Mitigating Supply Chain Uncertainty and Risk through Logistics Innovation Capability

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ABSTRACT

This paper aims to develop a framework for mitigating supply chain uncertainty and risk by adopting logistics innovation capability. Due to the increased globalised supply chain operations, logistics and transport industries now face more supply chain uncertainties and risks than ever. Managing these supply chain uncertainties and risks is a priority task to logistics and transport managers. Based on resource based review, logistics innovation capability provides valuable insight into mitigating supply chain uncertainty and risk. This paper focuses on the relationship between logistics innovation capability and supply chain uncertainty and risk. This would illustrate the potential solutions for mitigating supply chain uncertainty and risk systematically. In addition to make a contribution for development supply chain uncertainty and risk management strategy.

Keywords: logistics, innovation, supply chain management, service industries
INTRODUCTION

Supply chain uncertainty and risk has become one of the popular topics in supply chain management. As market competition for logistics and transport increases, more and more logistics and transport companies try to pursue the operational excellence, so that the company can provide the excellent logistics operations to gain a firm’s market share for sustainable development in the long term. One of the obstacles to achieve the operational excellence is supply chain uncertainty and risks. As many researchers urge supply chain risk and uncertainty is an issue in supply chain and logistics (Davis, 1993; Lee, 2002; Miller, 1992; Prater, 2005; Vasco, Andrew, & Mohamed, 2010). And the world leading logistics and transport companies (e.g. DHL) also recognise that the supply chain uncertainty and risk may hamper companies to toward the operational excellence. Therefore it is significant to pay attentions to the supply chain uncertainty and risk. Previous studies focus on supply chain uncertainties and risks (Simangunsong, Hendry, & Stevenson, 2012). However lacking of resolution of supply chain uncertainties and risks is a problem, which has also been raised in previous studies (Borut, Tina, & Bojan, 2012; Guido, Enrico, & Marta, 2008; Vasco Sanchez-Rodrigues, Potter, & Naim, 2010; Simangunsong et al., 2012).

Implementing logistics innovation to solve the problems in logistics and transport is not a new idea (Daniel & Fredrik, 2011; Scott, 2009). Logistics capability has been widely discussed previously, it can improve logistics operations, and an effective logistics operation can generate a competitive advantage for a firm and gain a firm’s market share (Mentzer & Flint, 1999; Scott, 2009). Therefore, logistics innovation capability may help companies to mitigate supply chain uncertainty and risk through excellent logistics operations. Seeking perfection is one of key principles of operational excellence. This paper proposes an idea to implement logistics innovation capability to seek perfection based on Resource Based View (RBV). This may achieve excellent logistics operations in order to mitigate the supply chain uncertainty and risk. Because supply chain uncertainty and risk mainly reflect the negative impacts on logistics operational performance, such as delays, damage, and loss (Vasco Sanchez-Rodrigues et al., 2010). Excellent logistics operations may mitigate these
impacts. The paper focuses on investigating the relationship between logistics innovation and supply chain uncertainty and risk in logistics and transport. The relationships may reveal that logistics innovation capability mitigates the supply chain uncertainty and risk.

**LITERATURE REVIEW**

**Resource Based View and Dynamic Capabilities**

Innovation capability was developed from RBV theory. Firms can gain and sustain competitive advantages by developing and deploying valuable resources and capabilities (Wernerfelt, 1984). The firms compete on the basis of their capabilities (Lai, 2004). RBV has been widely recognised in different industries. The paper is based on this theory to investigate the applicability of logistics innovation for mitigating the supply chain uncertainty and risk in the logistics and transport industries.

