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SUPPLY CHAIN RISK MANAGEMENT-A LITERATURE REVIEW

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ABSTRACT

Supply Chain Risk Management has been increasingly paid attention by most of the researchers, and industrialist. This has become more popularity area of research. This paper aims at comprehensive literature survey the paper supply chain risk management published in relevant journals between 2010 and 2019. This literature survey is classified into five categories: empirical, conceptual, case study, descriptive, and exploratory. Further this study has also focused on the supply chain risk types and various mitigation strategies. This literature review will provide the basis for the outline future research opportunities in this field.

KEYWORDS: Supply Chain Risk Management, Literature Survey

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Original Article

1. INTRODUCTION

In the past, the supply chain vulnerability has affected the performance ofmany companies irrespective of size. For Instance,in late 1980s, many manufacturing firms had executed various plans to improve their supply chain efficiency that to multiple sources,andcollaboration. This helped reducing the operational cost, increase revenues, improve quality and reduce lead time. Their attempt was not up to the standard and it further transformed their supply chain into more complex than before (Craighead et al., 2007, Sodhi et al., 2012).

The early 21st century has marked the major supply chain disruption that have accentuated vulnerabilities for individual firms and for the whole global industries- in late 2000, Ericsson the Swedish telecom company reported that the year-end losses of $2.34 billion for the cellular phone division is due to its supplier's factory caught on fire, in 2001 due to supplier's bankruptcy Land Rover discharged 1400 employees from their job, in 2006, Dell cancelled order for four million notebook batteries which was manufactured by Sony due to fire accident (Chopra and Sodhi., 2004; Christopher, 2004; and Sodhi et al., 2012). Thus, World auto industry was shaken by Japanese Tsunami in 2011 for several months. The telecom gear maker Nokia shut down their Chennai plant in 2014 due to no orders from Microsoft (Bijoy, Nokia to shut down its Chennai factory, The Hindu News paper October 2014). These supply chain disruptions have impacted the organizations in a long term as well as created the bad brand image among the society. Statistics revealed that 60 percent of the organizations approved their supply chains are in danger due to disruptions (Sodhi et al., 2012). IBM Supply Chain executives noted Supply Chain Risk Management (SCRM) is a paramount issue for them. Thus, a study conducted by Academy of Management Review (AMR) pointed out 46 percent top

management people hope that SCRM is essential for their firms (Hillman and Keltz, 2007). However, the corporate sectors try to mitigate these risks. Example, Cisco developed the supply chain resiliency for mitigating the supply chain risks. Nokia Chennai plants are reviving their operations after losing the order from the Microsoft. Of late, Organizations' top management people have been showing a serious concern over the risk in the supply chain and how its impact their business performance Ganeshan et al., (2017). This makes SCRM more interesting as a research area in academics and paid huge attention by practitioner and researchers Sodhi et al., (2012).

In the past, more than ten journal articles explored the SCRM literature that is published. Between 1964 and 2005 more than 200 SCRM articles were reviewed and classified the supply chain risks into four major categories, i.e. supply management, product management, demand management and IT management (Tang 2006). Rao and Goldsby (2009) reviewed 55 SCRM articles published between 1998 and 2008, and they identified the various risk factors, like organizational, industrial, environmental and top management related factors.

There were 138 articles published between 1995 and 2008 by Tang and Musa. They identified the major potential risks in supply chain including material flow, financial flow, and information flow. During that time 31SCRM articles were reviewed and published between 1998 and 2010 by Sodhi et al. (2012). They identified major research gaps in SCRM i.e, (i) No clear definition on the SCRM (ii) process gap (iii) empirical methodology gap. Colicchia and Strozzi (2012) also adoptedthe citation analysis on 55 journal articles published between 1994 and 2010, and found the emerging trends in SCRM.

The primary aim of SCRM is to identify the risks and develop the action plan to lessen the impact of the risk level. However, developing an effective SCRM model is always a paramount task and require skills and proficiency in various streams. Notable research papers have been done in SCRM literature deals with qualitative and quantitative models Ganeshan et al., (2018). Late 2000, few studies have been en devoured by some authors to analyze different magnitudes of supply chain risks and their impact on supply chain performance Ganeshan et al., (2017). Another researcher reviewed SCRM literature on the basis analysing the unit and risk management processes (Vanany et al., (2009)). PiyushSinghal et al. (2011) studied the SCRM literature based on the perceptive elements of categorize supply chain risk, structural elements of the supply chain and implementation phases of SCRM by using multi-layered taxonomy approach. Sodhi et al., (2012) formulated their own diversity in SCRM. Ho et al., (2015) analyzed SCRM in a comprehensive manner like definition of risk in supply chain perspective, classification of supply chain risk factors and mitigation strategies. Table no: 1addressed that SCRM literature and model applied by various authors.

