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Supply Chain Risk Management: Literature Review

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Abstract: The risks associated with global supply chain management has created a discourse among practitioners and academics. This is evident by the business uncertainties growing in supply chain management, which pose threats to the entire network flow and economy. This paper aims to review the existing literature on risk factors in supply chain management in an uncertain and competitive business environment. Papers that contained the word “risk” in their titles, keywords, or abstracts were selected for conducting the theoretical analyses. Supply chain risk management is an integral function of the supply network. It faces unpredictable challenges due to nations’ economic policies and globalization, which have raised uncertainty and challenges for supply chain organizations. These significantly affect the financial performance of the organizations and the economy of a nation. Debate on supply chain risk management may promote competitiveness in business. Risk mitigation strategies will reduce the impact caused due to natural and human-made disasters.

Keywords: risk management; outsourcing risk; supply risk; risk sharing; process management; supply chain disruptions



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1. Introduction

International trade leads to global supply chains, and risks are inherent in supply chain management (SCM). Globalization and trade openness have amplified the vulnerability in SCM and increased the risks. The monetary value of supply chain expenses is the highest in manufacturing organizations (Dey et al. 2011). Nonetheless, SCM risks are assumed to be non-financial risks in the traditional sense of risk in the finance and insurance industries.

Risk management refers to the implementation of strategies and plans to manage supply chain networks through constant risk assessment and reduce vulnerabilities to ensure resilience in supply chains. All supply chains do not have the same risks, but some risks are common. The risks are also specific to an area of business or the field of study (Jemison 1987). A supply chain is as strong as the most vulnerable member of the supply chain. Therefore, the longer a supply chain, the greater the risk of failure of the supply chain. Supply chains have many players. A high number of players present risks (Braithwaite and Hall 1999). However, building a robust supply chain is expensive (Vahid Nooraie and Parast 2016). Numerous research articles have suggested the need for such supply chains due to the magnitude of the adverse effects of risk on its performance (Chandra and Grabis 2007; Chopra and Sodhi 2014; Christopher and Lee 2004; Ritchie and Brindley 2007).

Supply chain risk management (SCRM) is a systematic and phased approach for recognizing, evaluating, ranking, mitigating, and monitoring potential disruptions in supply chains (Aqlan and Lam 2016). SCRM is an important area due to an incident’s cascading effects on logistics networks (Cigolini and Rossi 2010). Some examples of such events include September 11, the Gulf War, the outbreak of a pandemic (e.g., bovine spongiform encephalopathy, and coronavirus disease 2019, COVID-19), the millennium bug. These disruptive events have compelled practitioners to explore the vulnerabilities in

supply chains and evaluate risks. Vulnerabilities in a supply chain depend on the supply chain (Caniato and Rice 2003; Chapman et al. 2002). Moreover, the COVID-19 pandemic has resulted in disruption to the mechanics of most economies, irrespective of their size and phase of development.

Globalization, shorter product lifecycles, multifaceted networks of trade partners located in many countries, uncertainty in market demands, cost pressures, outsourcing, and offshoring are a few risks in SCM (Hachicha and Elmsalmi 2014; Lavastre et al. 2012). The complexities of SCM are rising, and the networks are becoming more complex, resulting in more uncertainty in the business environment (McInyk et al. 2005; Sofyalioğlu and Kartal 2012; Thun et al. 2011; Verbano and Venturini 2011). These represent risk events in supply chains that impact the entire supply chain network (Cagliano et al. 2012; Fernandes et al. 2011; Xanthopoulos et al. 2012). A risk event is an indicator of a threat that disrupts a supply chain (Fernandes et al. 2011; Huang et al. 2009). Global supply chains have many challenges and greater risks (Blackhurst et al. 2005; Chopra and Sodhi 2004; Tang 2007). The dependence on an organization for parts has changed to a supply chain (Christopher 1992). This requires greater transparency and sharing of information among supply chain players.

Global production practices have changed due to globalization and nations' economic engagements with partner countries. These have increased complexities and various forms of risks in supply chains. Organizations have created warehouse facilities, production plants, and fulfillment centers across countries to achieve cost benefits, access to cheaper raw material sources, or specialist skills and capabilities (Choi et al. 2012). The distribution centers in the modern era of global supply chains are also known as fulfillment centers. A fulfillment center is where customer demands are fulfilled. Therefore, these centers must be efficient because these centers' efficiency affects the entire SCM value.