The RBV states that in a firm, the resources comprise skills, technologies, capabilities, and infrastructure. The resources have to be coordinated and deployed in order to generate competitive advantage (Mohamed, Ann, & Yee, 2014). And capabilities are complex bundles of skills and accumulated knowledge, exercised through organisational processes, which enable firms to coordinate activities and make use of their assets (Day, 1994). Hafeez, Zhang, and Malak (2002) regard capability as the ability to make use of resource to perform some task or activity and define a resource as anything tangible or intangible owned or acquired by a firm. RBV of the firm provides valuable insights for understanding how competitive advantage within firms is created and how such advantage is sustained over time. Briefly, RBV states that firms obtain competitive advantage by accumulating internal resources and capabilities that are rare, valuable, and difficult to imitate (Grant, 1991; Olavarrieta & Ellinger, 1997; Russo & Fouts, 1997).

Innovation capability also is considered as a dynamic capability (Lawson & Samson, 2001). Dynamic capabilities view was developed from the RBV. Teece, Pisano, and Shuen (1997) developed the RBV approach one step further by formulating the dynamic capabilities perspective. According to their study, the term “dynamic” refers to the capacity to renew competences so as to achieve congruence with the changing environment. The term capabilities reflects the major role of strategic
management in adapting, integrating, and reconfiguring resources, organisational skills and functional competencies to respond to the challenges of the external environment (Helfat et al., 2009).

A dynamic capability was distinct from operational capabilities, which involved in the current operations of an organization. Dynamic capabilities, by contrast, refer to "the capacity of an organization to purposefully create, extend, or modify its resource base" (Helfat, 2007). Winter (2003) describes two different types of capabilities: ordinary or “zero-level” capabilities as those that allow a firm to “make a living” in the short term; the other type of capability is dynamic capability. The latter one is higher level capabilities, which can be deployed to extend, modify or create the ordinary or “zero-level” capabilities (Winter, 2003). Innovation capability is considered as a higher level capability to reconfigure operations capabilities in order to achieve excellent logistics operations.

**Logistics Innovation Capability**

Many authors urge logistics innovation capability is one of the important capabilities in logistics (Fawcett & Stanley, 1997; Hayes, Wheelwright, & Clark, 1988; Lu & Yang, 2010; E. A. Morash, 2001; J. T. Morash, Dewitt, W., Keebler, J.S., 1997). Innovation capability is defined as the firm’s ability to continuously transform knowledge and ideas into new products, processes and systems for the benefit of the firm (Lawson & Samson, 2001; Yang, 2012). Innovation can reconfigure and transform both external and internal resources in order to adapt company’s strategy (Teece et al., 1997). Logistics innovation refers to the new technology, new services, new processes and new ideas, which are used for improving logistics operations (Scott, 2009). In this paper, the logistics innovation capability is an ability to adopt the logistics innovation to solve the problem and adapt the change environment.

The rapidly changing and uncertain environment and a competitive market make firms to face the biggest challenge. Innovation is one of the important tools for enterprise to keep their competitive advantage (Lin, 2006). Also notably, some researchers found innovation may be used for reducing supply chain uncertainty and risk (Daniel & Fredrik, 2011; Lin, 2013), Dani (2010) emphasizes building an innovative culture, innovative processes and innovation capability is the key to managing
and mitigating supply chain risks. Besides, innovation has the positive effects on logistics operations (Wagner & Sutter, 2012). Lin (2013) urge logistics service providers must pay more attention to logistics innovation capability to provide better services performance for their customers.

**Supply Chain Uncertainty and Risk**

Literally, there are so many different ways to define the concept of risk and uncertainty. Everyone has own perspective to understand those two concepts. Therefore, it is significant to consider the uncertainty and risk in a specific context. This study concentrates supply chain uncertainty and risk in logistics and transport context. Supply chain uncertainties and risks are very similar (Simangunsong et al., 2012), there are some differences between supply chain uncertainty and risk in a deeper level analysis. However this paper does not focus on distinguishing the uncertainty and risk. Instead, the research considers the ways to mitigate the negative impacts of supply chain uncertainty and risk simultaneously without separate them. Supply chain uncertainty is often used interchangeably in practice with the term - supply chain risk (Peck, 2006). For managers, risk is a threat that something might happen to disrupt normal activities or stop things happening as planned (Waters, 2011). In a real world environment, the managers have to deal with both supply chain uncertainty and risk simultaneously.

