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A Systematic Review for Supply Chain Integration and Risks

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Abstract

In past decades, supply chain integration is used as a tool for manufacturers to earn competitiveness and improve performance. With the pace of globalization, the scope of the supply chain network has extended and increased the challenges for supply chain integration. This means the integrating processes have enhanced the vulnerability of a supply chain network. Recently, the integrated global supply chains are disrupted by disease outbreaks, natural disasters, and canal blocks. The risks embedded in the supply chain are catching the eyes of academicians and practitioners. Changes are expected after global supply chain disruptions concerning the size of the network, supplier locations, and network management, which are highly related to supply chain integration and supply chain risk management. Hence, this paper aims to investigate the dimensions of supply chain integration adapting to the changing world. Furthermore, this study adopts the systematic review approach to identify the dimensions of supply chain integration and construct a supply chain integration framework. The review found that supply chain integration dimensions including internal integration, supplier integration, customer integration, and service provider integration are important for practitioners. Ultimately, this review recommends future studies to focus on the impact of supply chain integration on supply chain risk management.

Keywords: Dimensions, Supply Chain Integration, Supply Chain Risk

Introduction

Nowadays, manufacturers are competing on the supply chain for providing quick delivery, innovative and customized products to satisfy customer needs. In addition, globalization and the development of technologies, especially information technology have changed the relationship structure of manufacturer and supply chain partners, which drives manufacturers to integrate internal functions and external partners. From the manufacturing industries' perspective, supply chain integration is a strategic and high-level inter-organizational collaboration between the focal manufacturing firm and supply chain partners, i.e., suppliers, distributors, retailers, and customers (Kang et al., 2018). In previous literature, supply chain integration is considered a way to improve the performance of supply chains. Increasing evidence indicates that supply chain integration positively impacts supply chain performance including cost, time, responsiveness, operation quality, and innovation (Kumar et al., 2020).

However, the expansion of network and integration has brought additional dependency on supply chain stakeholders, both internal and external, to the companies, which increased the supply chain's vulnerability (Flynn et al., 2009). Recent examples like the COVID-19 pandemic and the 2021 Suez Canal obstruction have negatively affected the supply chain worldwide. Hence, supply chain safety is highly concerned after global supply chain disruptions involving the size of the network, supplier locations, and network management, which are highly related to supply chain integration. The ever-changing external environment puts forward new requirements for supply chain integration. A clear supply chain integration framework can provide an adequate basis for related research and practice. Therefore, this paper aims to investigate the dimensions of supply chain integration adapting to the changing world. To achieve this objective, the following research questions need to be addressed: (1) What dimensions of supply chain integration are recognized in prior studies? (2) How the supply chain integration dimensions impact the supply chain in coping with supply chain risk?

To address the research questions above, the current study aims to determine the dimensions of supply chain integration and its impact on supply chain risks. In addition, this paper also focuses on the relationship between supply chain integration and supply chain risk, and proposes future research directions. This paper systematically reviews research papers and proposes a dimensional framework of supply chain integration, which can provide a reference for assessing supply chain integration and supply chain risks.

Concepts and Definitions

Supply Chain Integration

The definition of supply chain integration was first introduced by Steven in 1989, taking the manufacturing industry as a research objective. From then on, in the past few decades, researchers have refined the definition of supply chain integration which refers to a strategic and high-level inter-organizational collaboration (e.g., information sharing, joint decision making, and system coupling) between the focal firm and supply chain partners, i.e., suppliers, distributors, retailers, and customers (Kang et al., 2018). By integrating material flow, information flow, and financial flow, and other resources (e.g., human resources and knowledge) with supply chain partners, the supply chain can provide end customers with high-value products (Wang et al., 2018). Furthermore, supply chain integration should concentrate on customer value-creating activities and overcome the no value-added processes. Therefore, the supply chain integration refers to the focal firm breaks the organization's internal functional barriers and strategically collaborates with external supply chain partners in order to provide high-value products to final customers.

