Equivalent: Journal of Social Science Engineering
Volume 8, Number 2, 634-646
e_ISSN: 2775-0833
https://jurnalequivalent.id/index.php/jequi/index
DOI: doi.org/10.59261/jequi.8i2.331

The Use of Digital Technology in The Optimization of Modern Industrial Supply Chain Management: A Systematic Literature Review

Dwi Nurfitrianto*
Universitas Bina Nusantara, Indonesia

Rida Zuraida
Universitas Bina Nusantara, Indonesia

Febri Nur Wahyudi
Universitas Bina Nusantara, Indonesia

Jayadi Rahman
Universitas Bina Nusantara, Indonesia

***Correspondent author:**
Dwi Nurfitrianto, Universitas Bina Nusantara, Indonesia. ✉dwi.nurfitrianto@binus.ac.id

Article information:

Article history:
Received: April 27, 2026
Revised: May 29, 2026
Accepted: June 26, 2026

Keywords:
Digital Technology; Supply Chain Management; Industry 4.0; Digital Transformation; Systematic Literacy Assessment.

Abstract

Background: Digital development has transformed supply chain management (SCM) through key technologies such as the Internet of Things, artificial intelligence, blockchain, big data analytics, digital twins, and cloud computing, each providing unique contributions to operational efficiency and resilience. Despite the rapid growth of literature on digital SCM, significant gaps remain, as most studies examine technologies individually rather than exploring their combined effects on supply chain performance.
Objective: This study aims to present the latest scientific literature on the use of digital technologies to improve, identify, classify, and integrate supply chain management (SCM) through a methodological literature review (SLR) approach.
Methods: This study was conducted from 2021 to 2025 using databases such as Scopus, Web of Science, and Google Scholar. Of the first 309 selections, the last 10 articles met the selection criteria after progressive selection.
Results: The results show that the most prominent technologies are complementary elements in the digital ecosystem, where the Internet of Things (IoT), artificial intelligence (AI), blockchain, and big data analytics are integrated.
Conclusion: Digital technologies such as the Internet of Things, artificial intelligence, big data analytics, and blockchain operate synergistically to improve supply chain efficiency, transparency, and resilience. Future research is recommended to assess cross-sectoral multi-technology synergies and systematically integrate social and environmental sustainability into digital supply chain frameworks.

To cite this article: Nurfitrianto, D., Zuraida, R., Wahyudi, F. N., & Rahman, J. (2026). The Use of Digital Technology in The Optimization of Modern Industrial Supply Chain Management: A Systematic Literature Review. *Equivalent: Jurnal Ilmiah Sosial Teknik*, 8(2), 634-646. https://doi.org/10.59261/jequi.v8i2.331

INTRODUCTION

Digital development (Farajpour et al., 2022; Ivanov & Dolgui, 2021). Key technologies underpinning the digital transformation of supply chains, including the Internet of Things (IoT), artificial intelligence (AI), blockchain, big data analytics, digital twins, and cloud computing, have been identified. Each of these technologies is unique (Iftikhar et al., 2024; Zhang et al., 2024).

Integrating digital technology into SCM management has been proven to improve supply chain resilience while significantly improving operational efficiency. With AI-based and data-driven decision-making capabilities and big data analytics, businesses can respond to changing

market demands faster and more accurately. In addition, dynamic digital capacity management plays a critical role in improving supply chain resilience, especially in the face of unexpected external disruptions. Strengthening digital capabilities is closely linked to the effectiveness of governance that supports the adoption of technology at every node of the supply chain (Dubey et al., 2023; Huang et al., 2023)

Although the literature on the digitalization of supply chain management (SCM) is growing rapidly, significant research gaps still exist. Many studies study digital technologies such as artificial intelligence (AI), Internet of Things (IoT), big data analytics, and blockchain separately, without considering the interactions and synergies between these technologies in integrated supply chain systems. As a result, a full understanding of how the simultaneous integration of digital technologies affects operational efficiency and supply chain resilience in these sectors remains limited.

Additionally, current research is generally difficult to generalize because it relies on specific contexts and case studies. Previous bibliometric studies have focused on publication trends and theme mapping, but have not provided an in-depth and comprehensive causality analysis, technology integration mechanisms, or strategic impacts on overall improvements in social content management. This case highlights the need for a more systematic and integrated approach to integrate broad research findings into the literature (Andaloussi, 2024; Nguyen et al., 2022).

To bridge this gap, the study proposes a new approach that integrates multiple digital technologies in the context of supply chain management into a single comprehensive analytical framework. While previous studies were scattered, this study simultaneously examined the relationship between digital technology maturity, process efficiency, and supply chain resilience from a multidimensional and cross-industry perspective. Another benefit is the effort to create a consistent conceptual framework for previously fragmented experimental discoveries and to identify areas of research that have not been adequately explored as a direction of future investigation.

