OPPORTUNITIES AND CHALLENGES OF DIGITAL SUPPLY CHAIN: A SYSTEMATIC LITERATURE REVIEW USING SCOR FRAMEWORK

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Abstract

Firms are increasingly integrating digital technology into their supply network systems for the purpose of attain global competitiveness. The utilization of digital technology has resulted in the Rise of a new supply chain management system known as the digital supply chain. Many parties believe that digital supply chain has several opportunities for companies, however, a number of researchers argues that the dependence on digital technology in the worldwide supply chain is accompanied by substantial obstacles. Therefore, this study intends to understand the opportunities and difficulties of digital supply chain and identify the future research agenda in this research area to develop better digital supply chain concepts and implementations. This research conducted systematic literature review through content analysis based on five dimensions in the SCOR model, which is plan, source, make, deliver, and return dimension. The analysis in this research finds that digital supply chain can enhances demand forecasting and product development in plan dimension, enables supplier selection and procurement automation in source dimension, facilitates smart and additive manufacturing in make dimension, optimizes inventory management, order management, transportation and logistics management in deliver dimension, as well as supports closed loop supply chain or circular economy in return dimension. However, the lack of infrastructure, policy, and coordination, along with financial, technical, and technological barrier, has become the common challenges of digital supply chain. Cybersecurity issue is also another main issue of the digital supply network. Through this analysis, the future research agenda can finally be taken in this research.

Keywords: Digital Supply Chain, Systematic Literature Review, SCOR Model

1. INTRODUCTION

In the current fast-changing worldwide supply chain landscape, the importance of global competitiveness cannot be overstated. Countries and companies, especially multinationals companies, are currently trying their best to become a component of the worldwide supply network. For example, the best mechanical designer is in Germany and for electrical items is in Korea. China is superior in manufacturing, while Vietnam is excelled in assembling and India choose to specialize on the information system. There is no reason for each region or company to do all the work from design to distribution. Participating in the global supply chain provides benefits to them (Mukherjee, 2017) and their global competitiveness has a major role for them to survive in this hyper-competition global supply chain (Hülsmann et

al., 2008). Therefore, organizations aim to get a competitive edge by engaging skilled, cost-effective suppliers situated globally (Gereffi & Lee, 2016).

The global supply chain is distinguished by enterprises who distribute their products in many countries, establish production facilities abroad, or procure goods from overseas suppliers (Caniato et al., 2013). The worldwide supply chain encompasses the movement of resources and data from their initial state as raw materials to their final state as finished goods, spanning across the whole globe. The process entails the cooperation of several stakeholders, such as suppliers, producers, logistics partners, and retailers, to fulfill client demand across different nations (Chopra & Meindl, 2016). It makes it possible for businesses to reach international markets, reduce manufacturing costs, and make use of specialist skills in various geographical areas (Hugos, 2018). Nowadays, the global supply chain is driven and continuously evolving by global trade policies, technological advancements, and market dynamics (Christopher, 2016). With businesses under significant pressure to create new solutions, adapt, and optimize their practices to stay dynamic, it is essential to comprehend the primary patterns influencing the worldwide supply chain and the significance of global competitiveness in this framework.

To maintain their global competitiveness, an escalating number of supply chains have embraced the ideas behind the fourth industrial revolution, specifically digital technologies (Kamble, Gunasekaran, Ghadge, et al., 2020). Digital technologies have become more important because it is also revolutionizing corporate environments, markets, models, and the ways people work (Rajput & Singh, 2019). The Digital Supply Chain (DSC) is a new method for managing supply chains that has emerged as a consequence of digital technology's impact on supply chain applications (Zekhnini et al., 2020). The digital supply chain is an extremely complex system that relies on coordinated communication and cooperation between several businesses and handles massive amounts of data. The value, accessibility, and affordability of services are all enhanced by digital technology, software, and networks. The expected outputs that would be the result of such a system would then deliver Steady, adaptable, and efficient outcomes (Büyüközkan & Göçer, 2018). The adoption of the chain of digital supply practices allows companies to overcome the limitations of traditional supply chain operations, resulting in a highly efficient and integrated system for maximum performance (Li et al., 2023). It is clear that the shift towards the chain of digital supply is essential for the continuation of life and global competitiveness of a company (Hartley & Sawaya, 2019).

