RESEARCH TRENDS IN DIGITAL TRANSFORMATION IN SUPPLY CHAIN BASED ON BIBLIOMETRIC AND NETWORK ANALYSIS

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Abstract. With the development of the 4th Industrial Revolution technology, the digitalization of supply chain is also receiving a lot of attention. With various technological developments, the importance of digital transformation in a firm's supply chain is increasing. Therefore, for a more comprehensive understanding of digital transformation in supply chain, we have implemented a rigorous systematic literature review by supplementing the shortcomings of existing literature and combining bibliometric analysis and network analysis with keyword network analysis. Using the SCOPUS database, we collected 182 papers addressing digital transformation in the supply chain published in renowned business administration journals, identified research trends. Then, we analyzed the connection of citations as well as the author's keywords and their changes over time. Based on these results, this study presents the number of publications and changes in papers by period, influential authors and papers, key keywords and topics, etc. on digital transformation in supply chain.

Keywords: digital transformation, supply chain, systematic literature review, bibliometric analysis, network analysis, keyword network analysis.

JEL Classification: M11, C49, D24.

Introduction

The advances in digital technology have transformed offline retail stores into digitalized online retail stores and have created new values and competitive advantages (Llopis-Albert et al., 2021; Schwab, 2017). Thus, digital transformation (hereafter, DX) has become an essential topic in industrial practice and research. 84% of global firms consider DX as a critical strategy in the next five years (Ponis & Lada, 2021; Steiber & Alänge, 2021; Prasad et al., 2022). In particular, COVID-19 has expanded the digitalization of all business activities,

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causing a transient paradigm shift in supply chains (Berman, 2012; Diebner et al., 2020; Li et al., 2018; Matt et al., 2015; Pramanik et al., 2019).

As DX has been a critical trend in supply chain (Sunmola et al., 2021), previous research has been conducted various topics regarding the importance of DX on procurement (Alabdali & Salam, 2022), capabilities (Ning & Yao, 2023), integration (Oubrahim et al., 2023), and resilience in supply chain (Yuan et al., 2023). Although previous research has contributed considerably to our understanding of DX in supply chain, only some researches have used an overall aspect to investigate DX in supply chain. Therefore, this study attempts to look at the general overview of DX in supply chain through a systematic literature review.

Existing studies have taken two methods to a systematic literature review: "popularity-based" and "network-based" approach (Appio et al., 2014, 2021; Choi et al., 2011; Jeong & Yoo, 2022; Mishra et al., 2018; Muñoz-Villamizar et al., 2019; Rana & Daultani, 2023). One method is the "popularity-based approach", which is "bibliometric analysis", to provide insights through the frequency of use regarding the journals, authors, affiliations, author's keywords, and prominent words from titles and abstracts (De Bem Machado et al., 2022; Margiono, 2021; Rêgo et al., 2022). However, this method is inappropriate for identifying the main issues in associating shared topics among published papers (Jeong & Yoo, 2022).

Another area of research focuses on "network-based approaches" dealing with "citation and co-citation analysis," which studies the network structure by visualizing and mapping citations between published papers (Jeong & Yoo, 2022; Park & Jeong, 2019). Although the "network-based approaches" have considerably contributed to identifying main issues and shared topics through the frequency of citation and co-occurrence of papers in other articles, these methods are unsuitable for deriving more specific knowledge networks within a given research field because these methods concentrated primarily on published papers rather than specific keywords of author (Jeong & Yoo, 2022). Thus, to inclusively determine important topics about DX in the supply chain, it needs to contain specific keywords that are not included in the co-citation and citation network (Jeong & Yoo, 2022).

Therefore, to compensate for the shortcomings of the existing literature for more comprehensive research evaluation, we conduct a rigorous systematic literature review by combining bibliometric analysis with network analysis including keyword network analysis. Thus, this paper aims to achieve the subsequent two objectives: first, determine more important topics providing significant contributions to DX in supply chain domain; second, explore research gaps and future directions for DX in supply chain domain.

The structure of this study is as follows. Section 1 explains the research methodology. Sections 2 and 3 present bibliometric and network analysis, respectively. Section 4 presents research gaps and future directions. Finally, the last Section shows the conclusions and limitations in this research.

