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A systematic review of the literature on the use of information technologies in supply chain management

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Abstract

Purpose – The purpose of this study is to explore the opportunities provided by information technologies (IT) to improve supply chain processes. It aims to conduct a systematic literature review (SLR) to identify research areas that require further exploration to leverage IT and enhance supply chain performance.

Design/methodology/approach – This study employs a systematic literature review methodology to analyse a set of 177 publications, including journal papers, conference papers, periodicals, theses, and books published between 2013 and 2023. Thematic synthesis was chosen as the most appropriate approach to amalgamate the findings obtained from the systematic literature review conducted in the study. This method involves interpreting thematic information and facilitating the development of a comprehensive understanding of the literature being reviewed.

Findings – The literature review reveals that certain information technologies, such as the Internet of Things (IoT), Big Data, artificial intelligence (AI), Blockchain, information and communications technology (ICT) and information sharing, offer significant potential for improving supply chain processes. However, the application of these technologies in the field of supply chain is currently under-researched. The findings highlight the need for further exploration of these technologies and their impact on supply chain redesign and enhancement.

Originality/value – This study contributes to the existing body of knowledge by providing a systematic overview of the potential benefits of IT in the context of supply chains. It emphasises the under-researched nature of specific technologies and their potential to support organisations in improving their supply chain processes. The originality of this study lies in its comprehensive analysis of relevant literature and its identification of research gaps that need to be addressed in future studies.

Keywords Supply chain, Resilience, Agility, Vulnerability, Uncertainty, IT, AI, Digital twin, IoT, Big data, ICT, RFID, Blockchain and information system

Paper type Research paper

1. Introduction

In today's world, particularly because of all the worldwide decentralised complex networks, intricate occurrences, and volatile markets, our supply chains are extremely unstable and

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vulnerable to risks and uncertainties (Kamalahmadi and Parast, 2016). Companies are regionally expanding their market, which lengthens and complicates the supply chain in response to shorter product life cycles and customer demands (Zhu *et al.*, 2020). Managing risks and disruptions in supply chains, such as the loss of a crucial supplier, a fire accident at the manufacturing plant, or an act of terrorism, could become more challenging as a result (Pettit *et al.*, 2019).

The unexpected COVID-19 pandemic, for example, created extreme levels of disruptions in logistics and operations which have cruelly affected the production flow of organisations and multinational supply chain networks (Paul *et al.*, 2021), resulting in massive demand management and forecasting errors, making it impossible to predict upcoming events in the long-term and short-term (Ivanov, 2020; El Baz and Ruel, 2021).

To address unexpected risks, the supply chains must be designed to include event readiness, provide an efficient and effective response, and be capable of recovering to their original or even better state following the disruptive event. This is the essence of supply chain resilience (SCRes) (Adeseun *et al.*, 2018; Ponomarov and Holcomb, 2009). Likewise, businesses that can respond rapidly to process disturbances have the chance to become more stable and strengthen their market position (Sheffi and Rice, 2005).

Researchers have been exploring methods to achieve and maintain SC resilience, SC agility, and other related concepts, as they are essential for ensuring product quality and reducing cost (Linnenluecke, 2017; Scholten and Schilder, 2015). Moreover, scholars believe that collaboration between SC partners is one of the essential components of a resilient supply chain. Collaboration is seen as a crucial component for achieving supply chain agility (Sarkar *et al.*, 2020). Collaboration is the ability of two or more businesses to carry out supply chain operations in a coordinated manner to achieve common objectives. Due to intense rivalry, collaboration between corporations can be challenging (Scholten and Schilder, 2015; Al Saad *et al.*, 2023). However, the desire to collaborate within the supply chain has grown (Christopher and Peck, 2004). For this purpose, several scholars have discussed (IT) as one of the efficient tools for improving collaboration between supply chain parties, because it enables businesses to share information more quickly and accurately, reducing risk and allowing them to be better prepared for issues in the future (He *et al.*, 2021).

One of the emerging IT applications that can facilitate collaboration and information sharing in the supply chain is blockchain. Blockchain is a distributed ledger technology that records transactions in a secure and transparent way (Agrawal *et al.*, 2023). In the food supply chain, blockchain ensures the integrity of preserved foods through tamper-proof records. It addresses traceability issues by verifying the authenticity of documents without centralised authority (Singh *et al.*, 2023). This technology benefits government enterprises and consumers alike, enhancing regulatory oversight and product quality assurance (Haji, 2023).