Supply Chain Integration Dimensions

The dimensions of supply chain integration have been widely discussed in previous literature, and there are two main approaches to conceptualize supply chain integration. One is to ignore boundaries between and within organizations, focusing on strategies and operations that describes supply chain integration, and aims to make the supply chain participants into a unified entity and provides high-value products. Researchers stressed collaboration, information sharing, and joint decision-making are the fundamental components of the supply chain integration (Bruque-Cámara et al., 2016). For example, Angeles (2008) described supply chain integration as operations of integrating physical flow, information flow, and financial flow integration. Wang et al (2016) constructed a three-dimension framework, which involves strategic alliance, information sharing, and process coordination.

Another approach considered two boundaries concerning the supply chain integration framework: internal integration and external integration. Scholars who supported this definition have conceptualized supply chain integration into three dimensions: internal integration, supplier integration, and customer integration (Boer and Boer, 2019). Furthermore, as globalization makes the geographical distribution of supply chain partners more dispersed, the logistics service provider becomes a critical supply chain practice component (Wang et al., 2020). Moreover, the physical distance and increasing demand for information sharing forcing the supply chain participants to invest more in information technology, such as enterprise resource planning, radio frequency identification, electronic data interchange, and so on (Oghazi et al., 2018). Therefore, some authors extended the supply chain integration beyond suppliers and customers and introduced partner integration, e.g., trade partners, logistics service providers, and information technology service providers (Perdana et al., 2019).

Supply Chain Risk

The definition of supply chain risk is described as an unexpected and abnormal situation, such as interruption of raw material supply, which leads to inefficiency operations, high cost, or disruptions of the supply chain (Baryannis et al., 2018). Taking a recent supply chain disruption as an example, according to the British Broadcasting Corporation's report, the 2021 Suez Canal obstruction has disrupted approximately 9.6 billion US dollars worth of goods every day (Harper, 2021). The Suez Canal is an important channel for the global energy and commodity supply chain, and the blockage of the Suez Canal has caused the world crude oil prices rose by 4% on the second day of the incident (Bodt et al., 2021; Lee and Wong, 2021).

Globalization and supply chain integration, especially external integration, has expanded the supply chain network and increased the supply chain's complexity. Global sourcing and international logistics lead the supply chain to take risks, implying that the global supply chain structure has become more vulnerable to risks with low supply chain performance (Munir et al., 2020).

Methodology

The literature review is a scientific methodology of research for aggregating and comprehending knowledge recorded (Khanuja and Jain, 2019). By systematically reviewing literature related to supply chain integration and supply chain risk, this study deals with reporting the review, which involves articles employing descriptive analysis, thematic classification, and reporting of the review results. This study only contains the papers published in English between 2000 and 2020 in the Emerald insight database. The review processes are shown in Table 1.

Table 1: Review processes

Steps	Process	Outcome
Settling articles	Identify keywords over research themes of supply chain integration and supply chain risk.	
Article search	Searching articles in Emerald insight with keywords “supply chain integration” and “supply chain risk”.	685
Exclusion	Book part, case studies, and expert briefings are excluded.	680
Inclusion	Articles were included based on following criteria: The article must have problems or issues discussed from any one of the research questions. Research premises/objective should match with the objective of the paper. The paper should have at least one subject in its research work, which are “supply chain integration” and “supply chain risk”. Findings of the paper should be able to provide answers to the referred problem/research questions. Papers were then reviewed thoroughly, and on the basis of synthesis and comparisons, papers not related to research questions were excluded.	212
Critical comparison	Papers were then reviewed thoroughly, and on the basis of synthesis and comparisons, papers not related to research questions were excluded.	152
Final decision	Complete selection of research articles.	62

The current study explores the distribution of papers related to supply chain integration published between 2000 and 2020 in cited journals. Furthermore, this paper analyses the final selected articles and classifies them according to the adoption of supply chain integration dimensional framework. Summarizes the dimensional framework of supply chain integration, which can be used to provide help for future research. Finally, this study analyses the article that studies the impact of supply integration on supply chain risks, and summarizes the impact of supply chain integration on supply chain risks.

