The Impact of Supply Risk and Demand Risk on Supply Chain Integration

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ABSTRACT

 Supply chains are the lifeline of human existence. The complexity of a supply chain has increased with supply and demand uncertainties, outsourcing and globalization. Today Supply Chain Risk has become a major research area, as the exposure to risks in supply chains has increased due to increase in complexity of supply chain. This study aims to study the effect of supply and demand risks on supply chain integration in the supply chains of manufacturing firms.. Data was collected from manufacturing firms in India .

Keywords-Supply Chain Risk,Supply Chain Integration,Manufacturing

#  INTRODUCTION

 Supply chains are very important for mankind. Supply and demand uncertainties and increased globalization have increased the risks in the supply chain. (Ali, Govindan and Panicker, 2012). Juttner et al (2003) state that the focus on efficiency rather than effectiveness and globalization may have increased the level of risk in supply chain. (Juttner et al,2003)

There have been few studies which study the impact of supply chain risk on supply chain integration (Zhao et al,2013, Jajja et al ,2015) Zhao et al (2013) studied the impact of supply delivery risk and demand variability risk and found that the risks negatively impact Supply Chain Integration. Jajja et al (2015) found that a firm's supply chain risk was positive associated with supplier and customer integration.

Zhao et al (2013) stated that future research should investigate the relationships of internal risk, competitive intensity, disruption risk with Supply Chain Integration. Scholarly research in the area of Demand risk, Supply Risk and Supply Chain Integration with respect to developing countries like India is scant. Hence in this study we try to study the effect of Demand risk and Supply risk on supply chain integration in the supply chain of manufacturing firms in India.

The goal of this survey was to reveal (1) the impact of Supply chain risk (Demand and supply) on Supply Chain Integration. The rest of this chapter is organized as follows: In Sect. 2, we rpresent our understanding of the terms Supply Chain risk, Demand risk, Supply Risk and Supply Chain Integration.In Section 3 we present the literature review of various studies on Supply chain risk and supply chain integration. Section 4 discusses the hypothesis. Section 5 presents the findings of the empirical study. Finally, Sect. 6 discusses the results, and implications for managerial practice.

# Literature Review

## **Supply Chain Risk**

 Juttner et al (2003) states that supply chain risks comprise “any risks for the information, material and product flows” .Monroe et al (2014) states that supply chain risk consists of supply chain characteristics which create vulnerability in the supply chain and a supply chain disruption will reveal the negative consequences that result from supply chain risk. Wagner and Bode (2008) defined a negative deviation from the expected value of a performance measure resulting in negative consequences for the focal firm a “supply chain risk” when this deviation is the result of a supply chain disruption.

**Supply Chain Integration**

 Supply chain management is the integration of key business processes from end user to original suppliers to provide products, services, and information that add value for customers.” Inbound material quality, price, and quantity all impact the firm’s outgoing product and customer services. (Wisner ,2003)) SCI integrates core processes through improved communication, partnerships, alliances and cooperation which can result in cost reduction and improved service (Power,2005) Huang et al (2014) define Supply Chain Integration as information sharing and interdependence that exist among firms and states that Supply Chain Integration is critical for supply chain management.

Juttner, Peck & Christopher (2003) conducted a literature review on supply chain vulnerability and risk management . Juttner (2005) presented the business requirements from a practitioner perspective. Gaudenzi et al (2006) proposed an analytical hierarchy process model to identify supply chain risk factors.Wagner and Bode (2006) investigated the relationship between supply chain vulnerability and supply chain risk and found that supply chain characteristics are important for a firm’s exposure to supply chain risk. Khan & Burnes (2007) undertook a review of risk and a specific review of supply chain risk. Wagner and Bode (2008) provided an operationalization of the supply chain risk construct and studied the impact of supply chain risk sources on supply chain performance. Manuj and Mentzer (2008) proposed a model for risk management consisting of risk identification, Risk Assessment and Evaluation, Selection of Appropriate Risk Management and Implementation of Supply Chain Risk Management Strategy(s) and Mitigation of Supply Chain Risks. Kleindorfer et al (2009) provided a framework for the activities of risk assessment and risk mitigation important to supply chain disruption risk management. Thun and Hoenig (2009) conducted a survey in the German automotive industry and found that the group using reactive supply chain risk management had a higher average value in terms of disruptions reduction of the bullwhip effect .