Moreover, IT helps to enhance the organisation's visibility through the capabilities to monitor supply chain events and trends, such as the capability to monitor the flow of materials from multiple tiers of suppliers through to end-users, is one method to enhance SC vulnerability, disruption, and uncertainty (Attaran, 2020). Information sharing among supply chain members is critical to supply chain visibility (Christopher and Peck, 2004). Information technologies can significantly improve supply chain visibility by enabling faster and more cost-effective product delivery, enhancing product traceability, strengthening partner coordination, and facilitating access to flexible lines of finance. Additionally, IT can also assist in the collection of customer feedback, providing valuable insights into market trends (Attaran, 2020; Al-Talib *et al.*, 2020).

To conclude, researchers have also been exploring the use of various types of IT to improve supply chain resilience and agility. One example is the implementation of an information-sharing system, which promotes collaboration and improves visibility tactics. The recent research trends are exploring new and emerging technologies such as the Internet of Things (IoT), big data (BD) analysis, and ICT to enhance the supply chain (Yadav *et al.*, 2022). For example, the information-capturing capabilities of IoT in supply chain applications

allow companies to remotely monitor and control the location and conditions of shipments and products from production to the end customer (Verdouw *et al.*, 2013).

Despite the growing interest in IoT, BD, Radio Frequency Identification (RFID), and other related technologies, there has been limited research conducted on their application in the field of the supply chain (Gunasekaran *et al.*, 2015; Lam and Bai, 2016; Al-Talib *et al.*, 2020).

This paper aims to explore the potential benefits and challenges of applying various Information Technology (IT) tools, such as the Internet of Things (IoT), Big Data, information, and communications technology (ICT), Artificial Intelligence (AI), Digital Twin, Blockchain and information sharing, in different supply chain domains. While IT has been widely recognised as a key enabler of supply chain management, the existing literature has not sufficiently examined how these specific IT tools can be effectively integrated and utilised in supply chain contexts. Therefore, this paper contributes to the literature by providing a comprehensive review of the current state-of-the-art and identifying the research gaps and opportunities for future studies.

With the focus on the above, the following research questions have been formulated, and will be addressed throughout this study:

RQ1. What are the challenges and limitations associated with implementing ITs in the supply chain context?

RQ2. What are the implications of the use of ITs in the supply chain on organisational performance and competitiveness?

To address the research questions, this study employs a systematic literature review and searches of relevant journal articles to identify and select publications related to the review (Garza-Reyes, 2015). Additionally, the study applies existing literature on the various interactions between IT topics and the supply chain context. For practitioners, the paper provides insights into the potential benefits and challenges of implementing ITs in their supply chains.

The remainder of the article is organised as follows. The next section presents a brief literature review, followed by the steps of Systematic Literature Review (SLR), a discussion of the research methodology, and a presentation of the study findings. The paper concludes by presenting study implications, limitations, and future research directions.

2. Systematic literature review on supply chain topics and information technologies

Systematic literature review (SLR) has become a major approach for evidence-based practice (Hohenstein *et al.*, 2015). SLR is a structured methodological process that aims to provide researchers with a comprehensive understanding of a specific topic (Briner and Denyer, 2012). SLR is different from traditional reviews. It follows a set of step-by-step processes and guidelines, and it adopts replicable and clear methods.

The scientific process (Tranfield *et al.*, 2003) increases internal validity by mitigating selection bias and allows for conclusions to be drawn through a transparent and verifiable process (Booth *et al.*, 2012; Garza-Reyes, 2015; Ali *et al.*, 2017). Existing studies, as stated by Light and Pillemer (1984), are crucial for establishing the foundation for new research and serve as a valuable source of information. They argue that previous research can provide researchers with insights into the current state of the field, including identifying knowledge gaps and suggesting directions for future studies.

To enhance methodological scholarly communication regarding the body of literature on SC and information technologies, the SLR approach was adopted. Cooper *et al.* (2018) argue that it is important to be transparent about the systematic review process, particularly in

terms of the literature search and the selection of search terms and databases. This is because transparency enables readers to evaluate the quality of the review and detect any potential biases. This study follows the five-step guidelines by Garza-Reyes (2015) on conducting systematic reviews (see Figure 1).