The application of digital technologies such as IoT, blockchain, and AI has fundamentally transformed the functioning of global supply chains. It has led to improved efficiency, visibility, and cooperation between partners in the supply chain, ultimately resulting in a more agile and responsive supply chain. This phenomenon has also attracted much attention from researchers in recent years. Some research has concentrated on the execution of I4 technologies, the readiness level of I4 technologies, and the technology maturity model (Ramanathan & Samaranayake, 2022; Santos & Martinho, 2019; Schumacher et al., 2016). Other research focuses on the digital supply chain management resilience (Ivanov, 2024), digital supply chain dynamic capabilities (Queiroz et al., 2021), and digital supply chain finance (Banerjee et al., 2021). On top of that, they also examine the implementation of digital supply chain, including the shift from analogue to digital supply chain management (Agrawal & Narain, 2018), as well as the drivers and barriers to

the adoption of digital supply chain (Raj et al., 2020; Stentoft et al., 2021; Tjahjono et al., 2017). These studies prove that there is enormous potential in developing digital supply chains.

Nevertheless, several scholars argue that the reliance on digital technology in the global supply chain comes with significant challenges. The utilization of IoT, blockchain, and AI creates vulnerabilities that can be exploited by cyber attackers, leading to potential disruptions in the logistic network. Research by (Nozari et al., 2022) defines that the primary issues confronting IoT-based supply chains in fast-moving consumer goods (FMCG) businesses are cybersecurity and inadequate infrastructure. In India, challenges in digital supply chain include infrastructure constraints, digital divide issues, insufficient internet connectivity, technological disparities, lack of digital literacy, and skill gaps among stakeholders (Gupya, 2023). Blockchain-enabled supply networks have hurdles encompassing both technical and non-technical aspects, like the appropriateness of different consensus methods for supply chain applications (Jabbar et al., 2021). Therefore, while digital transformation offers efficiency and visibility, it also introduces new challenges and risks that require attentively ensured the global supply chain security and resiliency.

In this particular field of inquiry, there have been several literature reviews. The majority of these studies focused on the pros and cons of using digital supply network in several industries, including the food industry, and how to put them into practice (Subramaniyam et al., 2021), or a manufacturing company's supply chain and the possibilities and advantages of digitalization (Shah et al., 2023). Digital supply chain development, digitization, and technological implementation may be mapped out in literature studies as well (Büyüközkan & Göçer, 2018), in addition, digital supply chain maturity model may be used to create standards for the digital supply chain's implementation throughout the digital transformation process (Weerabahu et al., 2023). Digital supply chains increase global competitiveness, therefore this study focused on their pros and cons, especially given recent developments in global supply networks. Even though, there are a literature review studies that already provide the advantages, weaknesses, and emerging trends in the chain of digital supply research (Büyüközkan & Göçer, 2018; H. Zhang et al., 2024), This study examines how the digital supply chain fits within the global supply chain. The SCOR paradigm guides this examination of five dimensions: plan, source, make, deliver, and return.

Digital technologies implementation on supply chain not only offers several opportunities, such as improved efficiency, visibility, and collaboration, but also introduces another challenge that needs to be addressed, one of which is cyber security issue. Understanding the opportunities and challenges of the chain of digital supply could help companies to maximize the potential of the digital technologies, as well as provides the capability to anticipate, respond, and overcome the risks. By making the supply chain more resilient and sustainable, this will help the organization gain a competitive edge. Building a research and practice framework requires understanding digital supply chain potential and obstacles (Büyüközkan & Göçer, 2018). Thus, under these circumstances of the global supply chain, what are the advantages and disadvantages of digital supply chain?

2. RESEARCH METHODS

To better comprehend phenomena or social phenomena, this qualitative research intends to present a broader understanding of the phenomenon as a whole, rather than reducing it to its component parts. To reach this objective, a systematic literature review (SLR) following established guidelines introduced by (Tranfield et al., 2003) is performed. We collected articles from Scopus as it is one of the large literatures databases and the most relevant at the international level (Thelwall, 2018). Then, the SCOR model is being used as the content analysis framework to offer a thorough perspective of this research topic. The SCOR model has been employed in prior systematic literature reviews in the area of supply chain management (Chehbi-Gamoura et al., 2020; Kamble, Gunasekaran, & Gawankar, 2020).

