than empirical. This research gap augments the necessity of developing an empirically-validated SCRM strategy model that can incorporate scattered operational/tactical measures. In a similar vein, the risk management strategies for international logistics are required because global supply chain inevitably entails international logistics whose risk characteristics are slightly different from supply chain risks.

Methodology

This study aims to address two major objectives. The first is to conceptualise a framework of strategies to enable firms to assess and enhance their initiatives for the management of international logistics risks. The second is to validate the strategies (constructs) and practices (items) with a confirmatory factor analysis of survey data. In this regard, a mixed approach of qualitative and quantitative methods was rigorously applied. The concepts of strategies and practices were framed by information processing theory, and then developed by literature review as well as by case study interviews with eight companies involved in international logistics. From the conceptualisation of risk management strategies, measurement scales for the questionnaire were developed by Q-sorting and pilot study. The questionnaire was used for a large-scale survey, whose responses were statistically analysed for validation.

Theoretical Background

This research views the risk management strategies through the lens of information processing theory by Galbraith (1973). The theory adequately explains the strategic decisions of a firm in response to international logistics risks which entail uncertainty and complexity inherent in the long material and information flows as well as the number of entities involved in the operations. It defines uncertainty as the gap between “the amount of information required to perform a task” and “the amount of information processes by the organisation” (Galbraith, 1973, p. 5). The former is labelled as information processing needs while the latter as information processing capability.

To reduce uncertainty, an organisation may have strategies to reduce the information processing needs and/or the strategies to enhance the information processing capability. When it comes to strategies to reduce the information processing needs, creation of slack resources and creation of self-contained task were suggested. On the other hand, the strategies to enhance the information processing capability comprised of investment in vertical information systems and creation of lateral relations. In the international logistics which entails various entities, however, the strategies can be intra-firm within an organisation or inter-firm across supply chain partners. When it is assumed that the partners fulfil logistics functions of a focal company, the strategies suggested by information processing theory can be extended to intra-firm strategies. To this end, the framework of risk management strategies for international logistics can be developed as demonstrated in Figure 2.

	<i>Strategies to reduce information processing needs</i>	<i>Strategies to enhance information processing capability</i>
<i>Intra-firm strategies</i>	Strategy Type 1	Strategy Type 2
<i>Inter-firm strategies</i>	Strategy Type 3	Strategy Type 4

Figure 2: The Framework of Strategic Dimensions

Interviews and Questionnaire Survey

The interviews and questionnaire survey were conducted with industry practitioners in South Korea. The country was selected because it is the world’s fourth largest exporter and importer in terms of containerised cargo volume and its economic growth has benefited from international trade.

The sampling for the interview considered both industry and company size of the participating firms so that the interview results reflect the contexts of various firms engaged in international logistics.

This study sampled three international freight forwarders as well as five manufacturers in diverse industries and echelons. Also, these eight companies encompassed three large-sized, three medium-sized and two small-sized firms. All the interviewees from the sample firms were at the senior manager level or higher with expertise in international logistics. Interviews were conducted in February 2014 via conference calls and lasted for 1.5-2 hours respectively. After synthesising the findings from interviews with extant research, the risk management strategies were conceptualised.

Survey instruments were designed after establishing the domains of key constructs from conceptualisation. They consist of 4-5 items to evaluate each strategy with a 7-point Likert scale, which were later reviewed by Q-sorting and pilot study. The large-scale survey was administered to 1,224 logistics experts in South Korean firms identified in industry directories relating to international logistics from March to April 2014. A web-based survey was employed for efficient distribution and collection of questionnaires. Eventually, 174 usable responses were received, which gave a response rate of 14.2%. There was no non-response bias and common method variance.

The research used Confirmatory Factor Analysis (CFA) of the questionnaire survey data to ensure as to whether the conceptual model of four strategies is valid. Content validity is ensured because the scale items for the questionnaire were built on the rigorous process of conceptualisation and scale items development in order to address the content validity. Apart from this, the conceptual model was also validated by goodness-of-fit indices, construct reliability, convergent validity and discriminant validity (Garver and Mentzer, 1999).

Conceptualisation

From the literature review and interviews with practitioners, four types of strategy were conceptualised as follows.

Type 1: Building a stable logistics network (SL) strategy

Most interviewees recognised this as a proactive strategy that aims to build a stable logistics network which is resistant to logistics disruptions. They agreed that the stability stems from disciplined processes and solution flexibility. Firms pursuing this strategy are inclined to thoroughly reviewing the logistics processes and then redesigning the network with solution flexibility embedded. It comprises of time- and resource-consuming practices, but once disciplined and flexible logistics network is built, the needs for information processing can be significantly reduced since the likelihood of risk occurrence is minimised.