2.1 Locating studies

Following the formulation of research scope and questions in the introduction section, the objective of this phase involved searching relevant journal articles. The goal was to identify and select publications related to the review, as referenced by Garza-Reyes (2015). We

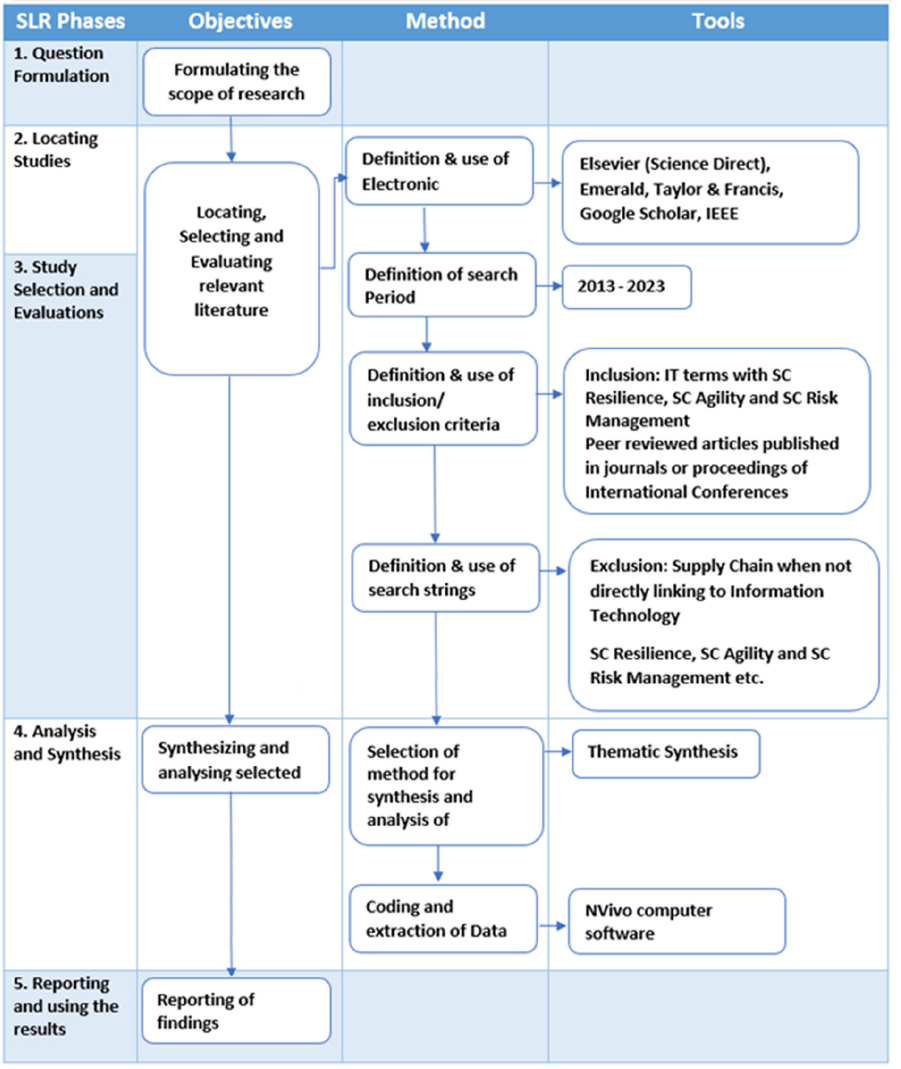


Figure 1.
A systematic literature review (SLR) phases

Source(s): Adapted from Garza-Reyes (2015)