Based on the previous background, this study aims to systematically revise the literature in accordance with the PRISMA Page et al. (2021), evaluate the integration of digital technologies in industrial supply chain management from 2021 to 2025, map technical maturity, operational efficiency, and flexibility across various dimensions, and serve as a bridge to identify theoretical gaps. By achieving this goal, research provides dual value in this area (Silva et al., 2026).

METHOD

This study uses Systematic Literacy Review (SLR) as the primary methodological framework for finding, selecting, and integrating relevant scientific articles. The search was conducted through reliable academic databases such as Scopus, Web of Science, and Google Scholar, which cover topics such as "Digital Technologies," "Supply Chain Management," "Industry 4.0," and "Digital Transformation." These are structured keywords. All articles reviewed are limited to 2021 to 2025 to reflect the current situation (Iftikhar et al., 2024)The literature selection process begins with sorting the titles and summaries, followed by reading the full text (a complete review of supply chain research published in an indexed journal in English or Indonesian). This approach is effective in ensuring objectivity and consistency in the literature selection process (Andaloussi, 2024; Nguyen et al., 2022). After the final selection, each article is objectively analyzed through content analysis to identify research patterns, trends, and gaps. Integrated results are presented narratively and visually, which helps to fully understand the state of digitalization in the modern industrial supply chain (Dubey et al., 2023).

Literature selection process

After a systematic literature search within Scopus and the Science Network, full feasibility assessment, and exclusion procedures based on two main reasons methodological inconsistencies (n = 24) and irrelevance of research focus (n = 22) the last 10 papers were included in the merger.

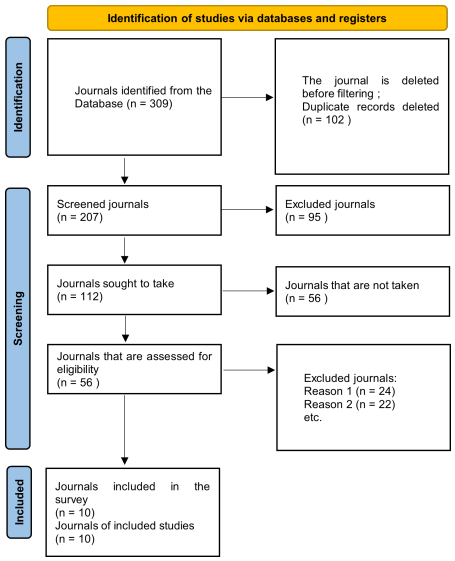

Figure 1. Literature Selection Using PRISMA Flowchart
Source: research data

RESULTS AND DISCUSSION

Results

This section provides a descriptive statistical analysis of the 10 selected literature review articles. The analysis was carried out based on several important factors, including the distribution of the research country, the year of publication and the research method used.

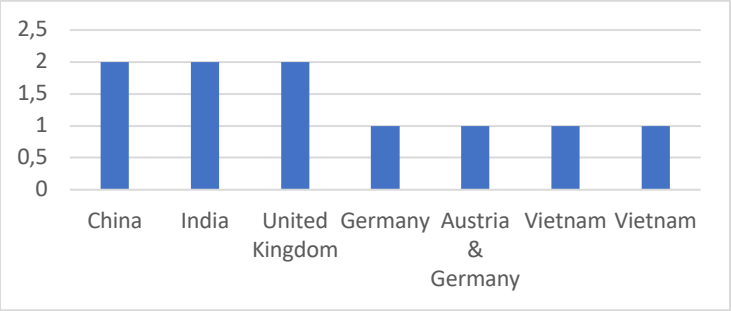

Figure 2. Distribution of study countries
Source: research data

As seen in the Figure 2, developing and developed countries in Asia and Europe are leading research on the digitalization of government supply chain management. China and India each published two articles, highlighting their strong focus on digital transformation in the industrial sector. In addition, the UK makes an important contribution to the sustainability of its supply chains, particularly in the region. Meanwhile, other countries such as Vietnam, Germany, the European Union, and cooperation between Austria and Germany each contributed one study.

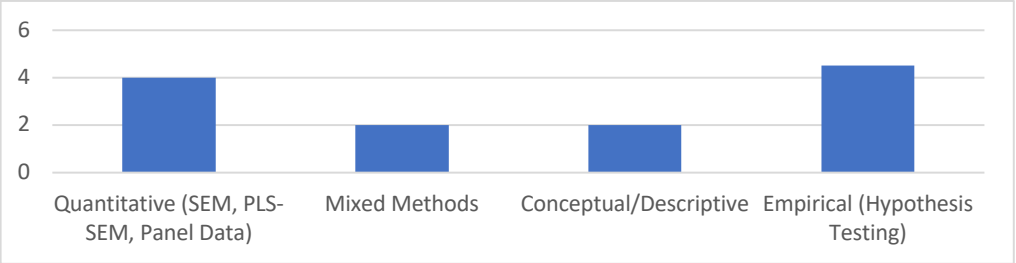

Figure 3. Dissemination of research methods
Source: research data

From a methodological point of view, many studies use quantitative approaches such as structural equation modeling (SEM), partial least squares-structured equation modeling (PLS-SEM), and panel data analysis. This suggests that research in this area focuses primarily on empirical verification of relationships between variables. In addition, there is a hybrid approach that combines advanced statistical research and analysis with conceptual research to develop a theoretical framework. In addition, empirical methods based on hypothesis testing help to understand the behavior and integration of supply chains, especially in the context of small and medium-sized businesses. This diverse approach reflects the complexity of supply chain digitalization research, which requires a multifaceted approach.

