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Digital transformation and sustainable supply chain performance: A systematic literature review

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Abstract

This study conducts a systematic literature review (SLR) of scholarly work at the intersection of digital transformation and sustainability, focusing on peer-reviewed publications indexed in Scopus between 2020 and 2025. The review is motivated by a surge in digital adoption during the COVID-19 pandemic, which accelerated organisational shifts toward remote work, e-commerce, and digital operations that has reshaped sustainability across sectors. Using PRISMA guidelines, a total of 625 articles were analysed, revealing six thematic clusters. Findings demonstrate that digital transformation is not only a technological upgrade but a strategic enabler for sustainable performance. Key competencies, such as digital literacy, organisational agility, and sustainability-oriented leadership, emerge as critical factors for successful implementation. Furthermore, the review highlights how environmental uncertainties such as pandemics, climate change, and regulatory pressures act as catalysts for digital transformation in supply chains. This study contributes to the literature by mapping key trends, gaps, and future research directions. It also provides recommendations to businesses on how they can leverage digital technologies to support sustainability objectives.

Keywords: Digital Transformation; Supply Chains; Sustainability; Systematic Literature Review; PRISMA

1. Introduction

The digital economy has fundamentally reshaped the global landscape of commerce, supply chains, and business models. The rise of the digital economy has created new pressures and opportunities, prompting entrepreneurs to migrate toward digital transformation. The term “digital transformation” can be referred to the integration of digital technologies into business processes (Rêgo et al., 2024). These digital technologies include social media, artificial intelligence, big data analytics, cloud computing, internet-of-things (IoT), smart devices and many more. By embedding digital technologies into their business processes, firms can position themselves to effectively participate in, and benefit from, the dynamics of the digital economy (Yang & Lin, 2025). The COVID-19 pandemic served as a critical accelerant for digital transformation among businesses. Globally, digital adoption shifted from a strategic option to a survival mechanism. In China, entrepreneurs including those involve in agricultural production turned to e-commerce and social media platforms to

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maintain sales during lockdowns (Cao et al., 2024). In Malaysia, food operators rapidly integrated online delivery platforms into their business processes such as GrabFood and FoodPanda to sustain operations (Jahari et al., 2022; Kee et al., 2025).). These examples demonstrate how digital transformation at the firm level allows businesses to remain resilient. At the macro level, the pandemic compressed years of digital economic transition into just a few months. Remote work, e-commerce, and digital payments quickly became embedded as everyday practices, reinforcing the centrality of digitalisation in modern economies.

The digital transformation, however, is not only benefit firms in terms of economic sustainability. It has also facilitated firms in achieving social and environmental sustainability across supply chains. The integration of digital technologies in supply chains, for example, allows them to collaboratively monitor carbon emissions, optimising energy utilization, and supporting circular production systems. AI-powered models can be used to forecast energy demand and carbon emissions, detect process anomalies, and facilitate predictive maintenance, equipping firms with the insight necessary for proactive management of sustainability risks (Uddin, 2024; Ameh, 2024). Notwithstanding this, digital technologies such as artificial intelligence and robotics can be used to continuously monitor workplace conditions and occupational hazards, strengthening health and safety standards. Such applications not only enhance efficiency but also foster sustainable supply chains holistically. Literature, therefore, seems to acknowledge that digital transformation and sustainability are not independent phenomena but deeply interconnected. Digital technologies such as artificial intelligence, blockchain, and the Internet of Things (IoT) are being deployed to monitor carbon emissions, optimize energy consumption, and enhance social inclusion through transparent supply chains. Although the benefit of digital transformation is acknowledged, a significant number of firms are struggling with their transition. These challenges stem from various barriers which include resistance change (Abdallah et al., 2021), incompatible corporate culture (Brunetti et al., 2020), limited technological capabilities (Tian & Ou, 2024) and financial constraints (Han & Zheng, 2022). These may result in uneven sustainability outcomes across supply chains. While these studies provide insights into why firms may struggle to transition toward digital technologies, the evidence remains sparse and context specific. They examine the barriers in isolation, with particular technologies.