1. Research methodology

To perform a systematic literature review on DX in supply chain by integrating traditional systematic methods (Bibliometric and citation analysis) with keyword network analysis, we applied the rough procedure of the systematic literature review analysis (Jeong & Yoo, 2022). Figure 1 presents the procedure performed in this study.
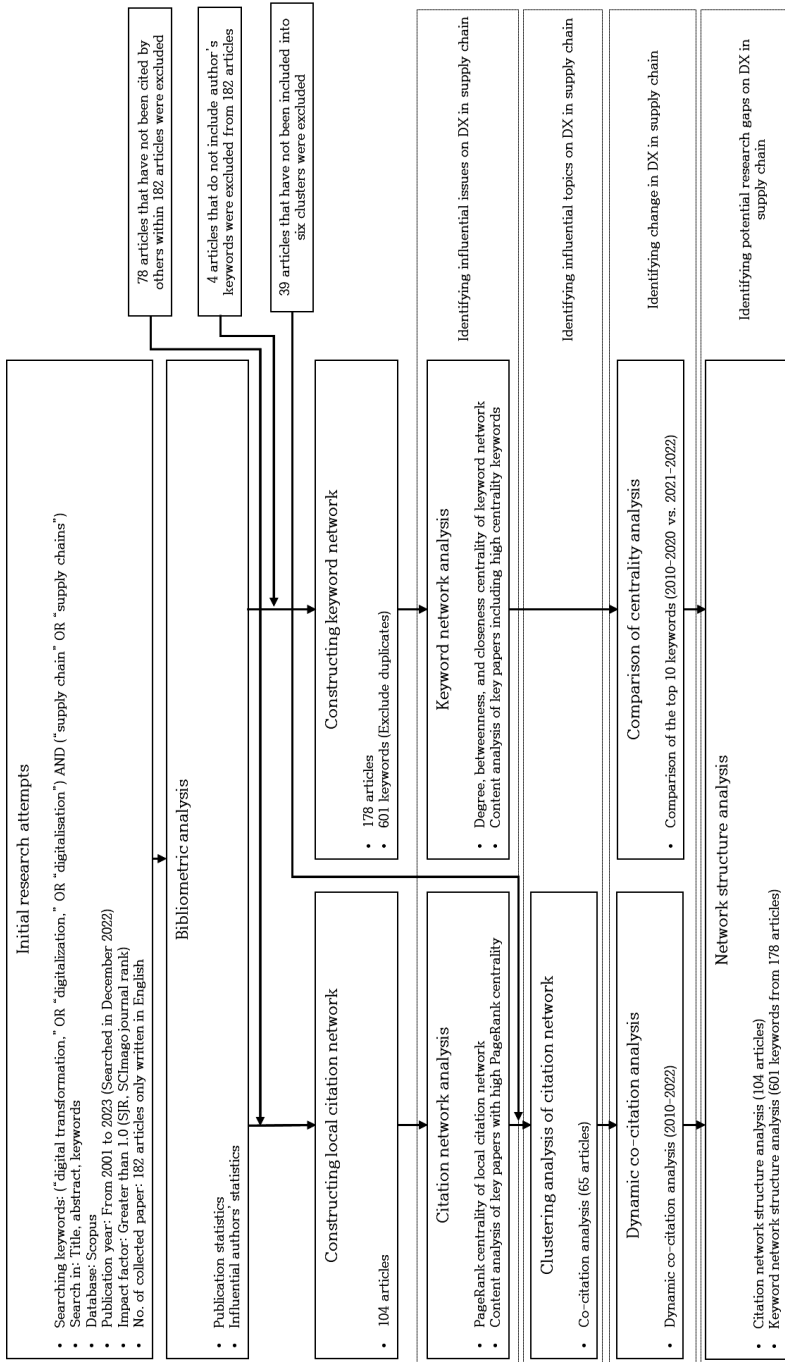
Figure 1. Procedure of the systematic literature review analysis

Using "digital transformation", "digitalization", or "digitalisation" as the principal search keywords on the basis of prior research (Leão & Da Silva, 2021; Ogrean & Herciu, 2021; Rha & Lee, 2022), we selected business administration journals from the SCOPUS database. For a more rigorous analysis, we used impact factor (SCImago Journal Ranking and SJR) to reduce the journals to only high-impact journals. The results for the initial research included 1,566 papers from 2001 to 2023 (searched in December 2022). Since this study covers the current status of "DX in supply chain", we finally collected 182 papers only supply chain-related papers using "supply chain" or "supply chains" search keywords from the initial 1,566 papers.