Table 1 shows the mentioned papers have made significant contributions to SCRM. Still there are few knowledge gaps in SCRM to motivate the researcher to carry out this study. This paper will propose a new description of SCRM, supply chain risk classification and supply chain risk mitigation.

Table 1: Topics in SCRM and Model Adopted

S.No	Topics in SCRM	Author	Model
1	Risk Management Methods	Tang (2006)	Qualitative and Quantitative
2	Risk factors	Rao and Goldsby, (2009)	Qualitative and Quantitative
3	Risk categorization	Tang and Musa, (2011)	Qualitative and Quantitative
4	Identification of Risk gap	Colicchia and Strozzi, (2012)	Qualitative and Quantitative

The Purpose of This Paper Is to Provide a Comprehensive Literature Survey on Supply Chain Risk Management. In Particular, Aim To:

- Classify SCRM articles between 2010 and 2019
- Classification of Supply chain risk factors and supply chain risk mitigation strategies
- Discuss theopportunities for future research in SCRM.

The paper is organized as follows. Section 2 provides introduction to the researchmethodology. Section 3 summarizes the existing definitions of supply chain risksand proposes new description of SCRM. Sections 4, 5 and 6 present supply chain risk types, supply chain risk mitigation methods and recommends future research directions and concludes the paper respectively.

2. RESEARCH METHODOLOGY

Firstly, the search terms were defined. The keywords used in the search process were "supply chain" and "risk". Second, various academic databases were utilized to identify the journal articles including Emerald Insight, Science Direct, Springer, Taylor and Francis, Wiley, EBSCOhost, and ProQuest. To achieve the highest level of relevance, only peer-reviewed articles written in English and published in International Journals were selected. In view of this, researchers reviewed the SCRM articles published between 2010 and 2019. Below Table 2 shows that literature survey is classified into five categories: empirical, conceptual, case study, descriptive, and exploratory.

The above statistical Table 2 shows that various research strategies used in SCRM areas between 2010 and 2019. The table shows that 31 % of the SCRM articles are published between 2010 and 2019. Thus, conceptual, case study, descriptive and exploratory research design are used respectively 26 %, 22 %, 13 % and 8 % in SCRM areas. Table 3 and Figure 1 addressed year wise distribution of articles in SCRM areas.

Table and Figure addressed distribution of number of journal articles over the late ten years between 2010 and 2019. The number of SCRM articles increased last three years. The total number of journal articles published between 2010 and 2019 was 205. The reason for not including papers published prior to 2009 because in late 2008, the major supply chain problems are aroused. As previously discussed in introduction section, the problems of supply chain risk management have gained much attention after a series of events had major impacts on supply chain for example, Dell cancelled order of four million notebook batteries which was manufactured by Sony due to fire accident (Chopra and Sodhi., 2004; Christopher, 2004 and Sodhi et al., 2012). Thus, World auto industry was shaken by Japanese Tsunami in 2011 for several months. The telecom gear maker Nokia shut down their Chennai plant in 2014 due to no orders from Microsoft. The SCRM has become popular and thrust area for research. Our work also proposes a new description for SCRM by classifying supply chain risk types and risk mitigation strategies and proposes a SCRM model (Figure 1). Finally, we analyze the comprehensive literature survey in exploring potential gaps contributing towards risk management in supply chains.