The articles are collected from the Scopus database in June 2024 using the search string. The search string is developed by considering the keywords that being used in previous literature review studies in the chain of digital supply. The search string that is being used in this study is the terms similar with the chain of digital supply term, or the combination of "supply chain" term and the digital technologies that most frequently used or researched. Here is the full search string: ("digital supply chain" OR "smart supply chain" OR "intelligent supply chain" OR "supply chain 4.0") OR (blockchain OR "big data analytics" OR "additive manufacturing" OR "augmented reality" OR "artificial intelligence" OR "cloud computing" OR "internet of things") AND "supply chain").

Searching the abstract, title, and keyword fields, it initially produced 14244 articles in total. Next, researchers proceed with a three-step process to determine the most pertinent research for the ultimate evaluation. Initially, the papers undergo screening using Scopus filters, which include criteria such as language, document type, publishing stage, and open access. This process yields a cumulative of 2724 articles. During the second stage, the titles, keywords, and abstracts are carefully reviewed and evaluated. Excluded from consideration are literature review papers, as well as items that are not relevant to the specified keywords or desired goal. This process yields a total of 1317 articles. Finally, the whole texts of the remaining articles were then examined for content analysis. Full text screening eliminates publications that do not clearly demonstrate the advantages or difficulties of digital supply chain. The total number of articles that will undergo the content analysis procedure is 786.

3. RESULTS AND DISCUSSION

3.1. Research Results

Once completing the screening procedure, there are 786 selected literatures that would go through he content analysis procedure. Table 1 presents 100 examples of literature into each dimension of SCOR model. Literature could be categorized into two or more dimensions if it belongs to more than one dimension of SCOR model. Any literature that does not fully belong into any dimension is classified as "Overall" dimension.

Table 1. Categorization of Selected Literature on SCOR Model Dimensions

Author	Plan	Source	Make	Deliver	Return	Overall	Author	Plan	Source	Make	Deliver	Return	Overall
(Vinayavekhin et al., 2024)		V					(Xiao et al., 2021)			V			
(Bistarelli et al., 2023)				V			(W. Wang, 2024)				V		
(Salmi et al., 2020)			V				(Xiong et al., 2019)					V	
(Satzer & Achleitner, 2022)			V				(Y. M. Chen et al., 2023)						V
(Apruzzese et al., 2023)				V			(Cheng et al., 2011)	V					
(Liang et al., 2023)				V			(Montero et al., 2020)			V			
(Abbas et al., 2020)		V					(Kousiouris et al., 2019)					V	
(Zhu et al., 2020)				V			(Boza et al., 2014)				V		
(Figorilli et al., 2018)		V					(Giannakis & Louis, 2016)				V		
(Musamih et al., 2021)				V			(Gorecki et al., 2020)			V			
(Lamela et al., 2022)					V		(Hassouna et al., 2022)			V			
(Cuñat Negueroles et al., 2024)				V			(Scuotto et al., 2017)		V				
(Tan et al., 2020)					V		(Modares et al., 2023)		V		V		
(Cui et al., 2019)				V			(Kamran et al., 2023)		V				
(Isaja et al., 2023)			V				(Muafi & Sulistio, 2022)			V			
(Farooq et al., 2023)				V			(Jha et al., 2020)	V					
(Priyan, 2024)			V	V			(H. Zhang et al., 2023)			V			
(Hawashin et al., 2022)			V				(Toyoda et al., 2017)	V					

Author	Plan	Source	Make	Deliver	Return	Overall	Author	Plan	Source	Make	Deliver	Return	Overall
(Marchese & Tomarchio, 2022)		V					(Liao & Wang, 2019)				V		
(Y. Zhang et al., 2023)				V			(Boru et al., 2019)	V			V		
(Cocco et al., 2021)		V					(Jamil et al., 2019)	V					
(Al-Rakhami & Al-Mashari, 2021)		V					(Popović et al., 2021)				V		
(Bhatia & Albarrak, 2023)			V				(Ghasemi et al., 2023)				V		
(L'Hermitte & Nair, 2021)				V			(Hasan et al., 2023)				V		
(C. H. Wu et al., 2021)				V			(Ferdousi et al., 2020)		V				
(Jesse et al., 2023)					V		(Gayialis et al., 2022)					V	
(Nasereddin, 2024)	V	V	V	V			(Xia et al., 2020)		V				
(Shamout et al., 2022)				V			(Shahbazi & Byun, 2021)				V		
(Nayak & Dhaigude, 2019)						V	(Ouf, 2021)				V		
(Sitek et al., 2017)						V	(A. Tan & Ngan, 2020)				V		
(Verdouw et al., 2015)	V						(Xue & Li, 2023)				V		
(Cantini et al., 2024)			V				(Parker et al., 2019)			V			
(Ransikarbum et al., 2020)			V				(Gondal et al., 2023)				V		
(Kulkarni & Xu, 2021)			V				(Saban et al., 2023)			V			
(Makridis et al., 2023)	V	V					(Valencia-Payan et al., 2022)				V		
(Tang et al., 2023)			V				(Kaur et al., 2024)			V			