Significant emphasis is to be employed on the impact of disasters distressing the supply chain and ensuring effects on operational performance (Prasad et al. 2016; Wang et al. 2014). Craighead et al. (2007) suggested that, "supply chain interruptions and the associated operational and financial risks represent the most pressing concern facing firms that compete in today's worldwide marketplace." Risk in a supply chain is "the likelihood of an adverse and unexpected event that can occur, and either directly or indirectly result in a supply chain disruption" (Garvey et al. 2015). However, there is a difference between disruption and risk. Disruption is an indicator of risk in supply chains. Nonetheless, risks exist without disruption. The 2011 tsunami in Japan affected the auto industry globally for months. Furthermore, floods in Thailand later in the same year affected the supply chains of semiconductors and auto manufacturing plants in Thailand (Chopra and Sodhi 2014).

Risks cause disruption, which ripples through the network of the supply chains. SCRM ensures the smooth functioning of supply chains (Christopher and Lee 2004). Risk can be termed as vulnerability, uncertainty, disruption, disaster, peril, or hazard. A lack of foresight about a likely disruption in a supply chain and its causes makes a supply chain vulnerable, and the SCM leaders less effective (Vorst et al. 1998). Uncertainty and risk have been used interchangeably in SCM. Uncertainty has more than one possibility and, therefore, is difficult to calculate (Knight 1921). Risk comes from uncertainty, which has a few possibilities (Hubbard 2007, 2020). However, risks can be quantified. SCRM is a strategic view of supply chains in an organization, and SCRM includes supply chain security (Williams et al. 2008).

This paper reviewed articles published from 2010 until the end of December 2019 to assess the word "risk" used in different areas/sectors under study. The analysis considered the frequency of risk as a keyword used in journals that published such articles in various research disciplines. The remainder of the paper is organized as follows: the second section presents a review of the relevant literature on SCRM and discusses the research methodology. The third section provides analyses, and Section 4 presents research implications for SCRM professionals. Section 5 concludes the research discussion on the risk and its impact on the supply chain network.

2. Literature Review and Research Design

The supply chain network consists of trade-offs interrelated by monetary, information, and material flows (Fugate et al. 2006). Many disruptions in supply chains have been seen since the year 2000. These disruptions include the fear of weapons of mass destruction, terrorist attacks, fuel protests, and disease outbreaks (Jüttner 2005). The risk is the probability of differences in expected outcomes (Spekman and Davis 2004). One can assign probabilities to various outcomes and calculate risk (Khan and Burnes 2007). However, uncertainty cannot be quantified (Knight 1921). Risk means that there is uncertainty about an outcome (Teigen 1996). Hence, uncertainty refers to a risk that may not be eliminated. However, these uncertainties can be minimized with proper assessment and planning (Slack and Lewis 2002).

SCRM can be divided into two broad categories of approaches. The first is the strategy for comprehensive risk management approach (Azad et al. 2012; Christopher and Peck 2004; Craighead et al. 2007; de Matta 2016; Tang 2007; Xu et al. 2015), and the second is a focused approach to a specific disruption. These specific disruptions could be security (Véronneau and Roy 2014), lead times (Kouvelis and Li 2008), or terrorism (Sheffi 2001). Although these methods provided enormous value and insights, the events causing disruption were presumed to be unintentional. The lack of risk managing strategies to understand the cause of disruption leaves a gap from a theoretical perspective, exposing firms to unavoidable risks in the environment. Children's toys contained lead-based paint in 2007 without the knowledge of Mattel. This caused disruptions in Mattel's supply chains. Mattel ended up setting quality assurance centers at the suppliers' factories to avoid the repetition of the lead paint crisis. The supplier used lead-based paint to save small operational costs. The cost of disruption to Mattel was much more significant and could have been avoided (Roloff and Aßländer 2010).

The remainder of the section is divided into four subsections. The first subsection reviews the past literature for various definitions of risk. The second subsection discusses risk disruption in SCM caused by natural disasters or events which are beyond human control. Risk disruption can occur due to weak supply chain strategies. The third subsection discusses risk management methods and strategies. The fourth subsection illustrates risk detection and risk mitigation in the supply chain network for a contingency plan and supplier evaluation to be carried for reducing risk impact and achieving supply chain resilience (Figure 1).