After collecting data, we first adopted bibliometric analysis to identify the overall DX trends in supply chain. Then, we identified the influential issues on DX in supply chain by combining citation analysis with keyword network analysis. To conduct rigorous citation analysis, among the 182 collected papers, we constructed a local citation network to determine the number of times a paper has been cited by other papers. Because 78 papers that others have yet to cite within 182 papers were excluded, we finally used 104 papers extracted from 182. Also, to further analyze the specific issues for DX in supply chain, we adopted a keyword network analysis on the basis of the 601 keywords drawn from the 178 papers because four papers, except author keywords, were drawn from 182 papers. Furthermore, we examined the clustering analysis based on co-citation to identify common shared topics for DX in supply chain. However, because 39 papers not included in six clusters were excluded from 104 papers, the co-citation analysis using only 65 papers was conducted. Also, we identified the changes for DX in supply chain by analyzing the evolution of common shared themes and by comparing the significant keywords from the previous 11 years (2010–2020) with the last two years (2021–2022). Finally, to identify the future research directions as well as the current status of the research area for DX in supply chain, we investigated the structures of citations and keywords network.

2. Bibliometric analysis

2.1. Publication statistics on digital transformation in supply chain

We examined publication statistics to determine the DX trends in supply chain in the number of published papers. Figure 2 presents that the DX segment of the supply chain is still in a period of expansion and growth. The number of articles published increased from 1 in 2001 to 73 in 2022 (searched in December 2022). These results highlight that practitioners and researchers recognized the significance of DX as an essential field of knowledge in the supply chain sector during post-COVID-19.

Table 1 shows the top 10 journals on DX in supply chain and their main author's keywords. The top journals could be grouped in various ways, relying on the characteristics of the main author's keywords. It was noticeable that "*Production Planning and Control*" and "*International Journal of Production Research*" covered various topics, ranging from Industry 4.0 to supply chain risk. In particular, the two journals also dealt with a subject related to supply chain risk, such as "supply chain risk", "supply chain resilience", and "reconfigurable
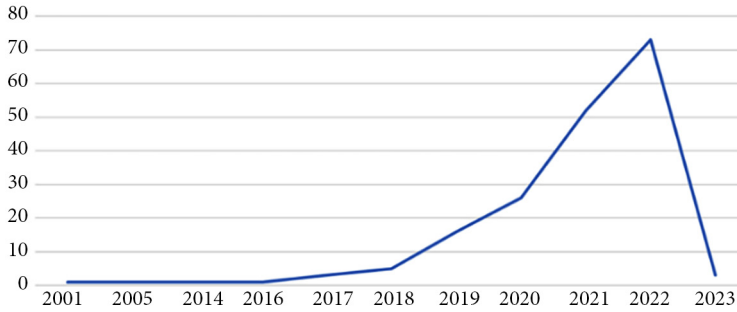
Figure 2. Publication trend

supply chain". On the other hand, "*International Journal of Production Research*", "*Journal of Cleaner Production*", "*International Journal of Operations and Production Management*", and "*Supply Chain Management*" are among the top journals that include the sustainability subject associated with DX in supply chain.

Table 1. Top 10 contributing journals

Ran-king	Journals	No. of Publication	Main author's keywords
1	International Journal of Production Economics	18	Industry 4.0; Digital transformation; Digitalization; Business model; Smart manufacturing; Supply chain visibility
2	Production Planning and Control	15	Industry 4.0; Supply chain digitalization; Digital transformation; Supply chain risk; Digitalization; Blockchain; Digital platform; Big data; Internet of things; Port community system
3	International Journal of Production Research	14	Industry 4.0; Blockchain; Digitalization; Ripple effect; Sustainability; Supply chain; Supply chain resilience; Supply chain risk management; Survey; Reconfigurable supply chain
	Journal of Cleaner Production		Circular economy; Industry 4.0; Sustainability; Digitalization; Electrical and electronic equipment; Sustainable development; Agriculture; Blockchain
5	International Journal of Operations and Production Management	13	Digitalization; Industry 4.0; Sustainability; Multiple case study
	Supply Chain Management		Sustainability; Information system; Case study; Digital transformation; Resilience; Dynamic capability; Innovation; Collaboration; Integration
7	IEEE Transactions on Engineering Management	12	Supply chain; Digitalization; Digital transformation; Interviews; Industry 4.0; Technological innovation
8	Industrial Marketing Management	9	Digitalization; Industry 4.0; Resilience; Supply chain; Servitization; Supply network
9	International Journal of Logistics Management	8	Supply chain; Industry 4.0; Resilience