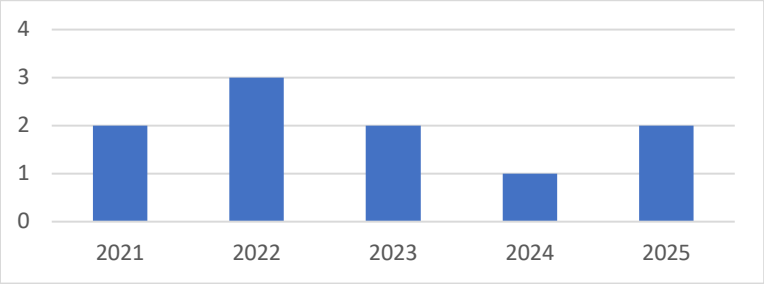

Figure 4. Distribution of the Year of Publication
Source: research data

Based on years of publication deployment, it's clear that research on digital technologies in supply chains has increased in recent years. The number of publications peaked at three in 2022, followed by two in 2021, 2023, and 2025. Meanwhile, one research article is scheduled to be published in 2024. This indicates that the topic of digital supply chains continues to grow, especially with the acceleration of digital transformation in the industry 4.0 era.

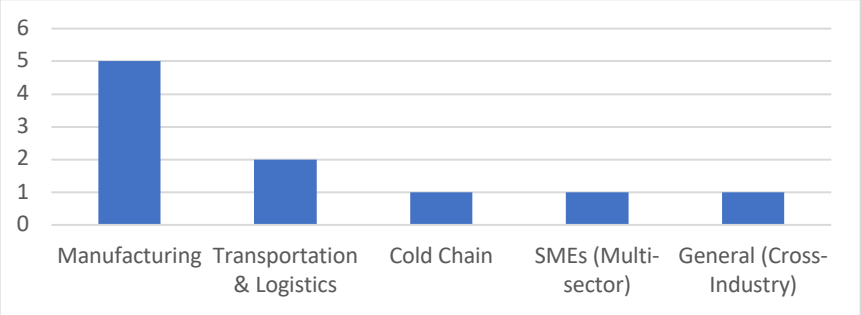

Figure 5. Industry-oriented applications
Source: research data

Most of the research focused on production, with five articles published. This shows that manufacturing is an important application area for digital technologies in the supply chain. In addition, the transportation and logistics sector is receiving increasing attention, especially as distribution expands. Key areas such as cold chains, small and medium-sized enterprises, and cross-industry studies show that the application of digital technologies is expanding to various fields. This card has several features.

Table 1. A comprehensive literature review on the use of digital technologies in supply chain management

Author	Address	Guidelines	Example	Researchers' findings	Related topics
(Sharma et al., 2022)	The Mediating Effects of	Structural equation (SEM)	There were 361 participants	Supply chain management practices are influencing the	This is important because digital

Author	Address	Guidelines	Example	Researchers' findings	Related topics
	Industry 4.0 Technology on Supply Chain Management Practices and Supply Chain Performance	research and modeling	from Indian manufacturing companies	adoption of Industry 4.0 technologies. Industry 4.0 technology has a significant positive impact on supply chain performance. Industry 4.0 technology mediates the relationship between SCM management practices and supply chain performance.	technology (Industry 4.0) plays a mediated role in improving the performance of supply chain management in the manufacturing industry
(Wang et al., 2023)	Will a company's digital transformation accelerate its carbon performance in the Industry 4.0 era? Proof of Chinese Industrial Entrepreneurship	Panel Data Analysis and Contrast Inspection	China Industrial Enterprise Data 2012–2020	Digital transformation (DT) has a significant positive impact on carbon performance. DT improves innovation capabilities, product distribution efficiency, R&D investment, and improvement of supply chain structure. Strong influence on private and large companies	This is important because it shows how the digital transformation of the supply chain in the Industry 4.0 era contributes to environmental sustainability (carbon performance)
(Akbari et al., 2023)	Transforming the Digital Supply Chain Transformation Landscape: The Impact of Vietnam's Industry 4.0	Online semi-structured questionnaire, ANOVA, regression analysis, Monte Carlo simulation	281 supply chain members in Vietnam	Big data analytics and IoT are expected to have the greatest impact and receive the largest financial investment in the next 5 to 10 years. Blockchain is considered impossible. There is a technological synergy between robotics, artificial intelligence, and the Internet of Things (IoT)	The book discusses the adoption of Digital Industry 4.0 technology in supply chains in developing countries, and offers investment insights and the impact of digital technologies
(Zhang et al., 2024)	The impact of digital transformation on supply chain restructuring and performance	Qualitative Comparative Analysis of PLS-SEM and Speculative Clusters (fsQCA)	379 participants in China's machinery, electronics, and household appliances industry	Digital Supply Chain Transformation (SCDT) has a significant impact on supply chain performance (SCP). Supply Chain Restructuring (SCR) mediates the relationship between SCDT and SCP. High-performance drivers	This is important because it shows that digital transformation directly impacts the supply chain performance and restructuring