Risks occur because people never know exactly what will happen in the future. People can use the best forecasts and do every possible analysis, but there is always uncertainty about future events. It is this uncertainty that brings risks (Waters, 2011). From this statement, supply chain uncertainty and risk are complex notions that may come in different forms and may comprise supply chain uncertainty and risk sources, consequences and drivers (Christopher & Lee, 2004; Jüttner, Peck, & Christopher, 2003; Manuj & Mentzer, 2008; Rodrigues, Stantchev, Potter, Naim, & Whiteing, 2008). In supply chain risk management literature, risk is unreliable and uncertain resources creating supply chain interruption, whereas uncertainty is matching risk between supply and demand in supply chain and logistics processes (Tang & Nurmaya Musa, 2011). Technically, although risk and uncertainty are two different concepts (Knight, 1921; Peck, 2006; Rodrigues, Potter, & Naim, 2010; Vasco Sanchez-
Rodrigues, Stantchev, Potter, Naim, & Whiteing, 2008; Simangunsong et al., 2012), in this paper, supply chain uncertainty and risk is considered as the impacts, consequences, unexpected events and/or errors (e.g. delays, damages and loss) may harm the logistics operations.

According to the extensive literature review, supply chain uncertainty and risk are categorised into four major clusters. (1) logistics uncertainty and risk, (2) information uncertainty and risk, (3) customer-related uncertainty and risk, and (4) environmental uncertainty and risk (Murugesan, Natarajan, & Lakshminarayanan, 2013; Vasco Sanchez-Rodrigues et al., 2010; Simangunsong et al., 2012). The four categories balance the way to assess the both internal and external uncertainties and risks in this industry (Christopher & Peck, 2004; Miller, 1992).

- **Logistics Uncertainty and Risk**

Logistics is described as a time-sensitive process of flow of goods and information from a point of origin to a destination point (Christopher, 1998), and supply chain uncertainties and risks in this paper are concentrated on logistics and transport service providers. Logistics uncertainty and risk can broadly be categorized as the potential disturbances to the flow of goods, information, and money (Ellegaard, 2008). In this paper, logistics uncertainty and risk is defined as weakness, faulty, error, loss and/or unexpected outcome may influence normal logistics-related activities/processes in transport service providers. The variables of logistics uncertainty and risks in literature include delays, transport network, storage, carrier strength and freight (Hauser, 2003; Rodrigues et al., 2008; Simangunsong et al., 2012).

- **Information Uncertainty and Risk**

In this paper information uncertainty and risk is defined as information-related unexpected incidents; outcome and/or problems may influence information in time, accuracy and availability in logistics and transport service providers. Information is the aider in the smooth functioning of the supply chain. The sources of information uncertainty and risk identified in literature include information delays, unavailability of information, information infrastructure, and information and communication issues. (Blackhurst, Scheibe, & Johnson, 2008; Cucchiella & Gastaldi, 2006; Guo, Fang, & Whinston, 2006; Vasco Sanchez-Rodrigues et al., 2010).
• Customer-related Uncertainty and Risk

Customer related uncertainty and risk are most likely occurred between the logistics service providers and customers. It is difficult to draw a clear boundary between different uncertainties and risks. However in this paper, the definition of customer-related uncertainty and risk is a part of supply chain uncertainty and risk, which mainly originate from customer side rather than companies, may cause disputes and / or influence the normal logistics operations in logistics service providers. Due to the nature of courier industry, receivers and senders play an equal important role in the industry. Therefore it is important to consider both receivers and senders together. In literature, there are various customer-related uncertainties and risks include: unanticipated customer, reputation, forecast error, delays to customer, receivable risks. (Chopra & Sodhi, 2004; Manuj & Mentzer, 2008; M.S. Sodhi & Lee, 2007; ManMohan S. Sodhi & Tang, 2012).