Ran-king	Journals	No. of Publication	Main author's keywords
10	Business Process Management Journal	7	Supply chain management
	Industrial Management and Data Systems		Digitalization; supply chain; blockchain; supply chain management; industry 4.0; digital transformation
	Journal of Manufacturing Technology Management		Industry 4.0; supply chain management; digitalization; digitization; digital transformation; technology implementation

2.2. Influential authors on digital transformation in supply chain

To take in the situation of DX in supply chain, scholars interested in performing DX in supply chain must determine which researchers are particularly influential. Therefore, we used the total citations and h-index as well as the number of articles they co-authored or authored to extract the top essential authors. Table 2 shows the primary contributing authors on the basis of the number of published articles in a given field. These top contributing authors have researched three main topics and could be categorized by topic. The first group represents the utilization of digital technologies in supply chain (Kumar, Pessot, Graham, Tortorella, Battini, and Zangiacomi). In particular, the topic highlighted how various industries' digital technologies, like DX, blockchain, and Industry 4.0 affect the supply chain. The second group dealt with supply chain risk and flexibility through DX (Ivanov, Govindan, and Dolgui).

Table 2. Top contributing authors

Authors	No. of published papers	Total citations	h-index
Ivanov D.	4	929	58
Graham G.		162	21
Pessot E.		103	10
Kumar A.		36	47
Tortorella G.		15	30
Frank A.G.	3	964	24
Dolgui A.		840	55
Chauhan C.		170	9
Raut R.D.		126	33
Narkhede B.E.		126	28
Nayal K.		126	6
Zangiacomi A.		96	11
Das A.		95	15
Govindan K.		17	6
Battini D.		2	35

Specifically, supply chain risks can be resolved through DX, and supply chain problems can be dealt with more flexibly through DX, along with the uncertainty of business environments. Finally, the third group focused on green and sustainable management of supply chain through DX (Nayal, Raut, Narkhede, Frank, Das, and Chauhan).

3. Network analysis

3.1. Influential issues on digital transformation in supply chain

Citation analysis could be used to determine considerable papers through their popularity on the basis of the number of citations from other papers, as well as their prestige by evaluating the number of publications cited by other greatly cited papers (Fahimnia et al., 2015; Jeong & Yoo, 2022). We adopted PageRank centrality to measure the "prestige" of the core papers to consider the essential topics (Brin & Page, 1998; Fahimnia et al., 2015; Jeong & Yoo, 2022). The PageRank was developed to prioritize web pages by the Google (Brin & Page, 1998). The PageRank of paper A (denoted by PR(A)) in a network formed with N papers can be computed as follows:

$$\frac{(1-d)}{N} + d\left(\frac{PR(T_1)}{C(T_1)} + \cdots + \frac{PR(T_n)}{C(T_n)}\right),$$

where paper T_i has citations $C(T_i)$, and d is a damping factor that illustrates the fraction of random walks propagating along the citations. The parameter d was determined to be 0.85 on the basis of Brin and Page (1998). Table 3 presents the top 10 papers on DX in supply chain by the PageRank centrality in a local citation network.