Author	Address	Guidelines	Example	Researchers' findings	Related topics
				are available in three configurations: technical, managed, and flexible	capabilities of modern manufacturing .
(Abbasnejad et al., 2025; Gerhátová et al., 2021)	Industry 4.0 Introduction Options in Rail Transportation	Concept study and technical analysis	EU rail transport sector	Digitalization and Industry 4.0 technologies improve capabilities, improve performance, and improve supply chain resilience. Automated data exchange simplifies communication in the supply chain. Digital transformation doesn't have to be complete all at once; It can be applied gradually	This is crucial to describe the gradual improvement of supply chains in the transport and logistics sector and the adoption of digital technologies for Industry 4.0
(Emon & Khan, 2025)	The Transformative Role of Industry 4.0 in Supply Chains: Exploring Digital Integration and Innovation in Manufacturing	PLS-SEM	364 supply chain members	The introduction of Industry 4.0 has had a positive impact on the Integrated Digital Supply Chain (IDSC), Innovative Supply Chain Practices (ISCP) and Supply Chain Vision (SCV) sectors. ISCP and SCV are key drivers for improving supply chain performance.	This book is important because it explores in depth how digital integration and technology-driven Industry 4.0 innovation improve supply chain efficiency and visibility
(Chehri et al., 2021; Reichardt et al., 2025)	Theory and practice of successful IoT strategies in Industry 4.0 companies	IoT Application Concept Study and Case Study	Industrial companies are adopting IoT	IoT and big data have significant transformative potential across a wide range of industries. IoT adoption increases productivity, innovation, and cost efficiency. IoT applications successfully transform industries into smart factories	This book is important because it discusses IoT as the core of digital technologies for supply chain transformation and industrial process improvement as a strategic approach
(Ghadge et al., 2022)	The relationship between	Two phases: Structural Analysis	243 participants, automotive	Industry 4.0 technology indirectly impacts GSC's	This is important because it

Author	Address	Guidelines	Example	Researchers' findings	Related topics
	Industry 4.0 and green supply chain management: evidence from the automotive industry	Modeling (ISM) and SEM	supply chain experts from Europe (including the UK)	performance through Green Supply Chain (GSC) practices. The Internet of Things, Cyber-Physical Systems (CPS) and blockchain are the most important communication technologies. Reverse logistics and eco-friendly agriculture are heavily influenced by innovative technologies	shows the relationship between Digital Industry 4.0 technology, green supply chain practices, and the increasing sustainability of the automotive industry
(Fatorachian & Pawar, 2025)	Improving Cold Supply Chain Waste Management Through Digital Transformation	Theoretical and empirical research; Development of a Unified Framework	Onboard cold chain network	Digitalization through IoT, artificial intelligence, and blockchain enables process optimization, waste reduction, and environmental impact in the cold chain. An integrated framework that combines Industry 4.0 with sustainable business theory improves waste management efficiency.	This is important because it supports environmental sustainability and improves cold supply chain management through digital technologies
(Winter et al., 2022)	Information exchange and supply chain management for SMEs in the context of Industry 4.0	Experimental Analysis and Hypothesis Testing	81 participants from small and medium-sized enterprises from Austria and Germany	Small and medium-sized businesses typically digitize information, which means there is less activity on MSCM. Integrating SMEs into digital supplier networks is essential to achieve transparency and traceability in the supply chain. There are non-technical barriers to information exchange	This book is particularly relevant because it discusses the role of digital information sharing in multi-layered supply chain management, particularly the challenges faced by SMEs in the context of Industry 4.0

Source: research data

Discussion

The Most Widely Used Digital Technologies for Supply Chain Optimization

The results of the 10 selected articles show that there is no single digital technology that drives supply chain optimization; They all operate in a mutually reinforcing ecosystem. The Internet of Things (IoT) is emerging as one of the newest fields of study by enabling real-time connection of physical devices and the ability to monitor accurate and automated operations. As

IoT is introduced to the industrial environment, not only productivity increases, but traditional manufacturing facilities are also transformed into smart factories that adapt to changing operational environments (Chehri et al., 2021; Reichardt et al., 2025).At the same time, big data analytics and artificial intelligence are driving discussions about the future of supply chains in the context of demand forecasting and strategic decision automation. According to a survey conducted in Vietnam, big data analytics and the Internet of Things are expected to have the greatest impact in the next 5 to 10 years, confirming that these two sectors allocate the largest financial investment compared to other technologies. *Blockchain* in developing countries, the outlook is relatively low (Akbari et al., 2023).