Author	Plan	Source	Make	Deliver	Return	Overall	Author	Plan	Source	Make	Deliver	Return	Overall
(H. Wu et al., 2017)		V					(R. Abbas et al., 2022)						V
(Fernández-Caramés et al., 2018)				V			(Bataineh et al., 2022)		V				
(Guixia et al., 2024)				V			(Singh & Chaddah, 2021)				V		
(Viswanadham & Jayavel, 2023)			V				(Yoo & Won, 2018)	V					
(Kittipanya-ngam & Tan, 2020)						V	(Lin et al., 2022)						V
(Yong Chan et al., 2019)				V			(Helmi Ali et al., 2021)						V
(Feng et al., 2023)					V		(Angarita-Zapata et al., 2021)						V
(Violino et al., 2020)				V			(Tao et al., 2023)			V			
(Kumar et al., 2013)		V					(Liu et al., 2022)	V					
(Goodarzian et al., 2024)					V		(C. L. Chen et al., 2021)				V		
(El Midaoui et al., 2022)				V			(Malatji, 2024)				V		
(Qu et al., 2024)					V		(Jegan Joseph Jerome et al., 2024)	V					
(Della Valle & Oliver, 2021)			V				(Trabucco & De Giovanni, 2021)						V
(Mahroof, 2019)				V			(Alamsjah & Yunus, 2022)	V					

Figure 1 shows the number of literatures in each dimension. Based on that, deliver dimension has the most literatures with 235 literatures categorized in that dimension, and followed by make dimension with 207 literatures. It means that researchers have more focus and interest to study the digital supply chain role in those two dimensions, as well as become the common topics in this research area. Besides, from five dimensions in SCOR model, return dimension has the least literatures with only 90 literatures categorized in this

dimension. It means that research about digital supply chain in this dimension research on X can still be developed further.

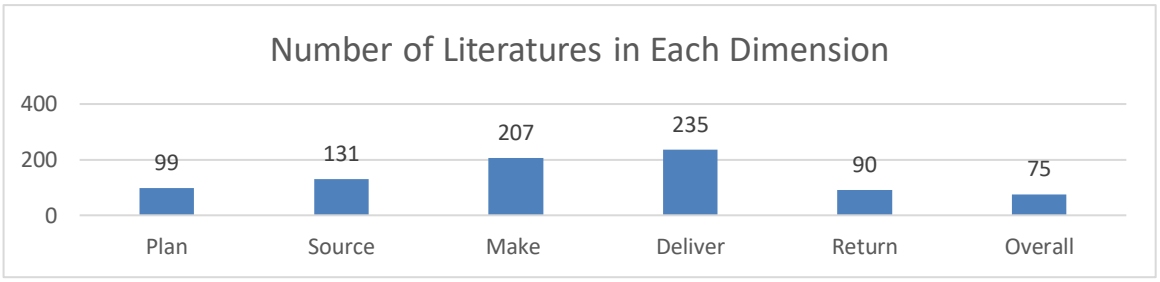

Figure 1. Number of Literatures in Each Dimension

4.2. Discussion

4.2.1. Plan Dimension

The challenges on plan dimension analysis state the effectiveness of digital technologies heavily relies on how thorough and accurate the training data is. As is known before, blockchain technology has several abilities, including privacy, openness, and auditability (L. Wang et al., 2022). Based on that, blockchain technology has the capability that should be able to be used to solve that problem. However, research about blockchain technology's role for demand forecasting and product development is still scarce. Therefore, future research should discuss the blockchain technology potential for maintaining quality and authenticity in demand forecasting and product development.