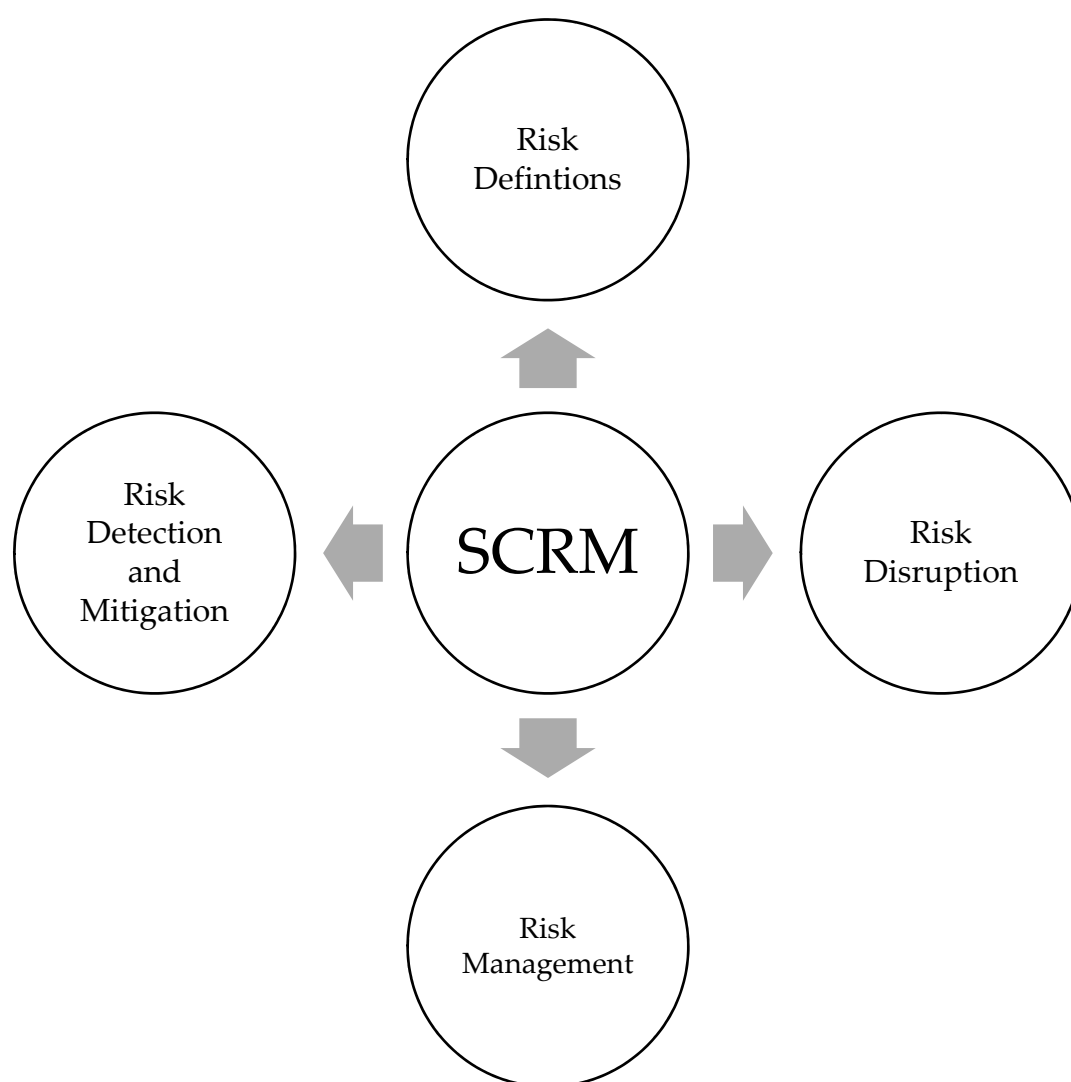


Figure 1. Supply chain risk management (SCRM) categories.

2.1. SCRM Definitions

The definitions of “supply chain risk” and SCRM are evolving (Diehl and Spinler 2013; Sodhi et al. 2012). A universally acceptable definition helps to identify, measure the chances of risk and its effect on the supply chains. This helps in adopting the most effective SCRM strategies. Therefore, standard definitions are vital (Diehl and Spinler 2013; Sodhi et al. 2012). Table 1 summarizes a few definitions of risk and SCRM.

Table 2 summarizes the findings and contributions of past literature reviews on SCRM. The authors have used various forms of literature review analysis, and each paper is unique in itself, which leaves the gap for further literature research in the field of SCRM.

Table 1. Definitions of Risk and SCRM.

Authors	Definitions
Bogataj and Bogataj (2007)	“The potential variation of outcomes that influence the decrease [in] value added at any activity cell in a chain.”
Wagner and Bode (2006)	“The negative deviation from the expected value of a certain performance measure, resulting in negative consequences for the focal firm.”
Norrman and Jansson (2004)	“To collaborate with partners in a supply chain apply risk management process tools to deal with risks and uncertainties caused by, or impacting on, logistics related activities or resources.”
Tang (2007)	“The management of supply chain risks through coordination or collaboration among the supply chain partners so as to ensure profitability and continuity.”
Jüttner (2005), Jüttner et al. (2010)	“The identification and management of risks for the supply chain, through a coordinated approach amongst supply chain members, to reduce supply chain vulnerability as a whole.”
Goh et al. (2007)	“The identification and management of risks within the supply network and externally through a coordinated approach amongst supply chain members to reduce supply chain vulnerability as a whole.”
Thun et al. (2011)	“Characterized by a cross-company orientation aiming at the identification and reduction [in] risks not only at the company level, but rather focusing on the entire supply chain.”
Jüttner et al. (2010)	“Any risks for the information, material and product flows from original suppliers to the delivery of the final product for the end user.”
Ellis et al. (2010)	“An individual’s perception of that total potential loss associated with the disruption of supply chain of a particular item from a particular supplier.”
Zsidisin (2003)	“The probability of an incident associated with inbound supply from individual supplier failures or the supply market, occurring, in which its outcomes result in the inability of the purchasing firm to meet customer demand or cause threats to customer life and safety.”