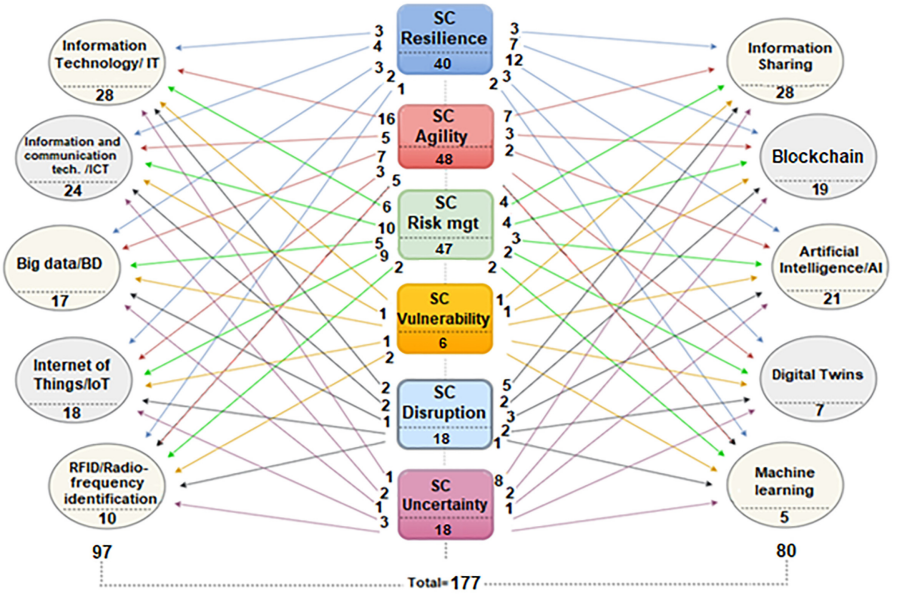
conducted searches across multiple online databases, including EBSCO, Emerald, ScienceDirect, Taylor & Francis, and Google Scholar, to minimise bias and ensure comprehensive inclusion of relevant articles.

In line with other systematic reviews on SC (Ali *et al.*, 2017), this review utilises several predefined keywords as search criteria. The keywords consisted of the phrase "supply chain" combined with the following keywords: "Resilience," "Resilient," "Agility," "Agile," "Vulnerability," "Vulnerable", "Uncertainty," "Disruption," "Risk," and "Risk management,". The selected keywords were then used to construct search strings using Boolean connectors (e.g. AND, OR) with other keywords from IT fields such as "Information technology," "IT," "Technological capability, "Internet of things," "IoT," "Big data," "BD," "ICT," "Information and communication technology," "RFID," "Radio-frequency identification," "Information sharing," "Blockchain," "Artificial Intelligence," "AI," "Digital Twins," and "Machine learning,". The year 2013 was selected as a starting point for studies till 2023.

The authors used a map, shown as Figure 2 in the study to showcase their search findings. This map illustrates how many articles were discovered for each pair of keywords, depending on the specific keywords used in the search. To make sense of the information presented in Figure 2, let's break it down.

The number 3 next to "SC resilience" indicates the quantity of papers that focused on how information technology (IT) impacts the resilience of supply chains. Additionally, the number 28 represents the papers selected to investigate how IT can be applied to various aspects of supply chain management. This pattern holds true for all the keyword combinations displayed in the map. In total, we examined 177 papers during this stage of the review process.

2.1.1 Descriptive analysis. This section describes a finding from a research study related to the number of published journal articles in recent years. According to the findings, there has



Source(s): Authors' own creation

Figure 2.
Keyword map

been an increasing trend in the number of published journal articles, and most of the selected papers (approximately 78%) were published between 2018 and 2023. This suggests that there has been a significant amount of research activity in the field during this period.

This development proves that research on SC topics and IT will continue to increase. It is becoming more important to firms' competitiveness, and it can enhance the operational performance of organisations (Pereira *et al.*, 2014; Scholten *et al.*, 2019). The significance of and growing interest in this research topic highlights the need to expand the research in this area. Most of these papers are journal publications, which means researchers may want to highlight the importance of these studies (Freyne *et al.*, 2010; Garza-Reyes, 2015). Figure 3 below presents infographics of the descriptive analysis.

2.2 Study selection and evaluation

To ensure clarity and transparency, we meticulously employed a clear and structured methodology during this phase to evaluate the relevance of studies in addressing our review question. Our approach was grounded in established criteria, as outlined by Denyer and Tranfield (2009), Booth *et al.* (2012), and Ali *et al.* (2017) in the existing literature.

The review process served as a quality indicator, enabling us to assess both the conceptual and methodological accuracy of each study. Our initial step involved a systematic search across multiple databases, utilising predefined keywords spanning the period from 2013 to 2023. To be included in the review, an article had to contain the phrase "supply chain" and at least one additional keyword from the list provided in the "locating studies" section.