Table 2: Research Strategies Used in SCRM Areas

Research Strategy	No. of Articles	% of No. of Articles Published in SCRM Area During 20102019
Empirical	62	31 %
Conceptual	53	26 %
Case Study	46	22 %
Descriptive	27	13 %
Exploratory	62	8 %
Total	**205**	**100 %**

Table: 3 Year Wise Distribution of Articles in SCRM Areas

Year	No. of. Articles
2010	24
2011	13
2012	11
2013	13
2014	14
2015	15
2016	14
2017	22
2018	36
2019	43
Total	**205**

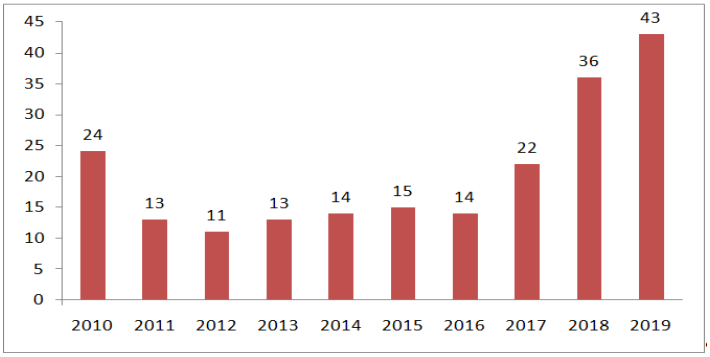

Figure 1: Distribution of Number of Journal Articles over the Last Ten Years.

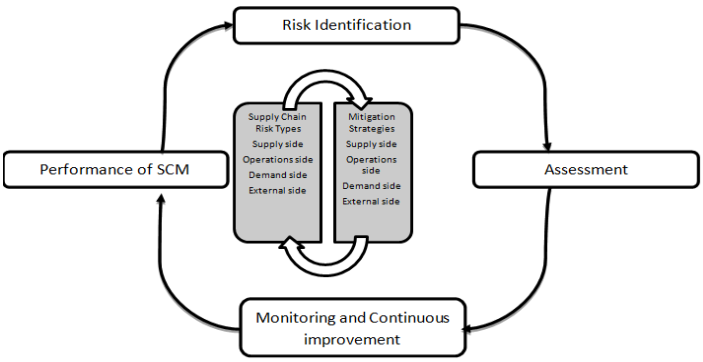

Figure 2: New Propose Model for SCRM.

3. DEFINITIONS

3.1. Supply Chain Risk

The foremost difficult question to be addressed is "What is the meaning of Supply Chain Risk?" Shortly, the risky event that occurs in the supply chain operation is known as Supply Chain Risk. With the globalization, rapid technology advancement and advent of increased product or service complexity, outsourcing, collaboration of supply networks with cross borders, risks are accelerating in an unprecedented manner. The risk of disruptions was caused by internal and external factors of supply chain. Harland and Brenchley, (2001) mentioned risks in supply chain in many forms viz supply risks, technology risks, production risks and external risks. Zsidisin and Ellram, (1999, p.222) addressed supplyside risk which are the probability of supplier failures to deliver raw materials to the firm in which its outcomes result in the firm's inability to meet the customers' demand. Christopher and Peck, (2004) mentioned two major risks in supply chain firstly, financial risk can be very high that is for example, inventory costs are very high due to stock-outs situation, obsolescence, rework of goods

and penalties for non-deliverable items. Secondly, the market risk which fails to capture the market opportunities lead to exist from the competition. The different threats or risks arise in inbound and outbound of the supply chain operation. Risks can be seized in different contexts, namely material flows, information flows, product flows, process and cost flows and it affects the overall supply chain performance (Ganeshan et al., 2018). In addition, the risk events might lead to late deliveries, shortages, stock out situations, supply disruptions, excess inventory and damaged or lost goods. In sum, the risk is any kind of threat of an event that interrupts smooth operation of supply chain (Dadfaretal., 2012). Researchers defined the supply chain risk in general term and the negative outcome of an event causes the poor performance of the firm (Wagner and Bode, 2006, p.303). Gaonkar and Viswanadham(2007) state supply chain risk is defined by the losses occurred in the entire supply chain operation resulting from the discrepancy in possible outcomes. Chenetal, (2013) defined the supply chain risk is the divergence from the expected value of supply chain performance. Thus, risks disturb the upstream and downstream of the supply chain in an organization or global supply chain (Badea et al., (2014)). Based on above definitions of supply chain risk management, researcher is summarized that–risk or threat or negative events occur in the supply chain operation, it affects the entire smooth operations of supply chain process and it leads to the economic loss for the firm.

3.2. Supply Chain Risk Management

Of late, Organizations' top management people have been showing a serious concern over the risk in the supply chain and how its impact their business performance. This makes SCRM more interesting as a research area in academics and paid huge attention by practitioner and researchers Sodhi et al., (2012). Paulsson U (2004) and Kajuter, P. (2003) described "Supply Chain Risk Management is the intersection of supply chain management and risk management".