Table 2. Literature reviews on SCRM.

Authors	Research Methodology	Key Findings/Contributions
Jüttner et al. (2010)	Focus group discussions, interviews, and statistical analyses.	Developed four basic conceptual constructs around risks
Khan and Burnes (2007)	Literature review	There is a need for analytical models
Natarajarithinam et al. (2009)	Literature review	Management of disruptions for rapid recovery needs improvements.
Rao and Goldsby (2009)	Literature review	Classification of risks into environmental, industry, and organizational risks
Tang and Musa (2011)	Literature survey and bibliographic analysis	There is a need for quantitative modeling in SCRM
Vanany et al. (2009)	Literature review from 2000 to 2007	Enterprise Resource Planning (ERP) will become a vital tool in SCRM. There is a need for collaborative strategies in SCM.
Williams et al. (2008)	Literature review	The authors built theories by working on the different categories of literature in SCM. However, they also stressed quantitative assessments for a better understanding of SCRM.

2.2. Risk Disruption

Disruptions in supply chains are evolving to be more comprehensive and recurrent in the business environment (Narasimhan and Talluri 2009). The scale and rate of risk events in supply network are increasing (Blackhurst et al. 2005). Disruptions determine the robustness of SCM in a company (Hendricks and Singhal 2003, 2009). Disruption events are described as when “the tornado hits, the bomb explodes, a supplier goes out of business or the union begins a wildcat strike” (Sheffi and Rice 2005). There are different types of risk identified by various academicians and practitioners from the field of SCM. The risk classified by various authors can be elaborated to include the scale and risk occurrence

(Blackhurst et al. 2005; Norrman and Jansson 2004; Sheffi and Rice 2005). Some other parameters to classify risks in SCM are: (i) based on the sources of risk and mitigation strategies (Chopra and Sodhi 2004); (ii) as organizational risks, environmental risks, and network risks (Jüttner et al. 2010); (iii) demand and supply risks (Manuj and Mentzer 2008); (iv) industry and organizational risks (Rao and Goldsby 2009); and (v) network risks (Garvey et al. 2015).

An uncertain business environment causes supply chain risks. The uncertain business environment results from cyclical business behavior, fluctuation in demands, or a disaster (Tang 2007). Therefore, uncertainty may be seen as a risk that can disrupt supply chain performance. Some authors have categorized risks in supply chains under operational risk, network risk, and external risks (Handfield and McCormack 2008). Operational risks are due to a strategic re-engineering failure arising from within the system. For example, a ferry named Moby Prince collided with a ship named Agip-Abruzzo ship in the Mediterranean Sea on 10 April 1991, causing a loss of 140 lives and 25,000 tons of oil; a fire in the Haven oil-tanker caused the loss of six lives, and 50,000 tons of oil on April 11, 1991 (Cigolini and Rossi 2010). Network risks are derived from the supplier network layers based on the title, vendor strategies, and agreements between the supply chain network vendors. Thirdly, external risks result from an organization's external environment, which poses a significant threat to the existing business environment. According to Silva and Reddy (2011), 73% of the U.S. organizations suffered more than USD 1 billion in sales in the previous five years due to volatile disruption in the business cycle, with the most recurrent disruption caused by unmanageable natural disasters. Such turmoil often immobilizes supply chains for an extended duration (Altay and Ramirez 2010).

2.3. Risk Management

"Risk management refers to strategies, methods, and supporting tools to identify and control risk to an acceptable level" (Alhawari et al. 2012). Additionally, risk management can also be referred to as a synchronized set of actions and approaches to direct an organization to minimize the risk for achieving the organizational goals. Managing risks allows the decision-maker to understand and assess the impact of risk in a supply chain network. Controlling complexity leads to higher cost efficiency and reduces risks. Early oil tankers had two interconnected storage compartments causing instability. This design made oil tankers susceptible to overturning. The design of oil tankers was modified to have more independent compartments to provide deep water stability, although it was expensive to build such ships (Chopra and Sodhi 2014).