Following this rigorous screening process, we identified a preliminary sample of 177 articles. These articles were subjected to further analysis using a transparent and robust methodology. By adopting this approach, we aimed to enhance the credibility and reliability of our findings.

The next step was to read the titles and abstracts of each paper to determine their relevance to the main topic. Articles that appeared irrelevant to the research questions were excluded, as were any duplicates. To be included in the review, journal articles had to demonstrate a clear focus on the supply chain (SC) and the purpose of this study.

In total, 96 papers were identified. Out of these, 76 were included in the reading and screening process. Each article was thoroughly read and analysed to determine if it met the criteria and addressed the review questions. As a result of the quality screening, 27 articles were eliminated, leaving 49 articles for the final review process. This process is summarised in Figure 4.

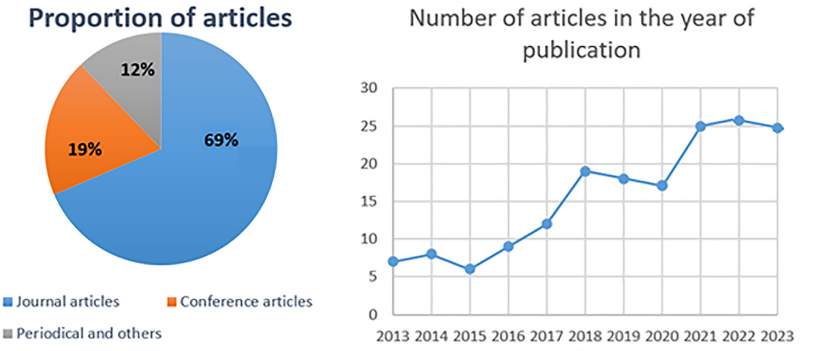


Figure 3.
Descriptive data- (a) Proportion of journals, conferences, etc., (b) Year of publication

Source(s): Authors' own creation

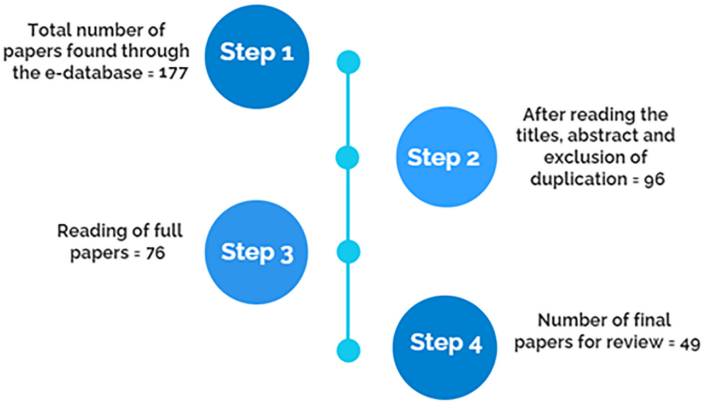


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Figure 4. Summary of the systematic review process

2.3 Analysis and synthesis

In this phase, we conducted a comprehensive analysis and evaluation of the 49 selected articles. Our objective was to generate novel insights and identify areas that lacked clarity, which could not be sufficiently addressed through individual article readings. To achieve this, we drew upon established literature by Denyer and Tranfield (2009) and Hohenstein *et al.* (2015). The resulting synthesis was designed to be relevant to the research questions and associated issues that emerged throughout our process. We incorporated insights from Rousseau *et al.* (2008) and Hohenstein *et al.* (2015) to ensure alignment with our research objectives. For combining the findings obtained from our systematic literature review, we employed a synthesis analysis approach. This method, consistent with the analytical framework used by Ceulemans *et al.* (2015) and Garza-Reyes (2015), allowed us to integrate diverse perspectives and enhance the overall rigour of our study.

Various methodologies exist in scholarly literature for the synthesis and analysis of qualitative data, including qualitative meta-summary, meta-ethnography, qualitative meta-analysis, grounded theory, content analysis, and thematic synthesis (Bearman and Dawson, 2013; Nye *et al.*, 2016). Given that thematic synthesis offers a structured approach to interpreting thematic information and facilitates the development of a comprehensive perspective on the literature under review, the decision was made to employ the thematic synthesis method in this research endeavour (Morton *et al.*, 2010). The effectiveness of the thematic synthesis method has also been demonstrated in analogous studies, enabling the extraction of significant thematic details during systematic reviews of management integration literature (Garza-Reyes, 2015).