This study therefore is motivated by three overarching reasons. First, since the period of 2020, we have witnessed a rapid increase of studies examining digital transformation across supply chains, which is driven by COVID-19 disruptions. However, these studies are scattered across disciplines, industries, and methodological approaches, making it difficult to derive coherent insights or identify dominant research trajectories, especially within the business perspective. Second, despite the increasing literature in the digital transformation and sustainability domains, these two areas remain fragmented. Previous research tends to examine them in isolation, resulting in dispersed body of knowledge that lacks integrative synthesis. Existing studies often focus on isolated outcomes, either economic efficiency, environmental performance or social impact. This fragmented view overlooks the interconnection between the three sustainable development goals. Consequently, there is a need for an integrative review that maps how digital transformation simultaneously influences economic, environmental, and social dimensions, thereby advancing a more holistic understanding of sustainable supply chain performance. Third, there is still limited consolidated understanding of the competencies required for its successful implementation and the contextual conditions under which such transformation will effectively affect sustainable outcomes. This SLR is therefore motivated by the need to systematically identify key competencies, organisational capabilities, and uncertainty-driven triggers that shape digital sustainability outcomes, offering clearer guidance for future research and practice.

Given the above motivations, this study aims to answer the following research questions:

1) What are the key thematic clusters and research trends shaping the digital transformation–sustainability nexus in supply chains?

2) In what ways does digital transformation influence sustainable supply chain performance across the triple bottom line?
3) What technologies, capabilities, and environmental conditions facilitate effective digital transformation for sustainable supply chains?

Given the rapid growth of publications, the diversity of approaches, and the absence of consolidated knowledge, there is a pressing need for a systematic literature review (SLR). Such a review can provide clarity on how digital transformation contributes to sustainability, identify thematic clusters and research gaps, and offer structured guidance for future scholarship and practice. By synthesizing existing studies, the SLR will establish a coherent foundation for advancing both theoretical development and practical application in this emerging field.

2. Literature Review

2.1 Evolution of Digital Transformation Research

Digital transformation has evolved significantly over the past two decades. Early studies have conceptualised digital transformation as a process for digitisation and automation of business operations (Westerman et al., 2014; Fitzgerald et al., 2014), which help enhance operational efficiency, reduce costs and improve productivity. Within this early stream, digital tools are viewed as supportive tools for business operations. Subsequent research has expanded into positioning digital transformation as a strategic and organisational phenomenon. Scholars began to underscore the importance of digital transformation in reshaping business models, value creation mechanisms and inter-organisational relationships (Baiyere et al., 2020; Zoppelletto et al, 2023). Collectively, these studies provide understanding that digital transformation is a process that requires structural reconfiguration, organisational change and capability development, rather than merely implementing new technologies.

The COVID-19 pandemic has marked a critical inflection point of digital transformation evolution. It acts as a catalyst for digital transformation, pushing businesses from various industries to adopt new technologies and redesign their business models. As a result, various studies existed to examine digital transformation within a broader context in relation to resilience, economic sustainability and long-term performance (Alghamdi & Alghamdi, 2022; Arnold et al., 2021; Arora et al., 2025). As a result, digital transformation is now widely recognised as a strategic response to environmental turbulence, uncertainty, and disruption, extending its relevance beyond efficiency-driven outcomes to include sustainability and societal impact.

2.2 Digital Transformation and Sustainability

Number of studies have focused on the relationship between digital transformation and sustainability, highlighting the potentials of emerging technologies such as artificial intelligence, big data analytics, blockchain and internet of things (IoT) to support environmental, economic and social objectives (Mohaghegh et al., 2025; Li, 2022). It enables real-time monitoring of carbon emissions, improve tracking and traceability and enhance data-driven decision-making. In the EU countries, digital sustainability is also linked to economic impact through its ability in facilitating the acquisition of green knowledge, eco-friendly innovation and resource allocation efficiency (Wu & Li, 2023).

Beyond environmental benefits, digital transformation has also been associated with social sustainability outcomes. It has been able to transform various aspects of humanity. It addresses global social issues namely disparities in education, healthcare services and income inequality (Wang et al., 2023). As compared to economic and environmental, the impact of digital transformation on social sustainability remains underexplored.