Results

Classification of Journals and Publication Trend

Analyse the source of the article and understand the journal's impact on the field of supply chain integration. As shown in Table 2, the 62 selected publications were published in 16 journals in the past decade. The top three journals cover 53% of publications. As shown in Fig.1, in 2006, Leavy (2006) and Wilding and Humphries (2006) published related articles. Between 2007 and 2013, researchers did not pay much attention. From 2014 to 2019, the number of articles fluctuated between 2 and 8. The number of articles fluctuated between 2 to 8 in 2014-2019. The number of published articles subsequently increased rapidly, with 11 articles in 2020 and 10 in 2021. The rapid growth of related research may be closely related to the epidemic of COVID-19 in 2019.

Table 2: Classification of journals

List of journals	Count.
Supply Chain Management: An International Journal	14
The International Journal of Logistics Management	10
Benchmarking: An International Journal	9
Industrial Management and Data Systems	4
International Journal of Operations and Production Management	4
Asia Pacific Journal of Marketing and Logistics	3
International Journal of Physical Distribution and Logistics Management	2
International Journal of Emerging Markets	2
Journal of Manufacturing Technology Management	2
Business Process Management Journal	1
Handbook of Business Strategy	1
International Journal of Energy Sector Management	1
International Journal of Pharmaceutical and Healthcare Marketing	1
Journal of Enterprise Information Management	1
Journal of Global Operations and Strategic Sourcing	1
Journal of Islamic Marketing	1
Journal of Knowledge Management	1
Journal of Enterprise Information Management	1
Journal of Business & Industrial Marketing	1
Industrial Management & Data Systems	1
International Journal of Productivity and Performance Management	1
Total	62

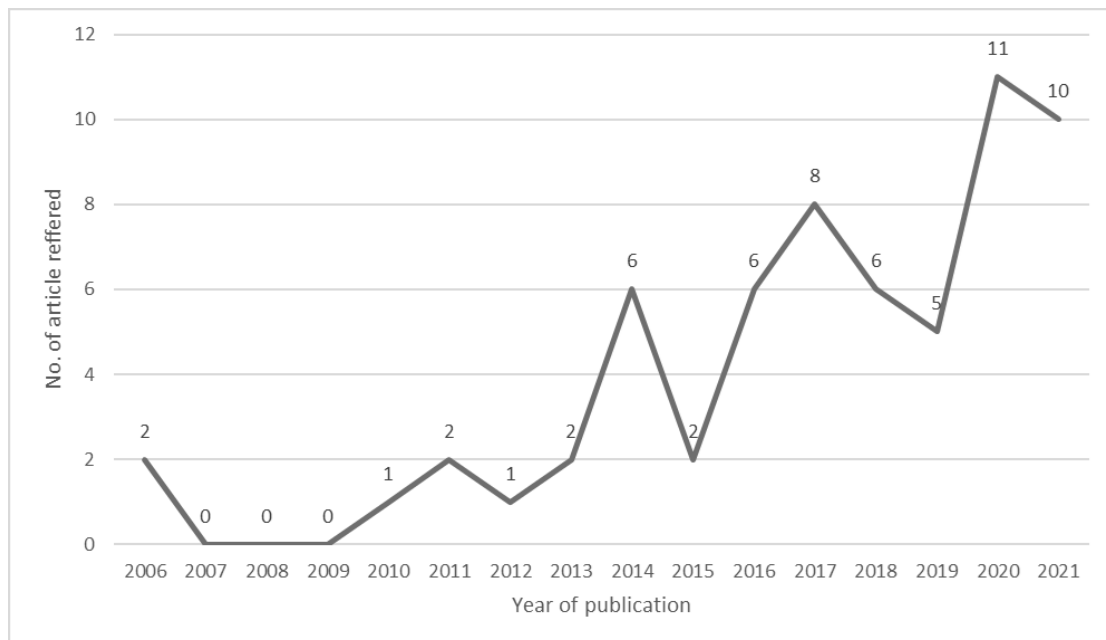


Figure 1: Publication trend

Supply Chain Integration Dimensional Framework

Both approaches mentioned in the previous text stress the critical role of information, material movement, and financial component in supply chain integration. As shown in Table 3, 8 articles in the reviewing pool adopted the unidimensional framework, which aimed to

integrate all supply chain participants into one organization. For example, Panahifar et al (2018) investigated the impact of information-related factors on the collaboration among all supply chain partners following similar instructions. Such a situation is challenging to realize when supply chain partners are from different regions. As the whole network becomes a unified entity, the scale of the organization will sharply expand, which may also increase the rate of supply chain risk.