Most of the articles elucidate how Information Technology (IT), its components, devices, and infrastructure, contribute to enhancing the preparedness of the supply chain (SC) in managing unforeseen risks through inter-organisational collaboration (Colicchia *et al.*, 2019). These collaborations rely on information-sharing systems to facilitate communication, resulting in a more resilient and adaptable SC (Yang *et al.*, 2022).

The 49 selected articles were categorised into five distinct groups: Supply chain disruption, Supply chain uncertainty, Supply chain risk, Supply chain agility, and Supply chain resilience. Figure 5 provides an overview of this categorisation, along with references to articles discussing the integration of IT within the SC context.

Subsequent sections within Figure 5 will provide an in-depth exploration of the articles concerning the application of IT technologies within the domain of supply chain

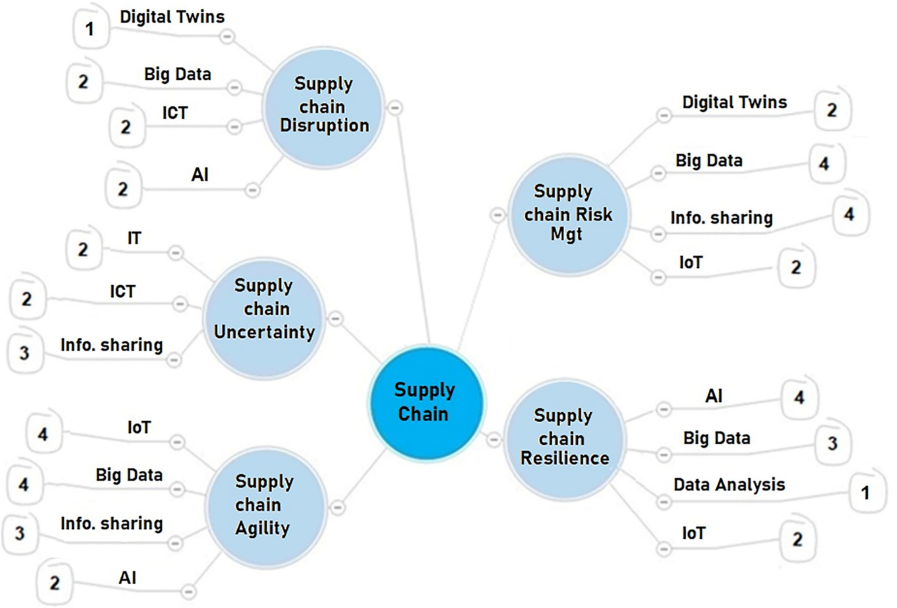

Figure 5.
Explore the dimensions in the selected articles on the topic of supply chain

Source(s): Authors' own creation

management. Furthermore, for clarification regarding the numerical data within this figure, it is important to note that the number 4 represents the specific count of papers that have been singled out for further comprehensive analysis and evaluation within the field of artificial intelligence (AI) and supply chain (SC) resilience.

2.4 Reporting and using the results

This section will focus on and analyse supply chain resilience articles that are illustrated in Figure 5.

2.4.1 Supply chain disruption. Information technologies enhance supply chain disruption management by providing real-time insights, automating processes, improving communication, and enabling predictive capabilities (Aljohani, 2023.). It equips companies with the tools and information needed to proactively respond to disruptions, minimise their impact, and build more resilient supply chains (Modgil *et al.*, 2022). Table 1 explains the impact of Digital Twin, Big Data, ICT, and AI on SC disruption.

2.4.2 Supply chain uncertainty. Information technologies enhance supply chain uncertainty management by providing real-time data and insights, enabling better demand forecasting, improving risk assessment, and enhancing overall supply chain visibility and agility. Table 2 explains the impact of Digital Twin, IT, ICT, and Information sharing on SC uncertainty.

2.4.3 Supply chain agility. Information technologies enable businesses to respond promptly to disruptions ensuring that their supply chains continue to operate through improved visibility, collaboration, automation, and resilience. At the end enhancing supply chain agility. Table 3 explains the impact of Big Data, Information sharing, IoT, and AI on SC Agility.