SCRM literature has exemplified various practices associated with this strategy. For instance, buffer and hedging (multiple suppliers and solutions) and postponement, suggested by Manuj and Mentzer (2008b), are the practices for solution flexibility, whereas avoidance, flow simplification, insurance, security and strict procedures for quality standard and revenue management constitute discipline processes. This strategy was studied most vigorously by SCRM researchers, but application to international logistics needed a precaution. Though all the interviewed companies pursued this strategy, the practices they were implementing varied across companies. Also, some practices that are valid to SCM were not appropriate in the international logistics contexts. As a result, this research identified the most common practices were hedging, avoidance, strict procedures and insurance.

Type 2: Leveraging logistics information (LI) strategy

Interviewees identified that the primary corporate strategy to enhance information processing capability is leveraging logistics information which encompasses collection, management and usage of the information. They indicated that the ability to proactively respond to risk events and redesign

the network promptly must be built upon accurate and real-time information available to all staffs. In particular, they cautioned against information distortion by entities involved in the long international logistics network and delayed decision-making due to insufficient and imminent information. Therefore, leading companies in international logistics operations have heavily invested in an integrated logistics information system that can incorporate end-to-end logistics information from supply chain partners and even customers.

In line with this, visibility was emphasised by SCRM literature (Christopher and Lee, 2004) because increased visibility makes it possible to monitor the supply chains in real-time and to make a timely decision on the mitigation in both predictive and reactive manners (Blackhurst et al., 2011). The management of knowledge from accumulated logistics information was also frequently discussed by researchers. Interviews revealed that how to use the information is as important as how to collect and integrate the information. Real-time risk evaluation, information-backed decision making and knowledge management, therefore, were also regarded as critical risk management practices for this strategy along with an integrated information system and real-time data collection.

Type 3: Leveraging outsourcing contracts (OC) strategy

As significant portions of international logistics functions were inevitably executed by external organisations, interviews showed the great importance of outsourcing contracts relating to both upstream and downstream logistics. In particular, the quality of logistics operations must be ensured first in order to minimise the uncertainties stemming from the external organisations. Outsourcing contracts, therefore, were viewed as a risk management strategy that reduces the information processing needs by augmenting the quality of logistics operations with the chance of disruptions affecting the focal company minimised.

Agency theory argues that both outcomes and behaviours of agencies need to be managed (Zsidisin and Ellram 2003). Likewise, SCRM research demonstrated various practices to maintain the quality of suppliers in performance and behavioural manners, such as supplier monitoring and auditing, supplier certification, supplier selection with multiple criteria, rewards and penalties, risk transfer and early supplier involvement. Interviewees acknowledged contracts with these measures were explicitly and/or implicitly prevalent in practice despite complex inter-dependency issues.

Type 4: Developing logistics collaboration (LC) strategy

Whereas the strategy Type 3 can be applied to any kinds of inter-firm relationships, the strategy Type 4 specifies collaborative relationships among partners to enhance the information processing capability. Most interviewees acknowledged that the single most important strategy in international logistics would be developing logistics collaboration because their logistics competencies heavily depend on the collaboration with their partners who perform logistics operations. They, in particular, paid attention to the limitation of a firm's capability in international logistics which can be overcome by closer relationships with partners. The investment in the collaboration development was deemed to be particularly effective when the logistics operations were disrupted.

Khan and Burnes (2007) divided relationship management from other strategic/proactive purchasing behaviours because the former emphasises partnership, strategic alliances and supplier development which are built upon loyalty and trust. Supply chain collaboration has been vigorously studied since the 2000s, and SCRM research also illuminated the importance of such collaboration practices as partnership, relationship development, information sharing, joint efforts, communication, aligned goals and even personal relationship as risk mitigating measures. These practices were implemented by interviewed companies because they considered these practices are less resource-consuming than intra-firm strategies and also free from dependency issues arising from forcing contractual obligations of the strategy Type 3.

Validation

Since the four types of risk management strategies consist of theoretical constructs with practices, the conceptualised strategies need to be validated by empirical data. For this purpose, the research model was converted into a questionnaire which constitutes latent variables (strategies) and measured variables (practices which explain each strategy). The questionnaire survey data was analysed by CFA, whose results are as follows.

Firstly, the overall measurement model was evaluated by five goodness-of-fit indices encompassing both absolute and incremental fit indices. The CFA results show that the values of all indices exceeded the cut-off values for an adequate fit level (Table 1). In this regard, they satisfied unidimensionality which refers to the existence of one underlying latent variable for set of measured variables.

Goodness-of-fit indices	CMIN/df	CFI	TLI	RMSEA	SRMR
Values	1.347	0.974	0.967	0.059	0.040
Cut-off values	< 3.0	> 0.90	> 0.90	< 0.10	< 0.09

Table 1: Goodness-of-fit indices from CFA results

Secondly, scale reliability was measured by Cronbach's alpha (α), composite reliability (CR) and average variance extracted (AVE). As shown in Table 2, these values for each construct were larger than the minimum thresholds required ($\alpha > 0.7$, CR > 0.7, AVE > 0.5), thus it can be concluded this model satisfied the criterion for scale reliability.