Supply chains evolve based on the market's requirements or manufacturing plants in different product development stages (Hayes and Wheelwright 1979). Furthermore, to reduce the global supply network's risk caused by increased economic engagements between nations, regional supply chains can replace global supply chains. For example, the world's largest distiller (Diageo PLC, London, UK) is shifting its supplier and distribution strategy from a global supply chain towards a more regional supply chain network. They minimize risks by sourcing locally and increase market share and profits by focusing on local markets (Lucas 2013). A manufacturing company (Li & Fung Limited., Hong Kong, China) ties up sub-contracts with various vendors spread mostly across southern Asia, which reduces the dependency on one supplier in times of crisis, focusing on improving efficiency and reducing the risks in supply chains. Such regional transitions were envisaged due to various risks in global supply chains (Gurtu et al. 2015, 2016). The estimation of risk can lead to better risk management, reduce the extent of damage, and improve supply chain resilience. Long term investment in a robust supply chain network in an organization will reduce operational costs and be flexible enough to the changing and competitive business environment. Contingency plans to disruptions make companies resilient and provide a competitive advantage (Sheffi 2005).

2.4. Risk Detection and Mitigation Strategies

Risk detection plays a pivotal role before disruption occurs. Force majeure disruptions are challenging to manage but can be estimated through conscious risk assessment strategies (Kleindorfer and Saad 2009; Norrman and Jansson 2004; Sheffi 2001), identifying risk indicators (Rodd 2003), and applying the principles of Total Quality Management (TQM) in sharing information among SCM partners (Lee and Whang 2005). Corporations should have contingency plans in the case of the occurrence of a disruptive event. Performance failures of a supply chain can be monitored through audits in an organization (Giunipero and Eltantawy 2004). Toyota have applied these principles in their supply chains (Dyer and Nobeoka 2000) and minimized the disruptions due to product recalls (Bates et al. 2007).

Strategies to control risk may be divided into seven categories: prevention, rescheduling, conjecture, numerical and economic, vertical integration, risk-sharing, and technology and security (Jüttner et al. 2010; Miller 1992). The prevention strategy is used when risks are linked with each product or its terrestrial markets, or close engagement with suppliers/customers is not possible. Divestiture of resources, delay of entry, or contributing to less ambiguous markets is prevention (Miller 1992). Ensuring flexibility and delay in spending refers to rescheduling (Bucklin 1965). Market demand, customization of products or services, input costs, product life cycle, and product modularity affects rescheduling (Chiou et al. 2002). The conjecture is the opposite of rescheduling (Bucklin 1965), and decisions are influenced by projected demand. Supply chain resources are leveraged to maximize the competitive advantage in serving the customers (Perry 1991). Financial risks are addressed through numerical and economic approaches (Chichilnisky and Heal 1998). The numerical approach is for a large population, e.g., insurance. The occurrence of an event for many people at the same time requires an economic approach. A few risks incentivize vertical integration because vertical integration reduces the risks due to better supply and demand control. Opportunism and asset specificity, capacity constraints, and improved supplier–buyer power balance are such incentives (Achrol et al. 1983; Ellram and Siferd 1998; Williamson 1979). Contracts with flexibility for possible changes in the environment reduces risks. Designing flexible contracts acts as a control mechanism (Macneil 1978). Outsourcing or offshoring transfers risks in SCM. Technology to detect nuclear, chemical, or biological elements exists and reduces the risk of carrying such shipments.

Organizations such as Container Security Initiative, Customs Trade Partnership Against Terrorism (CTPAT), and Operation Safe Commerce (OSC) act as instruments for global supply chain security (Mortimer 2004). The detection of a likely disruption from an unforeseen event is vital to risk mitigation. Therefore, SCRM facilitates a reduction in uncertainties and disruption while improving operational performance.

“A literature review is a systematic, explicit, and reproducible design for identifying, evaluating and interpreting the existing body of recorded documents” (Fink 1998). Literature reviews consist of two purposes: firstly, they summarize the present research findings by classifying patterns, themes, and issues. Secondly, they help to identify the conceptual content of the field (Meredith 1993) and contribute to theory development (Harland et al. 2006).

Literature reviews are content and structural analyses of the existing literature in an area (Brewerton and Millward 2001). The following steps suggested by Seuring and Müller (2008) have been used for this review:

1. Material collection;
2. Descriptive analysis;
3. Category selection;
4. Material evaluation.

This paper reviews and analyzes the existing academic literature on SCRM and discusses the future discourse of SCRM.

3. Analysis and Discussions

The total number of documents published in peer-reviewed journals in the English language that used “risk” in their titles, keywords, or abstracts in the EBSCO premium database between 2010 and 2019 was 455. This number includes papers published in ABDC and non-ABDC journals (Table 3). The papers published in non-ABDC journals were 143 ($455/143 = 31.43\%$).

Table 3. Document type for ABDC and non-ABDC journals.