Table 3. Top 10 papers on DX in supply chain based on PageRank

Ran-king	Local citation network	
	Papers	PageRank
1	Industry 4.0 technologies: Implementation patterns in manufacturing companies	0.0272
2	The impact of digital technology and Industry 4.0 on the ripple effect and supply chain risk analytics	0.0126
3	Procurement 4.0: Factors influencing the digitisation of procurement and supply chains	0.0088
4	Digital manufacturing-driven transformations of service supply chains for complex products	0.0084
5	Blockchain technology and its relationships to sustainable supply chain management	0.0079
6	New flexibility drivers for manufacturing, supply chain and service operations-	0.0077
7	The impact of Industry 4.0 implementation on supply chains	0.0059
8	Big data and the transformation of operations models: A framework and a new research agenda	0.0050
9	Tortoise, not the hare: Digital transformation of supply chain business processes	0.0045
10	Does finance solve the supply chain financing problem?	0.0044

To further explore the specific issues for DX in supply chain, we used the knowledge network for the author's keywords as well as citations among collected papers. Keyword network analysis is an effectual analysis to investigate trends of study on particular topics in the part by composing a keyword network on the basis of the author's keywords as nodes and the keywords occurrence as links in other papers (Jeong & Yoo, 2022). Several well-known and widely used network centrality measurements, such as degree, betweenness, and closeness centrality, were applied. The keywords with a high degree centrality contain a lot of links with other keywords, meaning prominent study points in the DX's field in supply chain. The top keywords in between centrality lie between all pairs of keywords in a keyword network, which is essential in bridging separated groups of research themes. Also, the top keywords in closeness centrality were utilized closely with all other keywords in the network because the keywords are in the core part of keyword network. Table 4 presents the results of top keyword based on centrality analysis.

Table 4. Top 10 keywords on DX in supply chain based on centrality measurements

Ranking	Degree centrality	Betweenness centrality	Closeness centrality
1	Industry 4.0	Industry 4.0	Industry 4.0
2	COVID-19	Blockchain	Sustainability
3	Sustainability	Operational performance	COVID-19
4	Blockchain	Sustainability	Blockchain
5	Resilience	COVID-19	Case study
6	Digital supply chain	Case study	Digital supply chain
7	Case study	Resilience	Resilience
8	Logistics	Circular economy	Logistics
9	Dynamic capability	Digital supply chain	Dynamic capability
10	Circular economy	Visibility	Technology

According to the citation and keyword network analysis results (Table 3 and 4), the main issues of DX in supply chain could be largely classified into three groups. The first group is about the use of digital technologies in the supply chain. Holmström and Partanen (2014), Roden et al. (2017), Bienhaus and Haddud (2018), Frank et al. (2019a, 2019b), Hartley and Sawaya (2019), Ivanov et al. (2019), Saberi et al. (2019), and Ghadge et al. (2020) investigated how the technologies of Industry 4.0 such as DX, blockchain, smart products, big data, and digitization of procurement processes are used in supply chain for efficiency, effectiveness, and profitability. Similarly, the main keywords according to Table 4 also include "Industry 4.0", "Blockchain", and "Digital supply chain", which represents that the use of technologies has been raising attention to supply chain domain. In particular, as the use of technology can optimize and effectively manage the supply chain, "Digital supply chain" keywords emerged as the top keywords.

The second group is related to flexibility through DX; Ivanov et al. (2018) studied the impact of flexibility on e-supply chains, smart operations, digitalization. Also, according to Table 4, "Dynamic capability" appeared as the top keyword. "Dynamic capability" represents

the ability to apply and adapt the uncertainty in supply chain quickly, which can drive high flexibility of a firm through DX in supply chain. It was noticeable that "Resilience" also appeared as the top keyword. "Resilience" can quickly adapt to disruption, find alternative suppliers, and maintain the efficiency of operations services. As the supply chain has become more complex and complicated, the ability to adapt the risk in the supply chain has gained more attention.

The last group is concerned with utilizing digital technologies to finance in supply chain. Caniato et al. (2016) researched the impact of digital technologies, such as digital manufacturing, blockchain technology, and level of digitization, on supply chain finance. In particular, "Blockchain" in supply chain finance can strengthen trust between transactions by protecting data and assistant transactions, which has been gaining as an essential issue of DX in supply chain. Similarly, "Blockchain" appeared as the top keyword in Table 4.

3.2. Influential topics on digital transformation in supply chain

We further used co-citation analysis performed to indicate common topics by means of two papers co-occur in different papers. A co-citation network built on the basis of highly co-cited papers presents that accompanying papers have analogous topic fields. Therefore, the co-citation analysis effectively can identify the common shared topics of a given field. In Table 5, through co-citation analysis, we divided the research on DX in supply chain into the connections between papers in that cluster were larger than the links between articles in other clusters. Moreover, to recognize the critical topic issues from six clusters, we extracted core papers from six clusters based on PageRank measures (Jeong & Yoo, 2022).