Many authors have given definition for SCRM. However, there is no specific meaning for SCRM (Ponomarovand Holcomb, 2009), as well as less knowledge of theoretical model and framework focusing on the area (Gaonkar andViswanadham, 2007). The Table 4 addressed the definition of Supply Chain Risk Management by variousauthors.Besides, a consistent definition helps researchers identify and measure the possibility and impact of the entire set of supply chain risks, and evaluate the effectiveness of supply chain risk management methodologies. Therefore, it is imperative to obtain a clear definition of SCRM.

SCRM is a multi-faceted concept. As a result, different researchers have defined SCRM in different ways. Some SCRM research papers emphasize strategies and business goals but very few paid attention to SCRM stages (Norrman and Jansson, 2004; Tang, 2006). Ho et al. (2015) and Wieland and Wallenburg (2012) studied a comprehensive view, the four stages of SCRM. Fan and Stevenson (2018) have proposed a holistic view definition of SCRM –"the identification, assessment, treatment, and monitoring of supply chain risks, with the aid of the internal implementation of tools, techniques and strategies and of external coordination and collaboration with supply chain members so as to reduce vulnerability and ensure continuity coupled with profitability, leading to competitive advantage. They highlighted objective, process and outcome based of SCRM. However, above mentioned papers have not addressed interrelationship between SCRM stages (Fan and Stevenson 2008). In addition to enrich the theoretical knowledge of SCRM, researcher has proposed SCRM definition with inter relationship of SCRM stages -"a cohesive approach with the supply chain partners by exploiting the risk management tools to detect possible potential risks in the supply chain, identify the potential risks, assess the impact of risk, develop plans to mitigate the inter connected risks, ascertain the relationship between risks and mitigating strategies and continuously assess the value of supply chain". If it fails to develop the mitigation plans the unexpected internal and external risks of the chain may lead to quantitative and qualitative loss in the supplychain (Ganeshan et al., 2015).

Table 4: Definitions of Supply Chain Risk Management

S. No	Definition	Emphasis	Author
1	Identify the possible sources of risks in supply chain process through a combined approach amongst the members in supply chain.	Collaboration approach among members in supply chain	Christopher, (2002) p2
2	To recognize the likelihood risks in supply chain and implement the action plan, to mitigate the risks or avoid the supply chain failures.	To know the potential sources of risks and implement the actions	Juttner et al., (2003) p. 9
3	Identify and monitor the risk events, probability of occurrences, firm finds the future possible alternative sources of supply.	Identify and monitor the risks and future alternative options to mitigate the risks	Barry, (2004) p. 695
4	Collaboration with the supply chain partners and apply risk management activities to deal with uncertain events.	Coordination among the supply chain members and apply risk management tool to mitigate the risksevent	Norrman and Lindroth, (2004) p. 14
5	SCRM focus on to reduce uncertainty in supply chain operation and increase customer satisfaction with the goal of organizational competitiveness.	Reduce ambiguity or uncertainty in supply chain and enhance the customer satisfaction	Singh et al., (2005) p. 3375
6	Managing risks in supply chain by way of coordination among the supply chain partners so as to ensure the profitability and stability of long term relationship.	Manage the potential sources of risks to increase the profitability and long term relationship with SC partners.	Tang, (2006) p. 453
7	The purpose of SCRM is to keep the business entity from the negative effects and enhance its performance.	Emphasis on purpose of SCRM	Maheshwari and Jain, (2014)
8	SCRM is an inter-organizational collaborative endeavor utilizing quantitative and qualitative method to identify, assess, mitigate and monitor unanticipated large and small level risky events or conditions, which mitigate adversely influence any part of supply chain.	Emphasis on SCRM processes and types.	Ho et al., 2015