Blockchain technology itself occupies a strategic position to support transparency and traceability in the supply chain, especially when integrated with cyber-physical (CPS) systems and the Internet of Things. The three form an important bridge connecting Green Supply Chain (GSC) practices to improve the sustainability performance of the European automotive industry (Ghadge et al., 2022). In addition, in the context of cold chains and refrigerated supply chains, the combination of IoT, artificial intelligence, and blockchain has proven effective in improving logistics operations and reducing waste and environmental impact (Fatorachian & Pawar, 2025).

The Impact of Digital Technology on Supply Chain Efficiency, Transparency, and Resilience

The true impact of supply chain digitalization can be seen in various aspects of measurable performance. From an operational efficiency perspective, Industry 4.0 has proven to act as a mediator between supply chain management practices and overall organizational performance. A study based on structural comparative modeling (SEM) in Indian manufacturing has shown that the adoption of Industry 4.0 technology significantly mediates the relationship between structural comparative management practices and supply chain performance, suggesting that technology is not just a tool but an important lever for system efficiency (Sharma et al., 2022). In this context, research on Chinese industrial enterprises shows that the digital transformation of supply chains (SCDT) directly impacts supply chain performance, and this influence is further enhanced by the ability of organizations to dynamically adapt their structures to market conditions (Zhang et al., 2024).

When it comes to environmental sustainability, the digital transformation of the supply chain is at least as important. According to data from China's Industrial Enterprise Committee between 2012 and 2020, digital transformation has a positive impact on carbon performance by improving innovation capabilities, expanding the allocation of production factors, and improving the overall supply chain structure (Wang et al., 2023). These findings contribute to the realization that supply chain digitalization is not only about cost efficiency, but also about environmental awareness, which is becoming increasingly urgent in the era of Industry 4.0.

From a transparency and visibility perspective, recent studies show that the adoption of Industry 4.0 has a positive impact on Integrated Digital Supply Chains (IDSCs), Innovative Supply Chain Practices (ISCPs), and Supply Chain Visibility (SCV). These three aspects are the driving forces that improve the efficiency of the supply chain from top to bottom (Emon & Khan, 2025).In this context, research on the EU rail sector shows that gradual digitalization is not always realistic or effective in increasing the resilience and capacity of supply chains without causing undue resistance within the organization (Abbasnejad et al., 2025; Gerhátová et al., 2021).

Research Gaps and Development Opportunities

Although the results of these 10 articles provide a relatively complete picture, some research gaps still reveal them. One particularly striking aspect is that small and medium-sized enterprises (SMEs) participate in layered supply chain management (MSCM) on a limited basis. Empirical studies in Austria and Germany show that SMEs tend to share less digital information and are less actively participating in digital supply chain networks. This is not only due to technical barriers, but also non-technical barriers such as organizational culture and trust between partners (Winter et al., 2023). This is a serious problem. This is because SMEs are a leading force in global supply chains, especially in developing countries.

Despite the promising results, it is important to realize that there are limitations to

adopting digital technologies. For SMEs, the high cost of investing in technologies such as artificial intelligence and blockchain remains a major barrier (Winter et al., 2022). As supply chains are spread across multiple jurisdictions, concerns about data security and privacy have emerged as a serious challenge (Ghadge et al., 2022). Compatibility between existing infrastructure and modern digital platforms remains an ongoing technical challenge. Digital readiness and culture are often underestimated by non-technical barriers in recruitment strategies (Akbari et al., 2023). These limitations should be carefully addressed in any action plan.

Future research opportunities are vast, with a particular focus on simultaneously verifying synergies between different digital technologies. Research on green supply chains in the automotive and cold chain industries strongly demonstrates the need for social coordination management studies to systematically integrate sustainability aspects into the digitalization framework (Ghadge et al., 2022). Therefore, future research topics are expected to focus not only on economic efficiency, but also on the resilience of social and environmental supply chains in response to climate change and the increasing complexity of global uncertainty.

Theoretical framework

When researching digital transformation in supply chain management, it is important to understand the theoretical approach to how digital technologies affect supply chain performance and resilience. After analyzing the ten selected papers, most of the research took a conceptual approach that integrated different perspectives, such as Industry 4.0, digital transformation, and technology ecosystem integration, without explicitly citing a single theory. Therefore, this section describes the implicit and explicit theoretical framework used in this study.

First, the concept of Industry 4.0 is the main basis for explaining the role of digital technology in the modern supply chain. The theory focuses on building intelligent and connected manufacturing systems by integrating technologies such as the Internet of Things, artificial intelligence, big data analytics, and consumer protection services. In this study, technology does not work in isolation, but functions as an ecosystem that reinforces each other and improves the efficiency, clarity, and resilience of the supply chain (Chehri et al., 2021; Reichardt et al., 2025). This approach states that, as empirical studies show, digital transformation acts as an intermediary between supply chain management practices and performance improvement (Sharma et al., 2022).