Table 5. Main topics of six clusters by core papers with high PageRank

	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5	Cluster 6
Main topics	Digital technologies in supply chain	Sustainability in digital and supply chain	Risks of supply chain in digitalization	Digital technologies for the environment in supply chain	Healthcare and life through the digital supply chain	Digitalization in logistics

Cluster 1 focused mainly on how digital technologies, such as unified platforms, blockchain, and e-booking systems in the supply chain, can support firms' performances and activities. Cluster 2 described sustainability issues such as social and governance in DX and the supply chain. Cluster 3 explained the difficulties and risks of digitalization and Industry 4.0 in supply chain activities. Cluster 4 showed the need for digital technology for the supply chain environment. Cluster 5 presented the impact and change of our health and life through the digital supply chain. Cluster 6 explained digitalization in logistics.

3.3. Change in DX in supply chain over time

Table 6 presents the number of papers published in six clusters since 2014. The first study was conducted in 2014, and studies have remained almost the same from 2017 to 2019. The

various studies regarding DX in supply chain have been growing since 2020. In 2021 and 2022, during COVID-19, all topics from six clusters were performed. COVID-19 has accelerated digitization and influenced changes in roles and behaviors in digital environments (Gabryelczyk, 2020). Studies are still ongoing in 2023.

Table 6. The number of papers published in six clusters (2014–2023)

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	Total
Cluster 1								3	2		5
Cluster 2					1		1	3	2		7
Cluster 3						2	2	7	6	1	18
Cluster 4						1	1	1	6		9
Cluster 5				2	1		2	1	4	1	11
Cluster 6	1					2	3	5	4		15
Total	1			2	2	5	9	20	24	2	65

As shown in Table 6, research on DX in supply chain grew at the same rate in 2017 and 2018. Moreover, studies on DX in supply chain, consisting of six general topics, were generally distributed from 2019 to 2020. In particular, the number of articles about Cluster 3 (Supply chain risk in digitalization) and Cluster 4 (Supply chain's digital technologies for environment) has sharply increased since 2021 and 2022, respectively, whereas the number of papers in Cluster 5 (Healthcare and life through the digital supply chain) and 6 (Digitalization in logistics) has steadily increased. The topics have been gaining researchers' attention because COVID-19 has affected supply chain risk, logistics, health, and life (Sarkis, 2020). In summary, since COVID-19, study on DX in supply chain has concentrated on the application of DX to risk and social responsibility topics.

To further find out the changes in significant keywords for DX in the supply chain, this paper performed a centrality analysis on the basis of the keyword network and contrasted the significant keywords from the previous 11 years (2010–2020) with the last two years (2021–2022). Table 7 shows that most of the top keywords (first to fifth) of degree, betweenness, and closeness centrality over the past 11 years (2010–2020) were "Digitalization", "Industry 4.0", "Digital transformation", "Blockchain", and "Digital supply chain".

Table 7. Comparison of the top 10 keywords across three centrality measurements

	Degree centrality		Betweenness centrality		Closeness centrality	
	2010–2020	2021–2022	2010–2020	2021–2022	2010–2020	2021–2022
1	Digitalization	Industry 4.0	Digitalization	Industry 4.0	Digitalization	Industry 4.0
2	Industry 4.0	Digital transformation	Industry 4.0	Digital transformation	Industry 4.0	Digital transformation
3	Digital transformation	Digitalization	Blockchain	Digitalization	Digital transformation	Digitalization

	Degree centrality		Betweenness centrality		Closeness centrality	
	2010–2020	2021–2022	2010–2020	2021–2022	2010–2020	2021–2022
4	Digital supply chain	COVID-19	Digital supply chain	COVID-19	Blockchain	COVID-19
5	Blockchain	Blockchain	Digital transformation	Blockchain	Digital supply chain	Sustainability
6	Sustainability	Logistics	Big data	Sustainability	Sustainability	Blockchain
7	Case study	Interviews	Transparency	Healthcare supply chain	Case study	Logistics
8	Resilience	Sustainability	Food supply chain	Circular economy	Circular economy	Resilience
9	Manufacturing	Circular economy	Information system	Sustainable development	Technology	Interviews
10	Circular economy	Small and medium-sized enterprises	Circular economy	Artificial intelligence	Resilience	Literature review