Funo et al (2011) studied the supply chain risk factors and prioritized it using AHP method. Diabat et al (2012) analyzed the various risks involved in a food supply chain with the help of Interpretive Structural Modeling. Hoffman et al (2013) studied the impact of environmental uncertainty and behavioral uncertainty, supply risk monitoring, supply risk mitigation, and supply risk management process maturity on supply risk management performance. Punniyamoorthy et al (2013) provided an accurate instrument to assess the supply chain risk of similar comparable industries. Monroe, Teets and Martin (2014) organized information about supply chain risk and Supply Chain Disruption on the basis of probability and impact, sources of risk, approaches for assessing risks and strategies for mitigating risks. Vanany et al (2011) conducted a literature review of SCRM on basis of the types of risks, the unit of analysis, the industry sectors, and the risk management process or strategies addressed. Ceryno et al (2014) identified the main risks in the automotive supply chain .Avelar-Sosa et al (2014) used a structural equation model to understand the effects of risk factors-demand, supply and processes on supply chain performance. The relationship of demand risk, supply risk, process/control risk, environmental risk, logistical and catastrophic risks with supply chain risk exposure was tested empirically in Indian automobile industry by Sharma and Bhat. (2014) Venkatesh et al (2015) used Interpretative Structural Modeling to establish the interrelationships between the supply chain risks of retail industry followed by Fuzzy MICMAC analysis. Prakash et al (2015) proposed a methodology using ISM, risk priority number and risk mitigation number to prioritize risk mitigation strategy decisions for the dairy industry.

Nyamah et al (2017) sought to understand the relationship between the major risk sources and the risk/disruption impact on agri-food supply chain performance in Ghana. Sridevi et al ( 2017 )investigated the relationships between environmental uncertainty and supply chain risk and the moderating effect of supply chain flexibility. Moktadir et al (2018) identified and analyzed the risks in the supply chains of the pharmaceutical industry and proposed a decision model, based on the Analytical Hierarchy Process (AHP) method. Fan and Stevenson (2018) reviewed the literature on supply chain risk management and developed a conceptual framework .Shahbaz et al (2019) aimed to provide a reliable tool to assess the overall supply chain risks of Malaysian manufacturing categorizing risks into supply side risks, process side risks, demand side risks, logistic side risks, collaboration side risks and environment side risks. Babu et al (2020) adopted interpretive structural modelling approach to establish the interrelationship among the risk variables faced by an Indian manufacturing SME and classified the risk variables using MICMAC analysis.

Wisner (2003) conducted a survey among U.S. and European business executives to understand the linkages between supply chain management, supplier management, customer relationship management and performance. Power (2005) highlighted the inter-dependence between integration (technologies, logistics, and partnerships) through review of literature. Zailani (2005) through case article research investigated supplier and customer integration strategies by comparing US and East Asian companies. Fabbe Costes et al (2008) studied the link between supply chain integration and performance by analyzing papers. Sezen (2008) empirically investigated the effects of supply chain integration, supply chain information sharing and supply chain design on supply chain performance and found that supply chain design had significant effects on resource and output performance. Kim (2009) examined the causal linkages among supply chain management practice, competition capability, the level of supply chain integration, and firm performance. Flynn et al (2010) studied the relationship between three dimensions of Supply Chain Integration, operational and business performance, from both a contingency and a configuration perspective. Kannan et al (2010) explored whether firms that integrate only with partners adjacent to them in the supply chain exhibit different patterns of supply chain practice and performance than those that also integrate with partners more distant in the supply chain. Zolait et al (2010) found that information flow, financial flow and physical flow integration were significant to firm performance.

Danese et al (2011) studied whether Supplier integration positively moderated the relationship between customer integration and efficiency. Prajogo et al (2012) investigated both information and material flow integration between supply chain partners and their effect on operational performance. Huo (2012) investigated the relationships among internal integration, customer integration, supplier integration, supplier-oriented performance, customer-oriented performance, and financial performance. Alfalla-Luque et al (2012) analyzed supply chain integration in the aeronautics sector using dimensions of information integration, coordination and resource sharing and organisational relationship linkage. Kim (2013) through literature review analyzed survey-based studies to understand the impact of supply chain integration on performance. Zhang et al (2015) proposed supply chain integration model that could guide managers to integrate resources and activities.

Pandiyan et al (2016) studied the mediating effect of Supply Chain Integration between Supply Chain Management Practices and overall performance of the supply chain utilizing survey data of 156 electronics firms in Malaysia. Kim et al (2016) empirically tested the impact of business uncertainty on supply chain integration. Shou et al (2017) examined the relationship between product-level characteristics- product complexity and product variety and different dimensions of Supply Chain Integration. Ataseven et al (2017) investigated the relationships between supply chain integration and various performance dimensions using a meta-analytical methodology. Van der Vaart et al (2018) analyzed survey-based research with respect to the relationship between Supply chain integration and performance. Ramirez et al (2020) explored the antecedents and performance outcomes of supply chain integration in the agri-food industry in Latin America. Hendijani (2020) empirically examined the moderating effect of demand uncertainty on the relationship between Supply Chain Integration and firm performance.