Strategies	Practices	Factor Loading	Reliability & Validity
Type 1 <i>Building a stable logistics network</i>	Hedging	0.625***	$\alpha = 0.755$ CR = 0.846 AVE = 0.583
	Avoidance	0.740***	
	Strict procedure	0.883***	
	Insurance	0.783***	
Type 2 <i>Leveraging logistics information</i>	Integrated system	0.899***	$\alpha = 0.956$ CR = 0.959 AVE = 0.823
	Real-time evaluation	0.913***	
	Decision-making	0.915***	
	Real-time data collection	0.912***	
	Knowledge management	0.898***	
Type 3 <i>Leveraging outsourcing contracts</i>	Monitor & Audit	0.843***	$\alpha = 0.924$ CR = 0.918 AVE = 0.693
	Certification	0.811***	
	Penalty	0.860***	
	Multi-criteria selection	0.869***	
	Risk transfer	0.775***	
Type 4 <i>Developing logistics collaboration</i>	Partnership	0.694***	$\alpha = 0.915$ CR = 0.911 AVE = 0.674
	Information sharing	0.709***	
	Communication channels	0.856***	
	Joint management	0.910***	
	Goal alignment	0.908***	

(Note: ***p<0.001)

Table 2: Factor loadings, reliability and validity of the measurement model

Thirdly, convergent validity was assessed by factor loadings of the latent variables. If the factor loading is greater than at least 0.5 or preferably 0.7 with statistical significance, convergent validity is satisfied. Table 2 indicates that the minimum factor loading for this measurement model is 0.625

with the majority exceeding 0.7. Therefore, this result demonstrates that latent variables are appropriately reflected by a set of measured variables.

Lastly, discriminant validity was tested by comparing the square root of AVE with inter-correlations between latent variables. As shown in Table 3, discriminant validity was satisfied because the square root of AVE of each construct is larger than its correlation with other constructs. This result reveals that measured variables representing a certain latent variable are discriminated from other measured variables for remaining latent variables.

	Mean	S.D.	Inter-correlation and the square root of AVE			
			SL	LI	OC	LC
SL	4.997	1.582	0.763			
LI	4.307	1.706	0.739***	0.907		
OC	4.880	1.532	0.760***	0.779***	0.832	
LC	4.926	1.353	0.726***	0.769***	0.802***	0.821

(Note: ***p<0.001; Square root of AVE is on the diagonal in bold)

Table 3: Mean, Standard Deviation (S.D.) and correlations of constructs

Discussion and Conclusion

This research developed a conceptual model of strategies and practices for international logistics risk management. It derived four types of strategies from information processing theory, and then specified each strategy with interviews with practitioners as well as the review of SCRM studies. Practices to materialise the strategies were also identified by the interviews in the international logistics contexts. Confirmatory factor analysis of questionnaire survey data revealed that the research model of strategies and practices was valid.

In practice, there was a variation in the extent to which those strategies were used. According to the mean values in Table 3, SL strategy is the most preferred, followed narrowly by LC and OC strategies. On the contrary, LI strategy falls behind others. This difference can be attributed to the cost-benefit analysis of each strategy because it requires vast amount of investment to maintain an integrate system that collects, manages, utilises and disseminates information and knowledge. In addition, the benefit of LI strategy is not as imminent as SL strategy, which also entails considerable costs, because it pays off only when disruptions occur. Firms tend to depending information processing capability on inter-firm collaboration which can guarantee the provision of accurate and reliable logistics information. Despite the varying degree of implementation, however, it is understood that firms use a mix of those four strategies to mitigate risks when the large coefficients of inter-correlations between strategies in Table 3 are taken into account.

Several academic and managerial contributions can be drawn from this research. As for academic contributions, it provided a strategic framework of risk mitigation, by adopting an organisational theory, which categorises diverse operational/tactical practices into four distinctive strategies. In addition, it demonstrated the risk mitigating strategies are differentiated by the aims of the strategy (reducing information processing needs vs enhancing information processing capability) and by the scope of strategic implementation (intra-firm vs inter-firm). It also exemplified risk mitigating practices prevailing in international logistics, thereby revealed differences in risk mitigating measures between general SCM and international logistics operation, particularly relating to SL strategy. The managerial contribution of this study lies in the utilisation of the framework to assess a firm's level of risks management and to implement strategies and practices that fit the firm. The strategies will indicate a firm's direction of risk management based on top management decisions, organisational culture and logistics circumstances.

Future research can incorporate more practices into the four strategies suggested by interviews and case studies of diverse companies involved in international logistics. In particular, this study can be replicated to compare the risk management strategies and practices in countries other than South Korea. Also, the strategic framework can be applied to research models that investigate the enablers/inhibitors and outcomes of implementing risk management strategies.

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