4. CLASSIFICATION OF SUPPLY CHAIN RISK TYPES:

Supply Chain Risk Management stages are identifying supply chain risks, assessing, monitoring, continuous improving and measuring the performance of supply chain activities. The first and foremost stage of SCRM process is the identification of potential supply chain risks. In comprehensive literature review the researcher classified supply chain risks (Table no:5). Supply chain mapping is thevisual representation of diagnosis of various risks occurred from supply side to demand side. It is a comprehensive and structured diagrammatic indication of risks in which the supply chain from the suppliers, manufacturer, wholesalers, and retailers and to end customers with the flow of goods, information and money. Mapping is a process clearly exposes the flow of materials, information and money describing what is going in the process, who is handling what and how and where it is done. An exhaustive analysis is required for the companies' entire supply chain operation. There are many layers of suppliers, internal production process and logistics flow of the firm that must be mapped out clearly. This analysis needs to know where the raw materials come from, how many suppliers and sub suppliersare involved, what is the mode of transportation used, where and how the raw materials are stored, how it is processed, how it is delivered from the production facilities and to understand the movement of information, money and materials. The process of mapping is described here in a structured and systematic manner. Hence, Supply chain mapping helps to identify all the risks inthe supply chain. It delivers a clearcut picture of the entire supply chain, the potential risks can be identifiedbetter.

Risks in the supply chain is broadly identified and categorized into functional aspects of the supply chain such as

upstream risk, operational or process supply chain risk, downstream risks and external risk. In addition, various authors identified and classified the supply chain risks which are environmental risks, organizational risks, network related risks, industry risk, problem specific risks, decision makers risks, disruption risks, operational related risks, market characteristics risk, product characteristics risks, businessorstrategiccharacteristicsrisksnaturalandman-madedisasterriskandother miscellaneous risks (Miller, (1992); Below Table 5 shows classification of supply chain risk factors by differentauthors.

For the motive of this paper author classified the supply chain risk into four categories which are supply side risks (upstream), operation side risks, demand side risks (downstream) and external risks. The two streams of supply chain create various risks which ultimately affect the supply chain performance. The internal side risks or operation or process risks affect the entire supply chain operations and it is controllable. However, the external side risks where supply chain interaction does not have much control over the risks and pose the different types of supply chain risk. Hence, it is required for the whole supply chain to identify the various potential risks in all these fourareas.

Table 5: Classification of Supply Chain Risk Types

S. No	Supply Chain Risks Classification	Authors and Year
1	Strategic risks, operations related risks, upstream risk factors, customer, property damage, competitive risk, goodwill, monetary risk, fiscal risk and legal risks	Harland et al. (2003)
2	External risk, supplier- customer risks, internal related risk	Jüttner et al. (2003)
3	Monetary, Physical and novelty risks	Cavinato (2004)
4	Distraction, late delivery, forecast, intellectual property, purchase, receivables, materials and capacity risks	Chopra and Sodhi (2004)
5	External risk such as environmental risk, demand and supply risks, Internal to the firm: process and control risks	Christopher and Peck (2004)
6	Operational risks: uncertain customer demand, uncertain supply and uncertain cost, Disruption risks like natural disasters floods, tsunami or terror attacks	Tang (2006)
7	Internal risks: manageable, partially manageable, unmanageable, External risks: manageable, partially manageable, unmanageable	Wu et al. (2006)
8	Supply side, processing/production side, demand side, control and external side risks	Bogataj and Bogataj (2007)
9	Disruptions/disasters, logistics, supplier dependence, quality, information systems, forecast, legal, copy right, patent related risk, purchase related risk, inventory, capacity, management and security risks	Blackhurst et al. (2008)
10	Supply side risk factors, demand side risk factors, operational side risk factors and other risk factors	Manuj et al.(2008)
11	Supply side related risks, process, demand or customer side risk factors intellectual property/knowhow risks, behavioural and social risks	Tang and Tomlin, (2008)
12	Demand or downstream side risk factors, supply or upstream side risk factors, legal related risks, infrastructure risk factors and disastrous risks	Wagner and Bode, (2008)
13	Endogenous risks like global market and technology, Exogenous risks: Manmade disasters	Trkman and McCormack, (2009)

	like terrorist attacks, diseases, workers' strikes, inflation rate and consumer price index changes	
14	Internal operational risks: demand, production and distribution, supply risks External operational risks: Anti social activities, earth quake, floods, foreign exchange rate variations	Kumar et al. (2010)
15	Internal risks: available production capacity, information system risks, internal operation risk factors. External risks: nature, political system, competitor and market risks	Olson and Wu, (2010)
16	Value-at-risk (VaR): labour strike, natural disaster, Miss-the-target: late delivery, meet poor quality requirements	Ravindran et al. (2010)
17	Risk in the external environment, Risk within the supply chain, Internal risk	Lin and Zhou, (2011)
18	Material flow, financial flow and information flow risks	Tang and Musa, (2011)
19	Demand or customer side risk factors, late delivery of materials, interruption, inventory, production (process) breakdown of machineries, physical plant layout, location and plant capacity, supply or upstream side risk factors(purchasing), system, independent and logistics risks	Tummala and Schoenherr, (2011)
20	Operational Risks, Market risks, Business or strategic risks, product characteristics risks, and miscellaneous risks	Piyush et al. (2011);
21	Organizational Risks, Network related risks, and environment risks	Ghadge et al. (2012)
22	Supply, demand, process and environmental risks	Samvedi et al. (2013)