Table 3: Adoption of dimensional framework

Dimensional framework	Authors	Count.
Unidimensional	T.S. and V. (2020); Panahifar et al (2018); Haque and Islam (2018); Tieman (2017); Pradabwong et al. (2017); Zhang et al (2015); Kamal and Irani (2014); Wilding and Humphries (2006)	8
Internal and external integration	Li et al (2021); Piprani et al (2020); Chaudhuri (2020); Azadegan (2020); Kalyar et al (2019); Nguyen et al (2019); Yu et al (2018); Polater and Demirdogen (2018); Tarifa-Fernandez and Burgos-Jiménez (2017); Kumar and Singh (2017); Riley et al (2016); Simangunsong et al (2016); Sundram et al. (2016); Meixell et al (2014); Sharma and Bhat (2014); Guan and Rehme (2012)	16
Internal, supplier, and customer integration	Kwamega et al (2019); Delic et al (2019); Kanyoma et al (2018); Turkulainen et al (2017); Abdallah et al (2017); Cao et al (2015); Xu et al (2014); Seo and Dinwoodie (2014); Zhao et al (2013); Hong et al. (2010); Danese and Romano (2013); Chowdhury et al (2019); Shou et al (2018); Martinez-Neri (2016); Kache and Seuring (2014); Sundram et al. (2011); Abdallah et al (2021); Afshan et al (2021); Kanyoma et al (2020); Liu et al (2021); Ramos et al (2021); Shukor et al (2020); Tian et al (2021); Sreedevi et al (2021)	24
Internal and supplier integration	Leavy (2006); Tse et al (2011); Dhaigude et al (2021)	3
Internal, supplier, customer and information integration	Nayal et al (2021)	1

Cross-functional and external integration	Poberschnigg et al (2020)	1
Cross-functional, demand and supply integration	Freitas et al (2020)	1
Cross-functional, manufacturing network, and external integration	Hu et al (2019)	1
Information, operation and relational integration	Zhu et al (2017)	1
Information, operation and new product development integration	Ramirez et al (2020)	1
Information integration, process integration or vertical integration	Sabet et al (2017)	1
Management information systems, inventory management and supply chain relationships	Tse et al (2016)	1
Strategic alliance, information sharing, and process coordination	Wang et al (2018)	1
Upstream and downstream integration	Aljanabi and Ghafour (2020); Yu, Huo, and Zhang (2021)	2
Total		62

In addition, as shown in Table 3, 39 articles used a dual (internal and external) or ternary (internal, supplier, and customer) framework in the study. At the same time, the cross-functional integration proposed by Poberschnigg et al (2020) and Freitas et al. (2020) refers to the internal integration of focal firm to a certain extent. Therefore, this framework of internal integration and external integration is a definition accepted by more scholars.

It is worth noting that some scholars who have adopted the dual framework pointed out that external integration should not be limited to suppliers and customers. For example, Tarifa-Fernandez and Burgos-Jiménez (2017) proposed that external integration should consider the moderating effect of logistics capabilities on performance. Kumar and Singh (2017) emphasized that information and communication technology affects the performance of this supply chain integration. Thus, logistics service providers and information service providers should be adopted in the supply chain integration dimensional framework.