Second, the Resource-Based Vision (RBV) perspective and dynamic capabilities are implicitly reflected in the results that highlight the importance of internal preparedness within the organization, such as management capabilities, business strategy, and technology infrastructure. Within this framework, digital technology is a strategic asset that creates a competitive advantage when supported by an organization's ability to manage and integrate effectively (Wang et al., 2023; Dubey et al., 2023; Zhang et al., 2024). Digital transformation has also been shown to contribute to improved environmental performance, such as resource allocation, innovation, and carbon performance.

Third, the Technology Regulatory Environment (TOE) and Innovation Diffusion Theory (DOI) frameworks are important to explain the factors influencing the adoption of digital technologies in supply chains. Technical factors include the features and benefits of technologies such as IoT and artificial intelligence. Organizational factors include internal preparation and business strategy. Environmental factors include competitive pressures, public policy and cooperation between industry stakeholders (Akbari et al., 2024; Winter et al., 2023).This approach emphasizes that the successful adoption of digital technology is highly dependent on the interaction between internal and external factors.

Fourth, the theory of supply chain integration and information exchange emphasizes that information exchange and collaboration between stakeholders are essential to improve transparency and coordination. Research shows that digital integration, especially through IoT and data-driven platforms, increases supply chain visibility and supports faster and more accurate decision-making (Winter et al., 2023). However, non-technical challenges, such as restrictions on digital adoption by SMEs, remain a major obstacle.

Fifth, from a sustainability perspective, Green Supply Chain Management (GSCM) and

Sustainable Supply Chain Theory explain how digital technology contributes to improving environmental performance. The integration of technologies such as the Internet of Things, blockchain, and consumer protection services has been proven to increase transparency, improve resource efficiency, and reduce waste and environmental impact, thereby improving environmentally friendly supply chain practices (Ghadge et al., 2022).

Table 2. Research Theoretical Framework

Theory	Author	Connection
Industry 4.0	(Chehri et al., 2021; Emon & Khan, 2025; Sharma et al., 2022)	Explains how integrating digital technologies such as the Internet of Things, artificial intelligence, big data, and consumer protection services can improve supply chain efficiency and performance
Resource-Based Perspectives (RBVs) and dynamic capabilities	(Wang et al., 2023; S. Zhang et al., 2024)	This emphasizes the role of the organization's internal capabilities in creating a competitive advantage through digital technology
Technology, Regulation, Environment (TOE) and Innovation Diffusion (DOI)	(Akbari et al., 2024)	Please explain the technical, regulatory, and environmental factors that affect the adoption of digital technologies.
Supply chain integration and information exchange	(Winter et al., 2023)	It emphasizes the importance of integration and information exchange to improve the visibility and coordination of supply chains
Green Supply Chain Management (GSCM) and Sustainable Supply Chain	(Fatorachian & Pawar, 2025; Ghadge et al., 2022)	Please explain how digital technology contributes to sustainability and environmental impact reduction?

Source: research data

The theoretical framework developed suggests that improving supply chain management cannot be described as a single theory, but as an interdisciplinary approach that integrates technical, regulatory, and environmental concepts. The synergy of digital technology, supported by internal and external capabilities, is critical to improving operational efficiency, supply chain resilience, and sustainability in the modern industrial era.

Analysis framework

A comprehensive analytical framework was developed to understand the relationship between digital technologies, operational efficiency, and supply chain resilience, with detailed analysis of 10 selected studies. The framework describes the complex relationships between various technologies such as the Internet of Things (IoT), big data analytics, artificial intelligence (AI), blockchain, and cyber-physical systems (CPS), as well as other supporting factors that influence the successful implementation of them. In addition, the framework shows that the synergy of digital technologies and the support of internal and external factors is essential to achieve sustainable supply chain optimization.