While the positive relationship between digital transformation and sustainability is acknowledged in the

literature, there are also several studies that noted the negative impact brought by digitalisation. With diversified digital infrastructure and social economy of community across countries, not all regions are equally benefitted from digital transformation (Nosratabadi et al., 2023). The use of certain technologies such as AI which is depending on algorithms may introduce privacy concerns and potential biases, hindering the attainment of equitable social sustainability performance.

2.3 Digital Transformation in Supply Chains

The digital transformation extends beyond organisational operations and has been reflected in supply chain performance. First, since supply chains involve various stakeholders along the network, coordination is important to ensure smoothness of activities and processes. This coordination is powered by information sharing, in which digital transformation plays a role (Liu & Chi, 2024). Through digital transformation, technologies such as IoT, blockchain, AI and data analytics are integrated to enhance transparency, improve traceability and facilitate real-time monitoring (Tavana et al., 2022). Several studies have also investigated the challenges of digital transformation in supply chains. They highlight common challenges namely technological complexity, lack of digital skills, cybersecurity risk issues and high capital investment (Bruneeti et al., 2020). The successive way of the transformation is depending on organisational culture and top management support (Favoretto et al., 2022). Using Scientometric-Thematic literature review, Tubis et al. (2023) suggests future studies to focus on sustainability, resilience, and sector-specific insights to further optimise supply chain management.

3. Methodology

This paper conducted a systematic review of literature that is related to digital transformation and sustainable supply chains. The aims of this systematic literature review are to explore the key insights of research trends that intersect between digital transformation and sustainability supply chains, how digital transformation impact sustainable supply chain performance and the technologies, capabilities, and environmental conditions required for such transformation. In this study, we followed the Preferred Reporting Items for Systematic Reviews (PRISMA) approach to ensure transparency, rigour and reproducibility in identifying, screening and selecting relevant studies (Liberati et al., 2009). A review protocol describing how the articles were sought, selected, extracted and analysed was developed.

3.1 Data Sources and Search Strategies

In this study, Scopus was used as the database source. This database was selected as it serves as the largest database of abstracts, providing a broad coverage in various fields (Marikyan et al., 2019). Only peer-reviewed articles, written in English was included. We focus on the articles published in the area of business, management and accounting. Search string employed was digital transformation" OR "digitalization") AND ("supply chain" OR "logistics" OR "distribution" OR "procurement") AND ("sustainability" OR "sustainable" OR "eco-friendly" OR "green") AND ("performance" OR "efficiency" OR "effectiveness" OR "productivity"). Boolean operators and truncations were used to increase coverage. Only articles published within 2020 to 2025 are included, to capture the most recent developments in digital transformation and AI-enabled organisational practices. The year 2020 also represents a structural break owing to the COVID-19 pandemic which has driven rapid digital deployment and heightened ESG and sustainability reporting. For the purpose of academic rigour, conference papers, book chapters and non-academic publications were excluded.

3.2 Selection of Studies

Titles and abstracts of the selected articles were reviewed by two researchers. Based on the abovementioned criteria, the paper eligibility was determined. For final inclusion, the full text of the articles was reviewed. Digital transformation studies that did not address the sustainability outcomes directly (e.g., purely technical DT without sustainability implications were excluded, as they fell outside the defined research scope.

3.3 Data Extraction and Quality Assessment

Data extracted from each study were exported to Excel and recorded in an evidence table. Duplicate entries were also removed. Data extraction and quality assessment were conducted by two researchers independently to minimise errors.

3.4 Eligibility Criteria

The selection of the articles to review was conducted in three rounds. In the first rounds, the title and abstracts were screened by two researchers. In the second round, the selection criteria were established according to the research questions, and the results were organised in a table form. Studies without full text, insufficient methodological details and lack of clear focus were eliminated. In the third round, a single researcher read and integrated all results into a single document.

3.5 Final Study Selection

Upon the eligibility assessment, 625 articles were retained for final analysis. They make up the final dataset used for synthesis and thematic analysis. The overall article selection process including identification, screening, eligibility, and inclusion are summarized using a PRISMA flow diagram.