• Environment Uncertainty and Risk

Uncertainty and risk can arise due to the interactions between the supply chain network and its external environment / events. The environment uncertainty and risk have been considered widely in previous studies (Simangunsong et al., 2012). It is significant to think about the environment uncertainty and risk, most environment uncertainty and risk are unavoidable, such as road congestions / closures and natural disaster. Therefore the logistics service providers have to consider these factors beforehand. In this study, we consider the environment uncertainty and risk form these five factors include: labor, road congestion, natural disasters, fuel price, and regulations.(Blackhurst et al., 2008; McKinnon & Ge, 2004; Vasco Sanchez-Rodrigues et al., 2010; Simangunsong et al., 2012).

Mitigation Strategy

Mitigating strategy has been widely used in both supply chain uncertainty and risk management. Manuj and Mentzer (2008) summarise the existing literatures from supply chain and related disciplines to suggest a five-step process for supply chain risk management. Those five steps include (1) risk identification, (2) risk assessment and evaluation, (3) selection of appropriate risk management strategies, (4) strategy implementation, and (5) mitigation of supply chain risks. Mitigation of supply chain risks is one of the important steps of supply chain risk management.
Jüttner et al. (2003) suggest the four basic constructs of supply chain risk management: (1) assessing the supply chain risk sources; (2) identifying the adverse supply chain risk consequences; (3) tracking the risk drivers in the supply chain strategy; (4) mitigating risks in the supply chain. From a single company view in a supply chain, Miller (1992) suggest risk mitigating strategies include avoidance, control, cooperation and flexibility.

Mitigation is one of the supply chain uncertainty and risk management strategies. The concept of mitigation is common in the risk management literature, and risk mitigation has the same perspective as a coping with uncertainty strategy (Simangunsong et al., 2012). Four major categories of techniques of managing the uncertainty and risk include: avoidance (eliminates, withdraw from or not become involved), reduction (optimise – mitigate), sharing (transfers – outsource or insure), retention (accepts and budget) (Dorfman, 2008). Furthermore, mitigating supply chain uncertainty and risks does not try to influence or alter the source of uncertainty. Instead, it tries to find ways to adapt and hence minimise the impact of uncertainty and risk (Simangunsong et al., 2012). Because supply chain is a complex system consisting of various processes and relationships, each party connects to the different business partners via separate channels in a supply chain (Lambert & Cooper, 2000). And any change in one party may cause new problems, unexpected consequences and chain reaction in an entire supply chain. Mitigation approaches comprise increase capability, acquire redundant suppliers, increase inventory, increase responsiveness, increase flexibility, pool and aggregate demand (Chopra & Sodhi, 2004). The mitigation strategy minimise the impact on a supply chain transaction. Therefore, Mitigation strategy seems an ideal solution for both supply chain uncertainty and risks at present.

**PROPOSITIONS AND CONCEPTUAL FRAMEWORK**

Logistics innovation capability has been widely involved in logistics and transport industries, such as packaging innovation decreased the risk of damaging goods in transportation (Daniel &
Containerisation is another example of innovating to improve logistics operations and reduce the risks and uncertainty in transit (Scott, 2009). The logistics and transport industry has been seen many examples of logistics innovation, another example is DHL founders flying the documents ahead of the freight they could be processed prior to vessel arrival and avoid delays. This minimise the supply chain uncertainty and risk. Logistics innovation is an important capability to address the logistics uncertainty and risks (Scott, 2009; Simangunsong et al., 2012). Therefore;

**Proposition 1. There is a negative relationship between logistics innovation capability and logistics uncertainty and risk in the logistics and transport industries.**