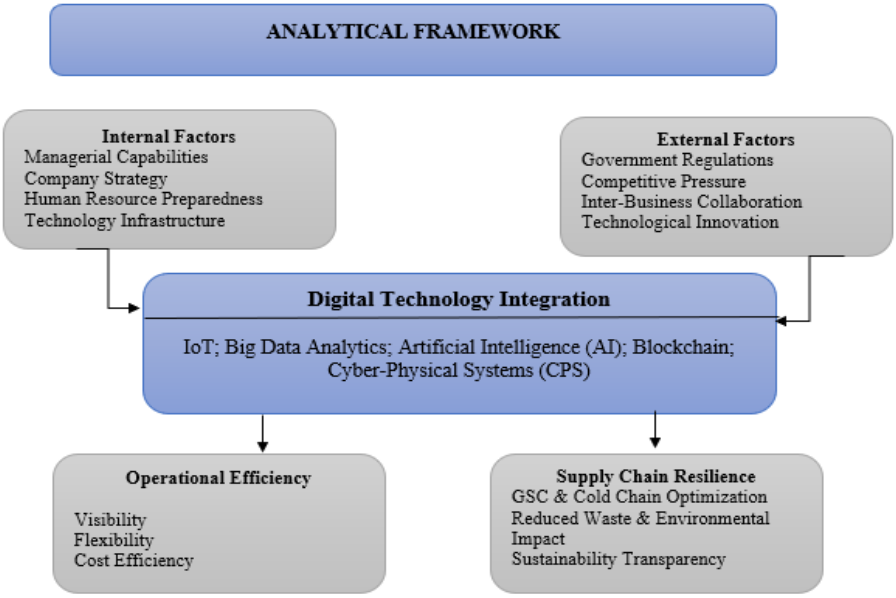

Figure 6. Analysis framework
Source: research data

CONCLUSION

This study concludes that digital technologies such as the Internet of Things, artificial intelligence, big data analytics, and blockchain operate synergistically to improve supply chain efficiency, transparency, and resilience. The integration of these technologies enables real-time monitoring, data-driven decision-making, and adaptive capacity management, contributing not only to operational performance but also to environmental sustainability. However, challenges remain, particularly for small and medium-sized enterprises (SMEs), which face high investment costs, infrastructure compatibility issues, and non-technical barriers such as organizational culture and trust.

Future research should go beyond a single technical study and provide a more comprehensive approach. In other words, it means you need to verify the synergies of different technologies in different fields and countries simultaneously. Special attention should be paid to the participation of marginalized SMEs in the digital supply chain ecosystem due to technical limitations, cultural barriers, and trust between partners. In addition, integrating social and environmental aspects of sustainability into the digitalization of supply chains should be a key research priority, especially given the increasingly real and challenging global climate pressures.

ACKNOWLEDGMENTS

The authors would like to thank the Universitas Bina Nusantara for providing the academic support and resources needed to carry out this research.

AUTHOR CONTRIBUTION STATEMENT

Concepts and methodologies by Dwi Nurfitriant and Jayadi Rahman. Original research, materials and concepts by Dwi Nurfitriant and Febri Nur Wahyudi. Overview and editing by Dwi Nurfitriant and Rida Zuraida. Data format by Febri Nur Wahyudi and Jayadi Rahman.

REFERENCES

Abbasnejad, B., Soltani, S., Ahankoob, A., Kaewunruen, S., & Vahabi, A. (2025). Industry 4.0 Technologies for Sustainable Transportation Projects: Applications, Trends, and Future Research Directions in Construction. *Infrastructures*, *10*(5), 104. https://doi.org/10.3390/infrastructures10050104

Akbari, M., Kok, S. K., Hopkins, J., Frederico, G. F., Nguyen, H., & Alonso, A. D. (2023). The changing landscape of digital transformation in supply chains: impacts of industry 4.0 in Vietnam. *The International Journal of Logistics Management*, *35*(4), 1040–1072.

https://doi.org/10.1108/IJLM-11-2022-0442

Akbari, M., Kok, S. K., Hopkins, J., Frederico, G. F., Nguyen, H., & Alonso, A. D. (2024). The changing landscape of digital transformation in supply chains: impacts of industry 4.0 in Vietnam. *The International Journal of Logistics Management*, *35*(4), 1040–1072. https://doi.org/10.1108/IJLM-11-2022-0442

Andaloussi, M. B. (2024). A Bibliometric Literature Review of Digital Supply Chain: Trends, Insights, and Future Directions. *SAGE Open*, *14*(2), 1–20. https://doi.org/10.1177/21582440241240340

Chehri, A., Zimmermann, A., Schmidt, R., & Masuda, Y. (2021). Theory and practice of implementing a successful enterprise IoT strategy in the industry 4.0 era. *Procedia Computer Science*, *192*, 4609–4618. https://doi.org/10.1016/j.procs.2021.09.239

Dubey, R., Bryde, D. J., Dwivedi, Y. K., Graham, G., Foropon, C., & Papadopoulos, T. (2023). Dynamic digital capabilities and supply chain resilience: The role of government effectiveness. *International Journal of Production Economics*, *258*, 108790. https://doi.org/https://doi.org/10.1016/j.ijpe.2023.108790

Emon, M. M. H., & Khan, T. (2025). The transformative role of Industry 4.0 in supply chains: Exploring digital integration and innovation in the manufacturing enterprises. *Journal of Open Innovation: Technology, Market, and Complexity*, *11*(2). https://doi.org/10.1016/j.joitmc.2025.100516

Farajpour, F., Hassanzadeh, A., Elahi, S., & Ghazanfari, M. (2022). Digital supply chain blueprint via a systematic literature review. *Technological Forecasting and Social Change*, *184*, 121976. https://doi.org/https://doi.org/10.1016/j.techfore.2022.121976