Document Type	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Total
Non-ABDC Journals											
Article	6	11	12	8	17	15	15	11	22	22	139
Case Study				1		1					2
Opinion							1				1
Interview									1		1
Non-ABDC Total	6	11	12	9	17	16	16	11	23	22	143
ABDC Journals											
Article	14	14	26	21	36	26	32	35	45	52	303
Case Study		1	1	1	1	1	2	2			9
ABDC Total	14	15	27	22	37	27	34	37	45	52	312
Overall Total	20	26	39	31	54	43	50	48	68	74	455

There were a total of 143 research papers published between 2010 and 2019 in non-ABDC journals. The papers were in the form of articles, case studies, opinions, and interviews. There were 139 articles, followed by one case study, and the rest were opinions and interviews. Forty-four articles on SCRM were published in the last two years of the study period, which were the highest in any two years between 2010 and 2019 and accounted for more than 31% of the publications.

There were 312 ($312/455 = 68.57\%$) papers published in ABDC listed journals as an article or a case study (Table 3). The number of research publications showed several research papers published on SCRM and the importance of risk management in the competitive and unpredictable business environment.

There were 303 research articles published in ABDC journals with nine case studies on the supply chain risks. However, no literature reviews were published. As stated earlier, the number of publications on risk factors in supply chains increased between 2010 and 2019 due to uncertainty and risk exposure. Economic engagements between nations due to globalization have sparked the need for efficient SCRM strategies to minimize the risk uncertainties.

Moreover, the papers were further analyzed into different ABDC ranking journal publications. Appendix A illustrates a detailed classification of journals listed in the ABDC category. There were 48 A* category article publications between 2010 and 2019, compared to 200 A category research publications on SCRM. The remaining B and C category journals had 48 and 16 research publications, respectively. Therefore, research publications in the A category have received the highest number of publications. The analyses were classified into the number of papers published in top journals since 2010. Seven journals topped the list in the maximum publications related to risk management in the supply chain. The *International Journal of Production Economics (IJPE)* had the most publications in the studied period (Table 4).

The top journals can be further analyzed based on the publication of more than ten research papers. Table 5 illustrates the combination of the number of papers published in the number of journals. The *International Journal of Production Economics* published by Elsevier has 41, followed by the *International Journal of Production Research* with 31 publications. This is provided in Table 6 with the names of publishers.

Table 4. Top journal publications.

Journal Name	No. of Publications
<i>International Journal of Production Economics</i>	41
<i>International Journal of Production Research</i>	31
<i>Journal of Cleaner Production</i>	19
<i>Computers and Industrial Engineering</i>	19
<i>European Journal of Operational Research</i>	13
<i>Benchmarking: An International Journal</i>	11
<i>Industrial Management and Data Systems</i>	10

Table 5. Information on the number of journals and papers published.

Number of Papers Published	Number of Journals	Number of Papers in These Journals
More than 10	6	134
10	1	10
9	1	9
8	2	16
7	1	7
6	3	18
5	3	15
4	3	12
3	11	33
2	7	14
1	44	44
Total	82	312

Table 6. Publishers of SCRM research papers in ABDC listed journals.

Publisher	No. of Articles	%
Elsevier B.V.	130	41.67
Emerald Publishing	61	19.55
Taylor & Francis Ltd.	53	16.99
Wiley-Blackwell	31	9.94
Springer Nature	9	2.88
INFORMS: Institute for Operations Research	5	1.60
Aspen Publishers Inc.	3	0.96
Pennsylvania State University Press	3	0.96
IGI Global	2	0.64
American Society of Civil Engineers	2	0.64
Wageningen Academic Publishers	2	0.64
American Accounting Association	1	0.32
Adonis & Abbey Publishers Ltd.	1	0.32
Palgrave Macmillan Ltd.	1	0.32
Food Distribution Research Society	1	0.32
Sloan Management Review	1	0.32
Global Academy of Training & Research (GATR) Enterprise	1	0.32
IEEE	1	0.32
Kluwer Law International	1	0.32
Global Business Publications	1	0.32
Academic Press Inc.	1	0.32
Harvard University	1	0.32
Total	312	100

4. Research Implications in SCRM

Global supply chains require a retrieval plan to ease the effects of disasters (Bryson et al. 2002). There needs to be a strategic plan, because uncertainties and risks surround the supply chain environment. Therefore, quick recovery is the prime objective after

a risk incident has occurred. The formation of suitable risk recovery models also needs planning and a combination of information and human intervention. There are a few authors who have suggested empirically grounded research tools in SCM (Jüttner et al. 2010), such as mathematical programming models and simulation models (Rao and Goldsby 2009), analytical hierarchy processes (Vanany et al. 2009), complexity and graph theories (Colicchia et al. 2012), and the development of models considering interdisciplinary research (Khan and Burnes 2007) for further research in SCRM.