Search Terms:
digital transformation" OR "digitalization") AND ("supply chain" OR "logistics" OR "distribution" OR "procurement") AND ("sustainability" OR "sustainable" OR "eco-friendly" OR "green") AND ("performance" OR "efficiency" OR "effectiveness" OR "productivity")

Selection Criteria:
Year: 2020-2025
Type of Documents: Articles
Language: English
Scopus Categories: Business, Management and Accounting

Excluded Articles
Non-English Publication
Articles not addressing sustainability outcomes directly (e.g., purely technical DT without sustainability implications

Inclusion Criteria
Peer-reviewed journal articles
Published in English.
Focused on the role of digital transformation (or related technologies) in supporting sustainability across environmental, social, or economic dimensions.

Selected for Analysis
625

Figure 1: Stages of the systematic search process

Figure 2 illustrates a year-by-year progression from 2020 to 2025. The year 2020 was chosen as the starting point because it represents a paradigm shift in both digital adoption and sustainability discourse. The COVID-19 pandemic forced organisations worldwide to pivot to digital platforms, e-commerce, and remote operations, thereby increasing interest in understanding how digitalisation intersects with sustainability goals (Farfán Chilicaus et al., 2025; Parker et al., 2023).

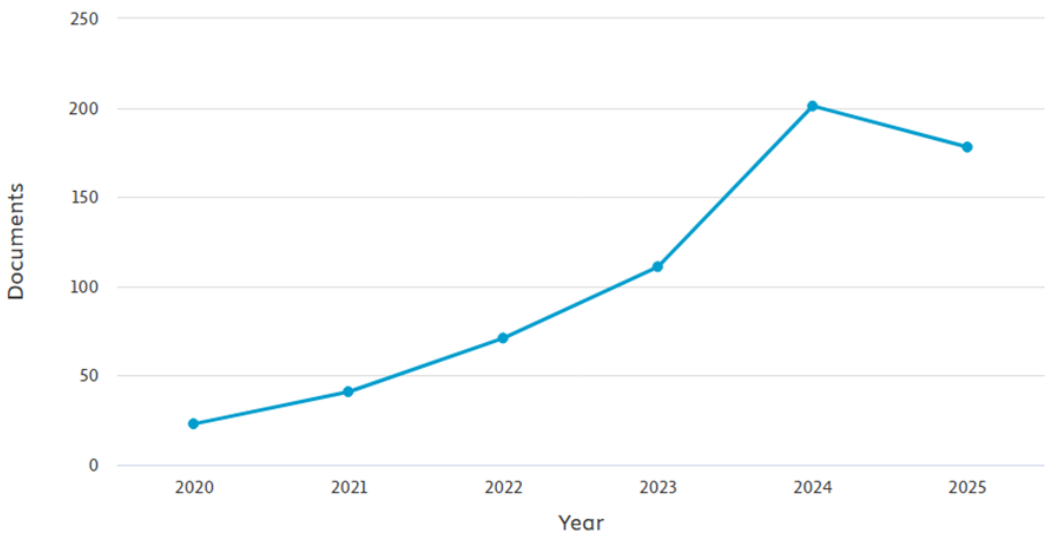

Figure 2: Documents Published by Year

It begins with fewer than 50 publications, likely reflecting the early stage of research interest in the digital-sustainability nexus. Prior to the year 2020, the discussions on digital transformation were often limited within the field of technology and business innovations, while sustainability was largely framed within environmental or social responsibility domains. The nexus between the two had not yet gained strong momentum in academic discourse. However, the emergence of the COVID-19 pandemic abruptly altered the trajectory. As countries implemented lockdowns and movement restrictions, businesses, governments, and individuals were compelled to adopt digital technologies at scale and speed (Reuschl et al., 2022). Physical stores closed, but online platforms thrived. Traditional supply chains were disrupted, but digital logistics and contactless delivery flourished. Schools, offices, and hospitals shifted online almost overnight. This sudden global shock created new questions and research gaps at the intersection of technology, resilience, and sustainability. Thus, it is not surprising that there was a growing trend of literature that focused on how digital transformation is related to sustainable supply chains. The year 2024 marks a breakthrough year in research output, with over 220 publications, the highest in the review period. This surge reflects the maturing of digital transformation research, especially its integration with sustainability concerns. By this time, scholars had shifted from conceptual debates to empirical, sector-specific studies spanning manufacturing, supply chains, smart cities, and energy. The rise was also driven by increased international collaboration, greater availability of open datasets and digital tools, and stronger institutional support for digital sustainability research. Although a decline in 2025 publication count is noted, this is likely due to delays in indexing, shifts toward more rigorous or niche research, and data retrieval timing. Rather than reflecting a drop in interest, it suggests the field is maturing and evolving into more specialised, theory-driven directions. Digital sustainability research may be splintering into more specialised domains such as carbon accounting, digital ethics, or regenerative design leading to a dispersion of publications across adjacent categories that may not have been captured under the same keyword sets.