5. SUPPLY CHAIN RISK MITIGATION STRATEGIES

Supply Chain Risk Mitigation Strategies is the third and the foremost step in supply chain risk management process. The supreme goal of supply chain risk mitigation strategies is to minimize any uncertain event that may occur in the supply chain and as well as to provide a suitable solution in order to manage the uncertain events effectively. Supply Chain risks may arise in various ways irrespective of industries and uses proactive and reactive strategy in handling the disruption. The risk mitigation strategies include classic mitigation strategies that is (before the uncertain event) to prepare preplan strategy and contingency plan that is (after the uncertain event) strategies applied after the risk event. Ila Manuj and Mentzer (2008) suggest six SCRM strategies (Table no 6) as follow as: *(Table no 6 given in Appendix 1)*

Below Table 7 addressed that the various Supply Chain Risk Management Strategies suggested by authors.

Table 8 addressed that list of journals published supply chain risk management articles between 2010 and 2019. It indicated that Supply Chain Management: An International Journal is published 37 articles followed by International Journal of Production Research are 25 nos. Total number of journals reviewed is 29 and number of SCRM related articles published is 205.

Table 7: Various Supply Chain Risk Mitigation Strategies

S. No	SCRM Strategies	Authors and Year
1	Excess capacity, Redundant suppliers, Responsiveness, Flexibility, Aggregation, More customer accounts, Increase capability	Chopra and Sodhi (2004)
2	Resiliency	Isotupa et al.(2004), Sheffi and Rice,

		(2005);
3	Finding supplier in new product/service development	Mikkola and Skjott-Larsen, (2006)
4	Trust and collaboration	Faisal et al.(2006)
5	Postponement, Product management, and Product Substitution	Tang (2006)
6	Agile Strategy	Masson et al. (2007);
7	Postponement, Speculation, Hedging, Share/Transfer, Control, Security and Avoidance	IlaManuj and Mentzer, (2008)
8	Flexible	Skipper and Hanna, (2009)
9	Proactive and Reactive	Thun and Hoeing, (2009)
10	Avoid, Spread, minimize and Accept	The Chartered Institute of Purchasing and Supply (CIPS) (2009)
11	Integration- Wide spectrum	Kannan and Tan, (2010)
12	Sharing information and incentive alignment	Eyaa et al.(2010), Wiengarten et al.(2010)
13	Combined decision making	Wiengarten et al.(2010)
14	Agile Strategy	Charles et al.(2010)
15	Lean Strategy	Carvalho et al.(2011)
16	Seeking Global Supplier	Christopher et al.2011
17	Shaper, Accepter and Recovery approach	Piyush et al.(2011)
18	Hedging and Speculation	Peiying et al. (2012)
19	Robustness	Wieland and Wallenburg, (2012)
20	Adaptability	Whitten et al.(2012)
21	Agility, Flexibility and preparedness	Ghadge et al.(2012)
22	Network Re-engineering, Collaboration between global sourcing parties, Agility and creating a global sourcing Risk management Culture	Maheshwari and Jain, (2014)
23	Government Support through developing good relation, strategic Alliance of Large enterprise	Kodithuwakku and Wickramarachchi, (2015)
24	Robustness and Agility	Yaakub and Mustafa, (2015)

Table 8: List of Journals Published SCRM Articles

S. No	Name of the Journals	Number of SCRM Articles Reviewed
1	Supply Chain Management: An International Journal	37
2	International Journal of Production Research	25
3	International Journal of Production Economics	18
4	International Journal of Physical Distribution & Logistics Management	16
5	The International Journal of Logistics Management	15
6	Industrial Management & Data Systems	9
7	Benchmarking: An International Journal	7
8	International Journal of Operations & Production Management	7
9	Journal of Operations Management	6
10	International Journal of Business Science and Applied Management	6
11	MIT Sloan Management Review	6
12	Journal of Purchasing and Supply Management	5
13	Journal of Business Logistics	5
14	Journal of Supply Chain Management	5
15	Business Process Management Journal	4
16	Modern Management Science & Engineering	4
17	European Journal of Business and Management	4
18	Academic Journal of Interdisciplinary Studies	4
19	International Journal of Logistics Management	4
20	Global Business Review	3
21	International Journal of Social, Behavioral, Educational, Economic, Business and Industrial Engineering	3
22	Journal of Logistics Management	2