There are different payment processes in the imports and exports of goods. The two methods are prominent, namely, direct payment between the parties, and through a third party such as a bank. In the case of advance payment, the financial risk in a supply chain is high, particularly for making payments to new vendors in different countries. Direct payment requires trust and relationships and is avoided where trust between the two parties is not strong. In such cases, parties choose a financial mediatory, such as a bank, to make the payment through a letter of credit. Banks play a significant role, but this increases the cost of supply chains. The process involves considerable documentation, which delays the process and increases the risk due to currency fluctuations or trade embargoes.

Mingers and White (2010) suggest that a system can be projected for innovative ideas to the ambiguous business environment. A cohesive approach to SCRM needs to incorporate risk issues from industry practice (Tang and Musa 2011). Industry 4.0 is expected to significantly impact the visibility of the SC. Modern technologies such as Radio-frequency identification (RFID), ERP, and General Packet Radio Service (GPRS) will become important tools for SCRM (Rao and Goldsby 2009; Tang 2007; Vanany et al. 2009; Wilson 2007). However, almost all shipping transactions involve many documents such as seller contracts, charter party agreements, bills of lading, certificates of origin, port documents, letter of credit (LC), and many other documents related to a vessel's consignment (Gurtu and Johny 2019).

Identifying and harmonizing strategies for different types of risk is an essential factor for success in risk management (Chopra and Sodhi 2004). There needs to be a corrective approach for recurrent risks for evaluating the costs of increasing or decreasing inventories, capacity, flexibility, responsiveness, and capability. Managing disruptive risks will require designing supply chains where the resource in question (parts inventory or the number of suppliers) is never completely centralized (Chopra and Sodhi 2014). For instance, Samsung Electronics Co. Ltd. has two vendors to supply necessary electronic parts, even though the second vendor contributes only about 20% of the volume (Sodhi and Lee 2007). The implications of these principles are simple to understand. The benefit of having multiple fulfillment centers at various locations reduces the supply chain risk network without increasing the cost and minimizing the risk.

5. Conclusions

Supply chains form the backbone of the global economy and promote trade, consumption, and economic growth. The changing phases of globalization, lean manufacturing processes, and outsourcing to low-income countries have made supply chain networks more efficient and changed their supply chain risk profile. Due to globalization, inter-supply chain competition has intensified; companies strive to deliver the best value to customers with greater efficiency at the lowest cost; communication with vendors/suppliers will play a vital role in many organizations (Mentzer et al. 2001; Wu et al. 2014). Supply chain cost reductions can be gained through optimally designed supply chain flows combined with goods' physical movement. This can be simplified by extending trade credit through conventional modes of distribution, reducing inventory levels, cost in supply chain management, and increase the access to trade finance organizations.

This paper reviews the existing literature on SCRM and the exploration of risk factors in SCM. In this paper, we reviewed 455 international journal articles appearing between 2010 and 2019 in SCRM. We further refined all these articles according to publications in the ABDC ranking list (Appendix A), which was around 312 articles with the document type (Table 3) and top publishers (Table 6) in SCRM. Furthermore, the non-ABDC list

of publications was considered to understand risk factors of SCM. The total number of papers published in the non-ABDC journals list was 143 (Table 3). This comprehensive classification of publications in top journals could help researchers conduct more detailed analyses based on risk factors affecting SCM networks. This indicates that the need for a greater focus on risks in global supply chains is needed. Risk assessments, risk analyses, and risk management are areas of interest in finance and insurance. However, the value of inventories in global supply chains and the impact of disruptions in global supply chains must be paid greater attention.

This study is not devoid of limitations. There are three main limitations of this paper. Firstly, the use of a single comprehensive, multidisciplinary database with a selection of only a few keywords; an article was likely unexplored if it did not contain the word “risk” in the title, keyword, or abstract. Secondly, we reviewed only international journal articles while excluding conference papers, master’s and doctoral dissertations, textbooks, book chapters, unpublished articles, and notes. Thirdly, this study’s goal was to present and categorize recent SCRM research and explore potential research gaps. Nevertheless, using this paper’s categorization and summary results, further research can be conducted into specific underexplored or unexplored areas. This literature review is expected to benefit researchers to further explore studies in SCRM so that supply chain risks can be managed more effectively and efficiently.

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Appendix A

Table A1. Research Articles Published in ABDC Journal by Category.