4. Results

In this section, the results found through the aforementioned systematic revision process are organised according to the research questions that guided our search and analysis.

4.1 What are the key thematic clusters and research trends shaping the digital transformation–sustainability nexus in supply chains?

After carefully analysing the articles based on the selected criteria in the database, we extracted relevant data namely the keywords, type of research, objectives and conclusions. Based on this information, we then conducted clusters analysis to identify themes and categories. As a result, we identified five distinct groups according to their main contributions.

Group 1: Sustainable Development

In this group, the studies look at digital transformation and its importance in achieving sustainable development goals. Articles in this domain specifically touch on how the digital transformation in supply chain operations would be able to support SDG 8 (decent work and economic growth). Research in this stream typically associates digital technologies with economic growth, in which they examine how digital platforms could drive entrepreneurships, gig works and contribute to inclusive economic participation (Nguyen et al., 2023; Kumar et al., 2024).

Group 2: Triple Bottom Line

In relating to Sustainable Development Goals, there are also studies that used triple bottom lines (TBL) as the lens in exploring the impact of digital transformation in supply chains on sustainable performance. In this cluster, digital transformation is understood not simply as a mechanism to boost productivity or efficiency, but as having multi-dimensional impacts across the TBL which includes economic, social, and environmental sustainability. Studies are found to examine the impact of digital tools on economic resilience (Putritamara et al., 2023), resource optimization (Reza et al., 2025), environmental (Machado et al., 2024) and social outcomes such as workplace safety and employment conditions (Casciani et al., 2022; Liu & Chi, 2024)

Group 3: Identification of Competencies

The third cluster focuses on the competencies and capabilities required to support digital transformation. Studies in this area highlight the pertinent role of human capital, technological literacy, organisational agility, and sustainability-oriented leadership as core competencies required for success (Hariyani, 2025; Zhang et al., 2022). They emphasise that digital transformation not only relies on technology per se, yet also on human capital development and organisational readiness.

Group 4: Technology-Enabled Sustainability in Supply Chains

In this group, studies (Mousa et al., 2025; Zhang et al., 2024; Jum'a et al., 2025) examin the various advanced digital technologies, such as blockchain, big data analytics and the Internet of Things (IoT). Research in this stream analyses the impact of combined technology deployment to support real-time data collection, traceability and process optimization across supply chain activities.

Group 5: Environmental Uncertainties as Driver

The final cluster of research indicates environmental uncertainties as key driver of digital transformation. Studies in this area (Ning & Yao, 2023). Investigate how disruptions emerging from pandemics, regulatory changes geopolitical turmoil and climate change act as a catalyst for digital transformation. This stream of research posits digital transformation as a strategic mechanism used to enhance responsiveness towards environmental risks.

4.2 In what ways does digital transformation influence sustainable supply chain performance across the triple bottom line?

Following the mapping of the research trends, the next step in this analysis is to investigate and map the impact of digital transformation on sustainable performance across the triple bottom line. Generally, the studies included in the analysis do agree that digital transformation significantly impacts sustainable supply chain performance through economic, environmental and social dimensions, which in collectively known as the triple bottom line.