4.2.2. Source Dimension

Sustainable procurement is an important issue in this era. According to (Wilson et al., 2024), when it comes to sustainable procurement, material passports (MP) play a crucial role by documenting every product characteristic and procedure that it goes through in its supply network. An MP is essentially a record that records a product from its creation to when it is no longer needed. Although MPs have been helpful, one major challenge in achieving sustainability goals is the lack of uniform methodologies or standards. This inconsistency means that MPs use a lot of different jargon and processes, which can make them less useful for those outside the organization. Future research should focus on finding ways to standardize or integrate MPs, so businesses can better meet their long-term sustainability objectives.

4.2.3. Make Dimension

The utilization of digital technology in manufacturing is a popular topic within digital supply chains, particularly in industries such as textiles and fast-moving consumer goods (Kaur et al., 2024; Nozari, et al., 2021). The implementation of smart manufacturing and additive manufacturing has become a much-discussed matter. While several researchers have explored the potential applications of digital technology in service industries like healthcare and education (Mustaffa et al., 2023; Parker et al., 2019b), there are still a big room for improvement in this research area. Smart services and how they are adopted in the other service industry could be the topics that need to be developed. Therefore, future

research could delve deeper into the implementation of digital technologies within the service industry.

4.2.4. Deliver Dimension

Cybersecurity becomes an important issue when companies try to adopt digital technologies. Cyber-attack targeting logistics based IoT data exchanges caused several threats and risks (Alzahrani & Asghar, 2024). As mentioned in the challenges on deliver dimension analysis, the complexity of detecting and mitigating these vulnerabilities is compounded by the heterogeneity of IoT devices and the volume of data generated. Despite blockchain's tamper-proof ledger, ensuring compliance with data privacy requirements and securing diverse and large volumes of sensitive information remain significant challenges (George & Al-Ansari, 2023). Thus, the scalability of digital technology solutions to handle those transactions efficiently is still an area that needs improvement.

4.2.5. Return Dimension

This research indicates that the return dimension has been the least investigated in studies. Even though sustainability aspect starting to gain digital supply chain literatures attention, there is still needs for empirical research of digital technology implementation in this dimension. This is because researchers only focus on certain industries which specifically revolve around CE or CLSC, such as agriculture industry, chemical industry, or resale industry (Gholipour et al., 2024; Monteiro et al., 2021; Shen et al., 2020). The implementation of CE or CLSC in the common industry, including manufacturing and service industry, could be a topic to study in the future. Additional technologies that might be explored in future studies to improve the literature on return dimensions include cloud computing, machine learning, and additive manufacturing.

4. CONCLUSION

A rising number of supply chains have integrated digital technologies into their system to achieve global competitiveness. Utilizing digital technologies has resulted in the future of SC control system which transform traditional supply chain to digital supply chain. This shifting towards chain of digital supply has several opportunities for companies to achieve sustainability and resilience supply chain, thus enhancing companies' performance and competitive advantage. However, some researchers have raised significant concerns about the global supply chain's reliance on digital technology. To address this, our research will explore the benefits and drawbacks of the chain of digital supply. We aim to understand both the opportunities and challenges that digital supply chains present in a global context and to outline a research objectives for future studies in this area.

This study undertaken systematic literature review through content analysis based on five dimensions in the SCOR model, which is plan, source, make, deliver, and return dimension. Plan dimension analysis focuses on digital supply chain opportunities and challenges in demand forecasting and product development, as well as how it has been implemented in industry. In source dimension, the analysis discusses digital supply chain opportunities and challenges in supplier selection and procurement processes, especially about how it mitigates the sustainability issues. The analysis about digital technologies

adoption to manufacturing system, maintenance management, scheduling and production control is described in make dimension. The analysis in deliver dimension highlights the digital supply chain opportunities and challenges in inventory management, transportation and logistics management, and also order management.

While in the return dimension, it explores digital technologies opportunities and challenges for CE or CLSC. Conversely, digital supply chain does come with its fair share of difficulties. Common problems with digital supply chains include a lack of infrastructure, policies, and coordination as well as financial, technical, and technological obstacles. This issue happens almost in every dimension of SCOR model. Cybersecurity and resistance to change issues also become another key challenge that need to be addressed. Lastly, through these analysis, the future research agenda can finally be drawn in this research.

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