Journal Title	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Total
A*											
<i>European Journal of Operational Research</i>	2	2			3	3	1		1	1	13
<i>Production & Operations Management</i>		2			3				1	2	8
<i>Decision Sciences</i>	1				1	2				1	5
<i>Journal of Operations Management</i>	1	1		1		2					5
<i>Transportation Research: Part E</i>					1			1	1	1	4
<i>Decision Support Systems</i>					2					1	3
<i>Management Science</i>					1		1			1	3
<i>Human Resource Management</i>	1										1
<i>International Journal of Information Management</i>										1	1
<i>Journal of Construction Engineering & Management</i>						1					1
<i>Journal of Management Information Systems</i>				1							1
<i>Management Accounting Research</i>				1							1
<i>Manufacturing & Service Operations Management</i>										1	1
<i>Transportation Research Part A: Policy & Practice</i>									1		1
A											
<i>International Journal of Production Economics</i>	1	2	8	2	5	5	9	6		3	41
<i>International Journal of Production Research</i>	1	3	2	2	2	6	5	2	3	5	31
<i>Computers & Industrial Engineering</i>			1	1	1	1	1	6	2	6	19
<i>Journal of Cleaner Production</i>		1		1			2	3	5	7	19
<i>Industrial Management & Data Systems</i>			2		1		1		6		10
<i>Omega</i>		1				3		1	1	3	9
<i>International Journal of Operations & Production Management</i>		1			1			1	4	1	8
<i>Production Planning & Control</i>	2		2					1	2		7

Table A1. Cont.

Journal Title	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Total
<i>Annals of Operations Research</i>				1			1	3		1	6
<i>International Journal of Logistics Management</i>			1			1	1	2	1		6
<i>International Journal of Physical Distribution & Logistics Management</i>		1					1	1	2	1	6
<i>Computers & Operations Research</i>			1						2	1	4
<i>Journal of Business Logistics</i>	1			1					1	1	4
<i>Journal of Purchasing & Supply Management</i>							2	1			3
<i>Journal of Retailing & Consumer Services</i>						1				2	3
<i>Journal of Supply Chain Management</i>			1						1	1	3
<i>Computers & Security</i>								1		1	2
<i>Systems Research & Behavioral Science</i>					2						2
<i>Applied Economics</i>								1			1
<i>Construction Management & Economics</i>	1										1
<i>Energy Policy</i>										1	1
<i>Harvard International Law Journal</i>					1						1
<i>IEEE Transactions on Engineering Management</i>							1				1
<i>IIE Transactions</i>			1								1
<i>International Journal of Project Management</i>							1				1
<i>International Journal of Retail & Distribution Management</i>									1		1
<i>Journal of Business & Industrial Marketing</i>									1		1
<i>Journal of Business Research</i>										1	1
<i>Journal of Enterprise Information Management</i>							1				1
<i>Journal of Global Information Management</i>					1						1
<i>Journal of Information Systems</i>			1								1
<i>Journal of Management in Engineering</i>										1	1
<i>MIT Sloan Management Review</i>					1						1
<i>Technovation</i>					1						1
<i>Transportation Science</i>										1	1
B											
<i>Benchmarking: An International Journal</i>		1	1	2	1			2	2	2	11
<i>Journal of Manufacturing Technology Management</i>			1	1	1		1		1		5
<i>International Journal of Logistics: Research & Applications</i>				1			1		1		3
<i>Management Decision</i>								1	1	1	3
<i>Thunderbird International Business Review</i>	1							2			3
<i>Transportation Journal (Pennsylvania State University Press)</i>				2			1				3
<i>Business Horizons</i>					2						2
<i>Business Process Management Journal</i>			1							1	2
<i>International Food & Agribusiness Management Review</i>		1								1	2
<i>Journal of Marketing Channels</i>			1				1				2
<i>Review of Quantitative Finance & Accounting</i>					1				1		2
<i>Cogent Economics & Finance</i>						1					1
<i>International Journal of Computer Integrated Manufacturing</i>			1								1
<i>International Journal of Productivity & Performance Management</i>					1						1
<i>International Journal of Quality & Reliability Management</i>							1				1
<i>Journal of Environmental Planning & Management</i>				1							1
<i>Journal of Intelligent Manufacturing</i>			1								1
<i>Journal of Manufacturing Systems</i>				1							1
<i>Journal of Revenue & Pricing Management</i>							1				1
<i>Multinational Finance Journal</i>	1										1
<i>Resources Policy</i>								1			1

Table A1. Cont.

Journal Title	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Total
C											
<i>Intellectual Property & Technology Law Journal</i>				1	2						3
<i>Journal of Risk Research</i>				1	1	1					3
<i>African Journal of Business & Economic Research</i>					1						1
<i>Business Law Review</i>								1			1
<i>China Agricultural Economic Review</i>										1	1
<i>Competitiveness Review</i>	1										1
<i>Information Resources Management Journal</i>									1		1
<i>International Journal of Managing Projects in Business</i>									1		1
<i>Journal of Business & Economics Review (JBER)</i>									1		1
<i>Journal of Food Distribution Research</i>							1				1
<i>Journal of Management Development</i>			1								1
<i>Strategy & Leadership</i>				1							1
Total	14	16	27	22	37	27	35	37	45	52	312

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