First, through the reviewed studies, digital transformation is consistently linked to better economic performance. Several studies (Nazir et al., 2025; Liu & Chi, 2024) highlight that digital transformation allows data-driven decision making. Through the adoption of predictive and prescriptive analytics, firms can optimise production planning, logistics routing, inventory and demand management. This will lead to improved productivity and service levels. There are also studies that emphasise the role integration as mediator between the digital transformation and sustainable supply chains. For example, Türkeş (2025) indicates that digitalisation alone may not be sufficient to attain economic performance, without process integration and assimilation. Similarly, in the context of Romanian, digital transformation has to be coupled up with process integration, cross departmental and organisational communication and learning capability. In this manner, the advancement of technologies such as IoT and cloud-based computing facilitates in supply chain transparency and seamless integration, leading to efficient process flow, cost reduction and productivity enhancement. In another study conducted in Netherland (Mohaghegh et al., 2023), it is found that the direction from digital transformation to sustainable supply chain performance is mediated by supply chain agility and supply chain alignment. The adoption of digital technologies helps businesses to establish a more robust and flexible process, which is susceptible to interruptions and defects. Similar findings were also reported in the Chinese context (Zhou et al., 2023). In a turbulent environment, businesses are required to process large amounts of data to maintain agility. Thus, technologies play a critical role in this process, allowing them to sense and respond to any environmental changes effectively. These findings are based mainly on resource orchestration, resource-based and dynamic capabilities theories, where organisations need to be able to reconfigure the digital technologies adopted to attain the positive outcomes.

Second, the review further emphasises the role of digital transformation in enhancing environmental sustainability of a supply chain (De La Calle et al., 2021; Sun et al., 2024; Meng et al., 2025). They found that the use of digital tools such as IoT and big data analytics facilitate real-time monitoring of resource consumption, carbon emission and waste generation along the supply chain. Additionally, digital transformation is also linked to circular economic practices. As transition to circular economy requires coordination with suppliers, customers, internal departments and stakeholders, digital tools are critical to support the integration. Without the digital tools, firms would have difficulties in tracking and tracing due to lack of real-time data sharing.

Unlike traditional supply chains, which often operate with fragmented data, limited visibility, and reactive decision-making, digitalisation enables real-time monitoring, predictive planning, and integrated coordination

across all supply chain stages (Karuppiah et al., 2024). This represents a transformative shift in supply chain management that enhances operational efficiency and supports long-term sustainability.

Third, the systematic review also revealed the social impact of digital transformation on sustainable supply chain performance, although the coverage is not as intensive as economic and environmental dimensions. Emerging evidence suggests that digital transformation supports better monitoring of labour conditions, supplier compliance and ethical sourcing practices (Casciani et al., 2022; Liu et al., 2023). There are also studies that indicate the role of digital transformation in promoting workplace safety. For example, Ghobakhloo et al. (2025) provides evidence of how automation of hazardous tasks is possible with digital transformation especially in manufacturing industries. Nevertheless, digital transformation also raises concerns on new inequalities through digital divides, job displacement, concentration of power within digital platforms (Nosratabadi et al.,2023) and data privacy (Zheng & Walcham, 2021).

4.3 What technologies, capabilities, and environmental conditions facilitate effective digital transformation for sustainable supply chains?

The systematic review highlights that effective digital transformation that is translated into sustainable supply chain performance requires a combination of enabling technologies, organisational capabilities and supportive environmental conditions.

Across the reviewed literature, several studies focusing on digital technologies stress the need for integrating advanced technologies such as IoT, blockchain, artificial intelligence and big data analytics, which enhance organisational capabilities namely operational agility and transparency (Schöggl et al., 2023; Hamedani et al., 2025). Real-time information sharing, which is powered by IoT helps in tracking waste and emissions, equipment conditions and logistics movement improving supply chain operation visibility. From the literature reviewed, it can be deduced that the technologies employed need to possess characteristics that allow for real-time data capture, supply chain integration and advanced analytics. This means that standalone technologies such as ERP systems that lack the characteristics play a limited role in enabling sustainable supply chain performance.

In addition to technology, the review has also identified several organisational capabilities as a crucial driver for digital transformation. First, the literature indicates the importance of digital leadership and culture (Chen et al., 2024). This is not surprising, as organisations are moving towards digitalisation, they experience various complexities and challenges, which require a leader who can guide them through. Having digital leaders help ensure that the technology investments are not driven by operational automation and efficiency but align with long-term value creation. As highlighted in literature, when organisations decide to embrace digital transformation, employees may resist, hindering a smooth transition. In this manner, digital leadership mitigates the challenges by establishing clear vision, supporting training and development and legitimizing change. To further support the adoption of new technologies, cultivating a digital-oriented organisational culture is important to promote continuous learning (Alakas, 2024). Beyond digital leadership and culture, dynamic capabilities are also highlighted. These capabilities help organisations to reconfigure processes to ensure the technologies can be integrated seamlessly into the business operations. In a digitally connected supply chains, collaboration capabilities including inter-organisational trust are equally important (Hamedani et al., 2025). This is because the implementation of digital technologies needs to be spread over the supply chains for organisations to be able to share the real-time data, track and trace products, services, carbon emissions, etc. Without the collaboration capabilities organisations need to depend on the siloed information system.