23	International Journal of Agile Systems and Management	2
24	Academy of Management Journal	2
25	Omega	2
26	Decision Support System	1
27	International Journal of Business Research	1
28	Production and Operations Management	1
29	Journal of Manufacturing Technology	1
Total		**205**

6. CONCLUDING REMARKS AND FUTURE RESEARCH

The researcher has depicted a comprehensive literature survey on Supply Chain Risk Management (SCRM) published in various journals. The reviews addressed that SCRM is a contemporary research area. The literature survey is classified into five categories: empirical, conceptual, case study, descriptive, and exploratory. Totally 205 articles were published between 2010 and 2019. This paper is addressed definition of SCRM, classification of supply chain risk types and supply chain risk mitigation strategies. Based on the Norrman and Lindroth (2004) where the supply chain risks are classified into supply side risks, operation side risks, demand side risks and external side risks. From methodological point of view, most published papers were based on empirical, conceptual and descriptive, while very few based on exploratory research. In future, research can be done in exploring the types of risks and their probability of occurrence as well as the suitable mitigation strategies for effective handling of the risk management. Further studies, how technologies can be used to mitigate and monitor the risks in supply chain. Zsidisin (2004) suggested that managerial perception of risk from different perspectives is an area for future research. Supply chain trade-off decision making is an important agenda for future research in supply chain risk management (Juttner et al (2003). Analytical Hierarchical Process (AHP) standard decision making model can be used for decision making application in supply chain risk management. Supply Chain Risk mitigation strategies are potential future research opportunities. This study explored different risk mitigation strategies particularly, proactive strategies and reactive strategies for upstream and downstream of supply chain risks. Each risk mitigation strategy has its own limitations and there is a need to identify and specified mitigation strategies for specify risks. This could be addressed by the future research. Future research can be extended to explore how to create robust supply chain strategies for different industrial sectors, because they may need different strategies. Thus, research on SCRM makes an attempt to compare the robust supply chain strategies of different sectors.

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Appendix 1: Table 6

Table 9: Supply Chain Risk Mitigation Strategies

S. No	Mitigation Strategy	Description	Examples	Advantages	Disadvantages	References
1	Postponement	Delaying the actual	Postponement-	Maintain flexibility	Expensive, as form	Bucklin (1965)

		commitment of resources to maintain flexibility and delay incurring costs	Production, Assembly, Packaging	and delay costs Reducing dependence on Forecasts	postponement requires high knowledge of the product and its design	Jüttner et al. (2003), Manujand Mentzer(2008), Guericke et al., (2012)
2	Speculation	Changes in form, and the movement of goods to forward inventories	Forward buying of Raw materials	Economies of scale in manufacturing, purchasing and logistics	Not suitable for industries with high obsolescence risk and inventory carrying costs	Bucklin (1965), Simchi-Levi et al. (2008), IlaManuj and Mentzer (2008)
3	Hedging	It is an expensive strategy, creating multiple options for decision variables.	Dual Sourcing	Reducing probability of a risk event affecting supply chain and creating multiple options	High investment is required	IlaManuj and Mentzer (2008a), Simchi-Levi et al. (2008)
4	Security	Working closely with government and port officials to proactively fulfill with rules and regulations and identify unusual or suspicious elements	Cross border movement	Customs Trade Partnership among the countries	Guidelines, Documents, Adequate knowledge required	IlaManuj and Mentzer (2008)
5	Control	Transfer of risks takes the form of contracts, and agreements	Retaining ownership and control over off shored operations	Reducing risks through increased control	Vertical integration changes variable costs into fixed costs	Jüttner et al.(2003), IlaManuj and Mentzer (2008)
6	Avoidance	Attempt to avoid risky tasks within the limitations of considerable returns	Avoiding certain regions, markets, suppliers	Reduce probability of Risk and eliminate causes	Opportunity costs and Less options	Jüttner et al.(2003), IlaManuj and Mentzer (2008)