Kache et al (2014) assessed the link between collaboration/integration and risk/performance through literature reviews. Zhao et al (2013) explored the relationships among supply chain risks, supply chain integration, and company performance using Structural Equation Modeling. Huang et al (2014) developed a SCI model that includes buyer-supplier-supplier relationships, and examined the SCI-supplier performance relationship under demand and technological uncertainties. Ellinger et al (2015) using survey data from the Chinese electronics industry, examined the effect of learning orientation and supply chain integration on Supply Chain Risk Management. Chaudhari et al (2018) studied the impact of internal integration, external integration, and supply chain risk management on manufacturing flexibility, and also studied whether SCRM moderated the relationships between internal and External integration, respectively, and manufacturing flexibility. Jajja et al (2018) used dynamic capabilities view to explain why companies are motivated to integrate their supply chain to enhance agility performance, when they face supply chain risks. Munir et al (2020) explored the association between supply chain integration and supply chain risk management to improve operational performance, using the information processing view of risk management. Weingarten et al (2016) explored the role of risk and risk management practices in the success of supply chain integration with reference to impact on cost and innovation performance.

# Research Methodology

**Hypothesis Development**

 A Firm's supply chain risk has positive association with supplier and customer integration; (Jajja et al.2018) Hence we propose the following hypothesis

H1: Demand Risk is positively related to Supply Chain Integration

H2: Supply Risk is positively related to Supply Chain Integration

 **Research procedures**

The research participants included SCM /Operations managers of Manufacturing firms in India. An online survey method was used to collect the data, and a total of 40 usable data were used in this study. SPSS Process Macro (Hayes, 2013) was used to analyse the relationships between the variables.

 **Research instrument**

A 1–5 Likert scale (5 strongly agree, 4 agree, 3 neutral, 2 disagree, 1strongly disagree) was used in this study. The constructs measurements in this study were adapted from relevant studies in this area. Two and five measurement items of Demand Risk and Supply Risk were adapted (Wagner and Bode ,2008). Five measurement items of Supply Chain Integration were adapted from Sezen (2008).

# Data Analysis and Results

Cronbach’s a was used to examine the internal consistency and reliability. Table 1 indicates the value of Cronbach’s α of all the constructs are greater than 0.70 thereby ensuring construct reliability. Zero-order correlations were examined .

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| 1 Reliability |
| Factor | Cronbach α  |
| Demand Risk | 0.784 |
| Supply Risk | 0.906 |
| Supply Chain Integration | 0.934 |

|  |
| --- |
| 2 Correlation Coefficient |
|   | Demand Risk | Supply Risk | Supply Chain Integration |
| Demand Risk  | 1 |   |   |
| Supply Risk | 0.558 | 1 |   |
| Supply Chain Integration | 0.376 | 0.35 | 1 |

|  |
| --- |
| 3 Mean, Standard Deviation and Correlation |
| Factor  | Mean | Standard Deviation |
| Demand Risk  | 2.725 | 0.913 |
| Supply Risk | 2.715 | 0.946 |
| Supply Chain Integration | 3.475 | 0.810 |

 **Results**

A total of 40 valid questionnaires were completed by SCM/Operation managers of manufacturing firms. Of the total sample size, 22.5% ,5%,10%.7.5%,12.5% and 42.5% of the companies had less than 1 year,1 to 5 years,5 to 10 years,10-15 years,15-20 years and more than 20 years’ operating experience. Of the total sample size, 5% ,15%,10%,12.5% ,10%and 47.5% of the companies had less than 1 million,1 to 5 million,5 to 10 million ,10-50 million,50-100 million and more than 100 million annual sales

H1 hypothesized a relationship between Demand Risk and Supply Chain Integration. The second hypothesis (H2) tested the relationship between Supply Risk and Supply Chain Integration. Correlation analysis showed a positive relationship between supply and demand risk; and supply chain integration.

**Discussion**

 All the tested hypotheses in this study were significantly supported. Supply Chain Risks was found to positively relate with Supply Chain Integration as found by Jajja et al (2018) Thus it is seen that when supply chain risks increases companies tend to increase supply chain integration to circumvent the negative effect of supply chain risks.

There are some limitations of the present study. First retrospective self-report measures are vulnerable to biases. The studies also need to be conducted in specific industry sectors.

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