The review further demonstrates external environmental conditions shape the effectiveness of digital transformation for sustainable supply chain performance. Regulatory concerns are among the prominent

challenges that organisations consider when they embrace digital transformation (Sharma et al., 2025). Since digital transformation in supply chains involves cross-organisational data flows, multi-tier supply chain integration and real-time data sharing, this is expected. As for now, the regulatory framework governing data protection and cybersecurity are sparse. As a result, firms may adopt a cautious or incremental approach to digital transformation to avoid regulatory non-compliance. This will also hamper the real-time data sharing for sustainability in scope 3. Similarly, organisations operating in a highly regulated environment will be more likely to embrace digital transformation to demonstrate their commitment in monitoring emissions and ensuring traceability. Additionally, digital transformation is also driven by environmental turbulence. The COVID-19 pandemic, for example, was recorded as a driver for a firm to accelerate their digital transformation, as a means to be more adaptable and resilient (Datta et al., 2021; Tsipoulanidis & Nanos, 2022).

5. Discussion

The topic of digital transformation in sustainable supply chains has been widely discussed in the literature. The five thematic clusters illustrate that studies on digital transformation and sustainable supply chains have evolved along multiple and interconnected dimensions, shifting from technology centric and economic perspectives towards broader considerations involving multiple dimensions of sustainable performance. The emergence of environmental uncertainty as a theme identified reflects the acknowledgement of external turbulence as a driver for digital transformation. This aligns with management literature that features digitalisation as a response to volatility and complexity.

A clear trend in the literature is the expanded lens through which digital transformation is evaluated. The evaluations have gone beyond economic performance. While economically, digital tools enhance predictive maintenance, transparency, and operational efficiency, it also led to social and environmental performance, which are important goals in today's context. Socially, they create employment and improve safety standards. Environmentally, real-time data from IoT devices enables resource optimisation, emissions tracking, and greener last-mile delivery. These findings indicate a shift from reactive environmental management toward a proactive and data-enabled sustainability strategies with the digital transformation. These multi-dimensional impacts reflect the maturation of digital sustainability thinking, moving beyond efficiency toward system-level value creation. While the positive impact of digital transformation on social is recorded, the findings should be interpreted with caution. The reviewed literature also indicates that the digital transformation can also generate unintended negative social outcomes. Reported concerns include workforce displacement, digital divides and the concentration of power among dominant platform actors. These findings suggest that the sustainability impacts of digital transformation are neither uniform nor automatic but are highly contingent on organisational capabilities, leadership, governance mechanisms, and contextual conditions.

The third research question focuses on the condition under which digital transformation would translate into sustainable supply chain performance effectively. Despite the potential of digital transformation in achieving sustainable performance, its success demands human and organisational competencies. The literature reveals that digital transformation without parallel development in digital literacy, organisational agility and supply chain integration, is unlikely to yield desired outcomes. The shift requires cross-functional collaboration, upskilling initiatives, and the dismantling of silos. This underscores the notion that digital tools are only as effective as the systems and people that deploy them. This shows that in response to the digital transformation, organisations need to have agility capabilities. They need to be able to be in a ready mode to change their business operations, strategies, skills and etc. to ensure the successful blends of digital technologies in their businesses. The impact of digital transformation also depends on the synergistic deployment of various technologies such as blockchain, big data analytics, and IoT. However, the literature

also cautions against techno-centrism, arguing that sustainability outcomes hinge on strategic alignment rather than mere technological adoption.

6. Implications and Conclusion

In summary, the discussion across the three research questions suggests that digital transformation for sustainable supply chains can be understood as a socio-technical process. Sustainability outcomes have not directly resulted from digital transformation merely. In fact, it emerges from the interaction between technological characteristics, organisational capabilities and environmental context. Figure 2 represents the conceptual framework of digital transformation and sustainable supply chain performance, as an outcome from the systematic literature review conducted.