Fatorachian, H., & Pawar, K. (2025). Enhancing Waste Management in Cold Supply Chains via Digital Transformation. *Procedia Computer Science*, *253*, 167–173. https://doi.org/10.1016/j.procs.2025.01.080

Gerhátová, Z., Zitrický, V., & Klapita, V. (2021). Industry 4.0 implementation options in railway transport. *Transportation Research Procedia*, *53*(2019), 23–30. https://doi.org/10.1016/j.trpro.2021.02.003

Ghadge, A., Mogale, D. G., Bourlakis, M., M. Maiyar, L., & Moradlou, H. (2022). Link between Industry 4.0 and green supply chain management: Evidence from the automotive industry. *Computers and Industrial Engineering*, *169*(June), 108303. https://doi.org/10.1016/j.cie.2022.108303

Huang, K., Wang, K., Lee, P. K. C., & Yeung, A. C. L. (2023). The impact of industry 4.0 on supply chain capability and supply chain resilience: A dynamic resource-based view. *International Journal of Production Economics*, *262*(July 2022), 108913. https://doi.org/10.1016/j.ijpe.2023.108913

Iftikhar, A., Ali, I., Arslan, A., & Tarba, S. (2024). Digital Innovation, Data Analytics, and Supply Chain Resiliency: A Bibliometric-based Systematic Literature Review. *Annals of Operations Research*, *333*(2–3), 825–848. https://doi.org/10.1007/s10479-022-04765-6

Ivanov, D., & Dolgui, A. (2021). A digital supply chain twin for managing the disruption risks and resilience in the era of Industry 4.0. *Production Planning and Control*, *32*(9), 775–788. https://doi.org/10.1080/09537287.2020.1768450

Nguyen, T., Duong, Q. H., Nguyen, T. Van, Zhu, Y., & Zhou, L. (2022). Knowledge mapping of digital twin and physical internet in Supply Chain Management: A systematic literature review. *International Journal of Production Economics*, *244*, 108381. https://doi.org/https://doi.org/10.1016/j.ijpe.2021.108381

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S., … Moher, D. (2021). The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ*, n71. https://doi.org/10.1136/bmj.n71

Reichardt, A., Murawski, M., & Bick, M. (2025). The use of the Internet of Things to increase energy efficiency in manufacturing industries. *International Journal of Energy Sector Management*, *19*(2), 369–388. https://doi.org/10.1108/IJESM-12-2023-0017

Sharma, V., Raut, R. D., Hajiaghaei-Keshteli, M., Narkhede, B. E., Gokhale, R., & Priyadarshinee, P. (2022). Mediating effect of industry 4.0 technologies on the supply chain management practices and supply chain performance. *Journal of Environmental Management*, *322*, 115945. https://doi.org/https://doi.org/10.1016/j.jenvman.2022.115945

Silva, F. M., Adegboye, A. R. A., Curioni, C., Gomes, F., Collins, G. S., Kac, G., Cook, J., Ismail, L. C., Page, M. J., Khandpur, N., Lamb, S., Hopewell, S., Kirtley, S., Bernardes, S., Durão, S., Vorland, C. J., Rebelo, F., Tibaes, J. R. B., Fink, J. da S., … Schlussel, M. (2026). Reporting Completeness of Systematic Reviews of Nutrition or Diet-Related Randomised Controlled Trials: A Meta-Research on Adherence to PRISMA Items. *Nutrition Reviews*. https://doi.org/10.1093/nutrit/nuaf218

Wang, S., Zhang, R., Yang, Y., Chen, J., & Yang, S. (2023). Has enterprise digital transformation facilitated the carbon performance in Industry 4.0 era? Evidence from Chinese industrial enterprises. *Computers & Industrial Engineering*, *184*, 109576. https://doi.org/https://doi.org/10.1016/j.cie.2023.109576

Winter, M., Dopler, S., Müller, J. M., & Zeisler, A. (2022). Information sharing and multi-tier supply chain management of SMEs in the context of Industry 4.0. *Procedia Computer Science*, *217*(2022), 1378–1385. https://doi.org/10.1016/j.procs.2022.12.336

Winter, M., Dopler, S., Müller, J. M., & Zeisler, A. (2023). Information sharing and multi-tier supply chain management of SMEs in the context of Industry 4.0. *Procedia Computer Science*, *217*, 1378–1385. https://doi.org/10.1016/j.procs.2022.12.336

Zhang, L., Gu, F., & He, M. (2024). The Influence of Digital Transformation on the Reconfigurability and Performance of Supply Chains: A Study of the Electronic, Machinery, and Home Appliance Manufacturing Industries in China. *Sustainability (Switzerland)*, *16*(7). https://doi.org/10.3390/su16072689

Zhang, S., Yu, Q., Wan, S., Cao, H., & Huang, Y. (2024). Digital supply chain: literature review of seven related technologies. *Manufacturing Review*, *11*, 8. https://doi.org/10.1051/mfreview/2024006