The top keywords (first to fifth) of the last two years (2021–2022) in three centralities are mostly "Industry 4.0", "Digital transformation", and "COVID-19". Overall, "Industry 4.0" and "Digital transformation", which encompass the whole, are top keywords, and "COVID-19" has emerged as a top keyword after COVID-19. Of the bottom keywords (sixth to tenth) of degree, betweenness, and closeness centrality over the past 11 years (2010–2020) and the last two years (2021–2022), unlike the top keyword (first to fifth), where most words are repeated, various words are shown in the bottom keywords (sixth to tenth). Some words, including "Sustainability", "Circular economy", "Food supply chain", "Resilience", "Sustainable development", and "Healthcare supply chain", are related to social responsibility and the environment. In contrast, others, containing "Logistics", "Manufacturing", "Information systems", "Technology", and "Artificial intelligence", are concerned with operations management and new technologies.

3.4. Network structure analysis

Network structure analysis was conducted to identify the characteristics of the network structure for identifying potential research gaps through the network structure of citations and keywords. We adopted several usually used measures of network to comprehend the network's structural properties (Choi et al., 2011).

The results of this research are presented as shown in Table 8 and Figure 3. Unlike the citation network, the number of keyword networks was relatively high in links representing a connection between nodes (keywords) (Scott, 2012). Furthermore, the values of the keywords network were the highest in average degree and average distance. The results indicate that the wide-ranging issues are dealt with in the field of DX in the supply chain despite relatively lower numbers of published papers.

Table 8. Network structural properties of citation and keyword network

	# of Links	Density	Average degree	Clustering coefficient	Average distance
Citations network	186	0.013	1.576	0.121	1.492
Keywords network	2,821	0.015	9.249	0.888	2.891

Figure 4 indicates that nodes (citations and keywords) that have more relationships with other nodes (citations and keywords) are likely to gain new relationships in the evolution of the network (Barabási, 2009). Therefore, in the network of DX within this supply chain, as specific issues, such as the utilization of digital technologies in Industry 4.0, risk, and sustainability represented by a publication and a keyword becomes more popular, scholars select that issues more frequently, establishing and communicating new ideas in connection with other issues.
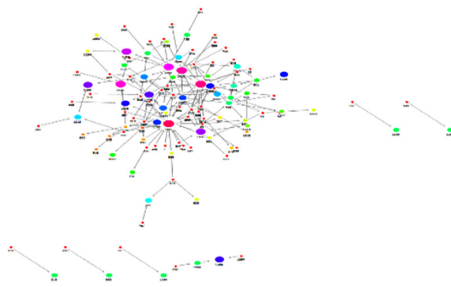
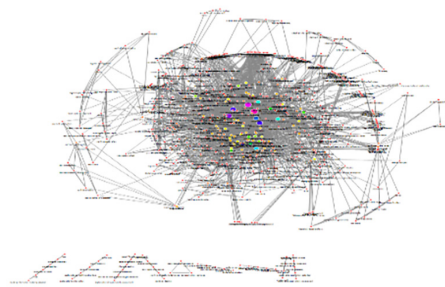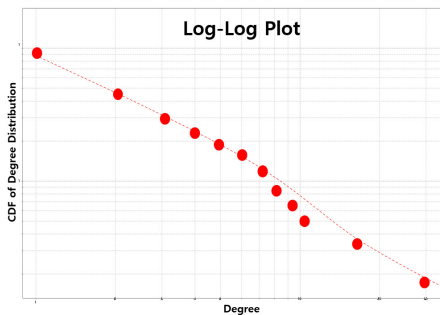Citations network   Keywords network