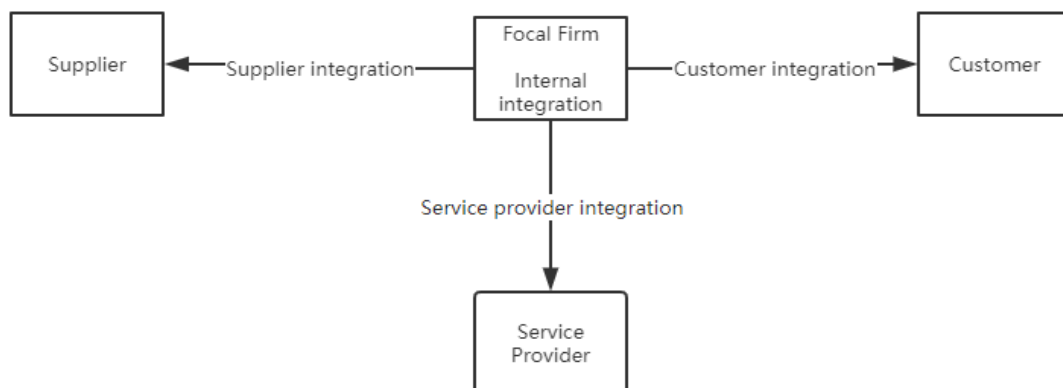


Figure 2. Supply chain integration dimensional framework

Impact of Supply Chain Integration on Supply Chain Risks

Supply chain integration is considered a powerful weapon for supply chain managers to improve supply chain capacity. For example, Sabet et al (2017) pointed out that a high supply chain integration helps fast-growing industries cope with demand uncertainty. Riley et al (2016) suggested that internal integration enables managers to improve their ability to scan supply chain risks and identify them. Sreedevi et al (2021) emphasized that in the global supply chain, companies need to rely on many external resources to maintain operations. Therefore, effective external integration plays a vital role in mitigating supply chain risks. Thus, the supply chain integration improves the efficiency of information sharing among the supply chain partners, which may enhance the risk prediction ability of the supply chain. Moreover, joint decision-making and system coupling have the advantages of smooth supply chain processes, reducing the supply chain risk rate. Nayal et al (2021) pointed out that the information integration among supply chain participants enables real-time information sharing, which helps artificial intelligence to identify supply chain nodes' disruption risk factors.

Chaudhuri et al (2020) believes that when supply chain integration is used to develop capabilities for joint risk planning within the organization and with members of the broader supply network, and then to develop collaborative risk management capabilities, which may improve the supply chain's ability to respond to risks. However, the network characteristics produced by high-level supply chain integration harm the effectiveness of risk management. A possible explanation is that modern supply chain integration leads to a complex network system involving global supply chain stakeholders. As more participants from different countries joining the supply chain system, the supply chain potential risk has increased. For example, during the COVID-19 pandemic, the quarantine of Wuhan China resulted in a shortage of auto parts for Hyundai Motor Company, which eventually closed its South Korean factory (Chowdhury et al., 2019). Therefore, the impact of supply chain integration on the ability of the supply chain to respond to risks is still controversial. Further research needs to be established to determine the connection between them.

Conclusions

In past decades, supply chain integration has been widely discussed. Researchers tried to define supply chain integration and conceptualize the framework from different views. Most researchers believe supply chain integration enhances supply chain performance. In this context, the scope of supply chain network and integration expand rapidly, meanwhile, bring the vulnerability to supply chain system. In the past few years, natural disasters and human-caused accidents frequently have disrupted the integrated global supply chain and caused many economic losses. Especially, COVID-19 has exposed the lack of effective means to cope with changes in geopolitics or customer needs in the global supply chain (Free and Hecimovic, 2020). Therefore, conceptualize a supply chain integration dimensional framework in the context of changeable natural, economic and political environment is necessary.

In this investigation, the aim is to identify the dimensions of supply chain integration and assess the impact of supply chain integration on supply chain risk, which should provide a systemic view of adopting supply chain integration in supply chain management practice. Practitioners need to balance the risk while integrating with supply chain partners. Furthermore, the present study focuses on conceptualizing a supply chain integration structure which may contribute to further study of the impact of supply chain integration on supply chain risk management. The main contribution of this research is embodied in the

definition of the framework of supply chain integration through literature review, which can provide researchers with references for future research. At the same time, practitioners can use the framework of supply chain integration to provide ideas for implementing supply chain integration.

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