Logistics innovation capability comprises new technologies and service, such as online tracking and tracing service have been widely applied in logistics companies to provide accurate and timely information. The technologies reduce risk of delay or unavailability of information (Christopher & Lee, 2004; Ho, Teik, Tiffany, Kok, & Teh, 2012). Material requirements planning (MRP) systems are used to improve the information manipulation. This result in reducing supply chain uncertainty and risk in logistics systems (Chrwan-jyh & Phillip, 1994). Therefore;

**Proposition 2. There is a negative relationship between logistics innovation capability and information uncertainty and risk in the logistics and transport industries.**

Logistics innovation capability is critical for strengthening the LSP-customer relationship, generating customer loyalty (Flint, Larsson, Gammelgaard, & Mentzer, 2005; Wagner & Sutter, 2012). A good relationship between logistics firms and customers may reduce the customer related uncertainty and risk. For example FedEx overnight delivery service changed the way in which business to business and business to customer transactions operated. This offered businesses the opportunity of using just-in-time techniques, which saved warehousing space and reduced overall costs. The introduction of efficient-consumer-response (ECR) techniques led to smaller and more efficient shipment sizes, which in turn further reduced supply chain uncertainty and risk (Black & Hunter, 2003). Therefore;
Proposition 3. There is a negative relationship between logistics innovation capability and customer-related uncertainty and risk in the logistics and transport industry.

One example of logistics innovation capability reducing environment uncertainty and risk is logistics companies introduced flexible fuel factor or fuel surcharge to against unstable fuel price (Hoffman, 2006). Today most transport and logistics companies introduced the fuel surcharge into the delivery cost. And using new technology and innovation to mitigate environment uncertainty and risk have been promoted in previous studies (Hayes et al., 1988; Kim, 2006). Therefore;

Proposition 4. There is a negative relationship between logistics innovation capability and environment uncertainty and risk in the logistics and transport industry.

Overall, this study comprises two main constructs: logistics innovation capability, and supply chain uncertainties and risks. The measurements of logistics innovation capability in this paper are drawn from previous studies (Braunscheidel & Suresh, 2009; Hayes et al., 1988). The four categories of supply chain uncertainties and risks include logistics uncertainty and risk, information uncertainty
and risk, customer-related uncertainty and risk, and environment uncertainty and risk (Vasco Sanchez-Rodrigues et al., 2010; Simangunsong et al., 2012), are used to assess the supply chain uncertainties and risks in the logistics and transport industries. The research conceptual framework is indicated in Figure1.

DISCUSSION AND FUTURE RESEARCH

This paper presents a conceptual framework for investigating the relationship between logistics innovation capability and supply chain uncertainty and risk. The negative relationships may indicate that a higher level of logistics innovation capability leads to a lower level of supply chain uncertainty and risk. It may imply that logistics innovation capability mitigates supply chain uncertainty and risk. Logistics innovation capability has become an important concept in today’s supply chain and logistics management. However there are few studies on the mitigation supply chain uncertainty and risk through logistics innovation. As mentioned before, logistics innovation refers to the new technology, new services, new processes and new ideas, which are used for improving logistics operations (Scott, 2009). The logistics innovation capability is an ability to adopt the logistics innovation to solve the problem and adapt the change environment in this paper. An excellent logistics operation is a way to seek perfection. And logistics innovation capability may be an appropriate way to assist firms to work out how the unexpected problems and risks can be managed, so that they may achieve operational excellence in supply chain and logistics. Supply chain uncertainty and risk may be measured by their impacts in the firms. Four categories of supply chain uncertainty and risk are developed for assessing supply chain uncertainty and risk in the logistics and transport industries. According to the relationship between two constructs, both academics and practitioners may develop potential solutions for mitigating supply chain uncertainty and risk systematically. In addition to make a contribution for development supply chain uncertainty and risk management strategy. This paper focuses on the relationship between logistics innovation capability and supply chain uncertainty and risk. However future research may be conducted to investigate the extent of different types of firm capabilities for mitigating supply chain uncertainty and risk. Furthermore, the proposed conceptual framework may also be enriched with an empirical work in different countries and industries.
REFERENCES


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