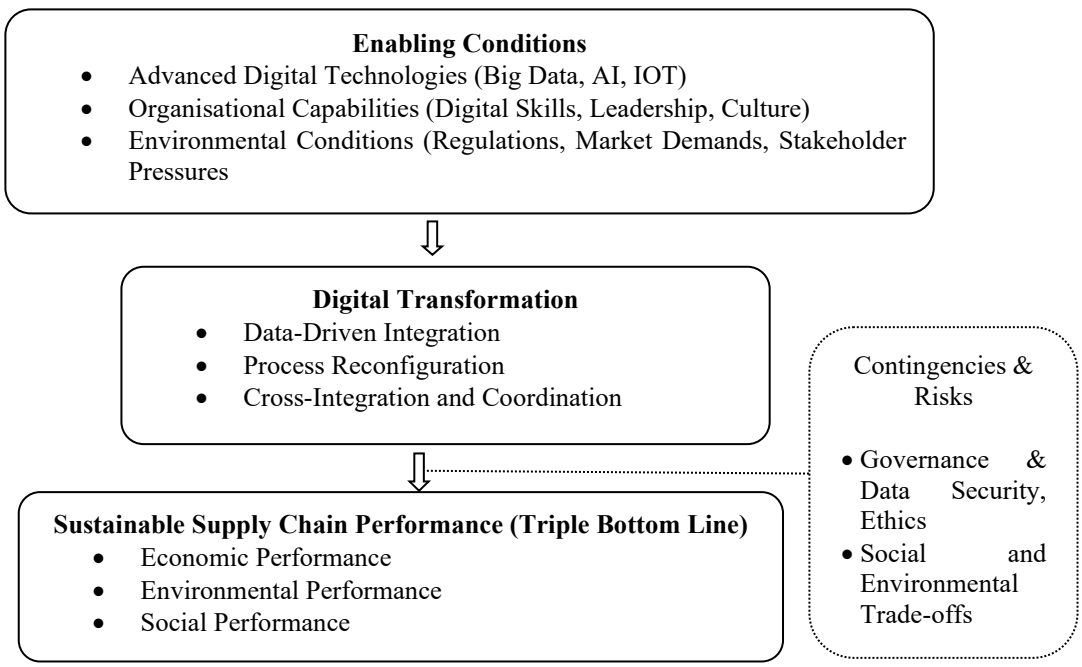

Figure 2: Conceptual Framework of Digital Transformation and Sustainable Supply Chain Performance

As indicated by Figure 2 digital transformation in sustainable supply chains is enabled by a combination of digital technologies, organisational capabilities, and environmental conditions. These components mold the extent to which digital transformation can be translated into sustainable outcomes effectively. Importantly, the framework highlights that these impacts are contingent rather than deterministic, as governance mechanisms, regulatory constraints, and implementation-related risks may moderate or constrain sustainability outcomes. This framework provides support for the relevancy of capability-based and contextual dimensions in explaining the digital transformation on sustainable supply chain performance. This highlights the need for future research to adopt more integrative framework and longitudinal approaches that capture the dynamic effects of contingency components across time.

In addition to theoretical implications, this study also carries profound implications for practice, specifically businesses who are navigating the convergence of digital transformation and sustainability. First, as the demand for sustainable performance grows and environments become volatile, firms should integrate digital tools into their business operations. Digital technologies are not only enablers of operational efficiency, but also catalysts for new business models, such as platform-based services, circular economy ventures, and digital-enabled green supply chains. They should explicitly position their digital solutions around environmental efficiency or social values which are more likely to benefit them, specifically in attracting sustainability-oriented customers, partners and investors. Since the impact of digital transformation on the sustainable supply chain performance is uneven, businesses should adopt a balanced approach. They should ensure that the digital transformation is able to deliver not only economic viability but also address environmental and social responsibilities. This may require firms to invest in employee upskilling, ethical data practices and inclusive digital access across supply chain partners. Building partnerships with technology providers, logistics partners and sustainability experts can facilitate businesses in overcoming resource constraints, thus accelerating capability development. More importantly, they should prioritise technologies that enable real-time data capture, supply chain integration and data analytics, rather than standalone or legacy systems.

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