Figure 3. Citation and keyword network of DX in supply chain

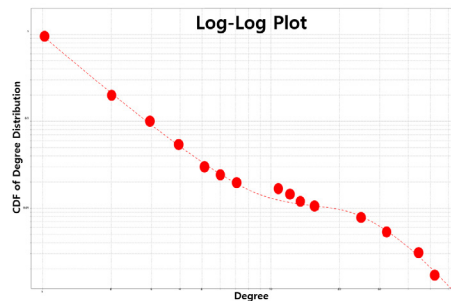Citations network   Keywords network

Figure 4. Cumulative degree distributions

4. Future research agenda

According to all the streams of previous studies, this paper could provide several primary research directions. First, we suggest more research about the difficulties and side effects of the use of DX in supply chain. Previous research on DX in supply chain has highlighted the importance and role of DX in supply chain. This can be seen from the fact that citation and keyword network analysis had the influential articles and keywords related to the use of DX (see Table 3–5). After COVID-19, researchers have identified the importance and role of DX in addressing non-face-to-face business with supply chain members. However, most research on DX in supply chain has focused only on the advantage of application through DX. The influential papers and keywords, including the difficulties and side effects of the DX, did not appear in citation and keyword network analysis (see Table 3, 4, and 7). Therefore, it is necessary to conduct more studies with a focus on the difficulties and side effects of the use of DX in supply chain.

Second, it is need to take more attention to risk and social responsibility topics. According to changes in DX in supply chain and network structure analysis, the risk and social responsibility topics have been gaining attention since 2020 (see Table 5–7 and Figure 4). Therefore, the main topics that underline the role of DX in addressing risk and social responsibility in supply chain are expected to continue to grow. In particular, as "Dynamic capability" and some articles relevant to flexibility appeared as the influential keyword and papers (see Table 3–4), flexibility to resilient risk of supply chain is expected to be more important. Furthermore, the "Sustainability" keyword appeared as the top betweenness centrality keyword, representing that the issues play a role in bridging risk and social responsibility themes (see Table 4–7). For example, DX prevents supply chain risks arising from the firm's environment-related activities, such as energy consumption, waste reduction, efficient use and distribution of resources, and optimization of resource utilization (Chen & Hao, 2022). Therefore, the sustainability issues bridging risk and social responsibility are expected to be gaining more attention.

Third, it is necessary to focus on the use of DX in supply chain finance. According to keyword network analysis, the "Blockchain" appeared to be a significant issue (see Table 4–7). Blockchain, one of the DX technologies, can play an important role in supply chain finance, including improved transparency, security and trust, smart contracts, and efficiency and cost reduction. As blockchain technologies continue to advance, it is likely to play an essential role in addressing transaction among supply chain members. For example, Walmart has been working on blockchain technology to stabilize its food supply chain tracking the movement of food, which has become even more important during the COVID-19 pandemic. Walmart worked with IBM to trace the origin of food and to solve the problem quickly. It can streamline financial transactions related to supply chain (Chang et al., 2020). As a result, it is necessary to research using blockchain for supply chain finance for the transparency, efficiency, and security of supply chain operations.

Conclusions

This study presents theoretical implications and managerial implications. First, an overview of DX in supply chain can help researchers interested in DX issues in supply chain recognize study chances and make new views. Although a few studies have investigated a systematic literature review research on DX, most did not research the trend of DX within supply chain. Thus, our research shows meaningful guidance for emerging researchers in the DX of supply chain. Our paper suggests detailed directions to pragmatic questions regarding which journals are being researched, which scholars are being studied, which issues and topics are important, and what are the latest issues and topics.

Second, we adopted a rigorous systematic literature review to generally estimate study on DX in supply chain by integrating the traditional systematic literature review method with a keyword network analysis. Those combinations of various methods can derive a more specific knowledge network of DX in supply chain, complementing the shortcomings about existing reviews of systematic literature.

Third, we provide meaningful guidelines for practitioners through our findings. To identify which issues and topics are significant, we identified what researchers are interested in regarding DX in the supply chain, as well as why the issues and topics are interesting. In particular, we highlighted the importance of DX on the given main topics, such as supply chain risk, social responsibility, and blockchain. Therefore, it can be suggested that firm's managers need to utilize DX in accordance with each firm's supply chain strategy.

However, this study, like other studies, may have fundamental limitations. First, because we used only SCOPUS database, a few papers found only in other databases may be excluded. Second, this study was limited to the field of business administration in the process of collecting published papers. But in many cases, they are also addressed in academic areas such as industrial engineering and convergence major. Therefore, in future research, not only business administration but also studies in other fields should be considered.

Acknowledgements

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