• Digital twin	Digital twins are a way of creating digital copies of physical things, such as products, processes, or systems, which can help manage supply chain disruptions. They can show how the supply chain works and where the problems are, and they can also evaluate different solutions and see how they affect the supply chain performance. They can use data and algorithms to suggest the best actions to take, and they can also help different people in the supply chain work together and share information	Badakhshan and Ball (2023)
• Big data	Big Data analytics is essential in modern supply chain operations, enhancing disruption management by providing data-driven insights, enabling initiative-taking measures, and improving overall agility and resilience. Organisations can use Big Data to predict and prevent disruptions, identify patterns, forecast demand, optimise processes, and enhance operational efficiency in supply chain management	Wamba *et al.* (2020), Anshari *et al.* (2019)
• ICT	ICT plays a critical role in supporting and enhancing supply chain disruption management. It facilitates real-time communication and collaboration among supply chain partners, allowing for swift response to disruptions. ICT tools enable data sharing and visibility across the supply chain, aiding in identifying disruptions early and making informed decisions	Shiralkar *et al.* (2021), Moons *et al.* (2019)
• AI	Artificial Intelligence (AI) offers substantial support and enhancement to supply chain disruption management. AI-powered technologies, such as machine learning and predictive analytics, enable the early detection of disruptions by analysing vast datasets for patterns and anomalies. This allows for initiative-taking decision-making and risk mitigation. By using AI to predict disruptions, optimise inventory levels, reroute shipments, automate tasks, and improve communication, businesses can reduce the risk of disruptions and minimise their impact	Belhadi *et al.* (2021), Akhtar *et al.* (2023)

Source(s): Authors' own creation

Table 1. Information technologies impact on SC disruption

2.4.4 Supply chain risk management. Information technologies improve supply chain risk management through real-time data, predictive analytics, visibility, automation, communication, scenario planning, and resilience strategies. It enables early risk detection, efficient risk response, and enhanced communication among supply chain partners. Table 4 explains the impact of Digital Twin, Big Data, Information sharing and IoT on SC Risk Management.

2.4.5 Supply chain resilience. Information technology enhances supply chain resilience by providing real-time data, predictive analytics, automation, and communication tools. It enables rapid response to disruptions, scenario planning, and the development of resilient strategies. Technology also improves visibility, by improving visibility, collaboration, automation, and resilience, technology can help businesses respond quickly to disruptions and keep their supply chains running smoothly. Table 5 explains the impact of AI, Big data, Blockchain and IoT on SC Resilience.

3. Discussion

In this section, the theoretical implications, practical implications, and potential research avenues are uncovered through this research on the opportunities provided by information technologies (ITs) in improving supply chain processes.

• IT	IT plays a crucial role in enhancing supply chain uncertainty management according to the literature. By providing real-time data sharing, better visibility, and efficient collaboration, IT enables organisations to respond swiftly to unforeseen events. It also aids in accurate inventory tracking and demand forecasting, ultimately reducing uncertainty in supply chain operations	Verdouw *et al.* (2016), Pereira *et al.* (2017)
• ICT	ICT provides real-time data sharing and communication capabilities that enable supply chain stakeholders to respond promptly to unforeseen events and fluctuations in demand. Through advanced tracking and monitoring systems, ICT enhances supply chain visibility, allowing for better tracking of inventory levels, order status, and transportation. Moreover, ICT facilitates effective collaboration among supply chain partners, enabling the quick exchange of information and coordination in response to uncertainties	Chen *et al.* (2019), Mirkovski *et al.* (2016)
• Information sharing	Information sharing has been recognised in the literature as a vital mechanism for addressing supply chain uncertainty. Through effective information sharing among supply chain partners, organisations can improve their visibility into demand patterns, inventory levels, and potential disruptions. This heightened transparency enables quicker decision-making and more agile responses to uncertainties, leading to enhanced supply chain performance and resilience in an uncertain environment	Butt (2021), Wang *et al.* (2020), Hu (2022)

Table 2. Information technologies impact on SC uncertainty

Source(s): Authors' own creation

3.1 Theoretical implications

The theoretical implications of this study support the findings of other similar studies. A study by Nozari and Nahr (2022) identified ten research hot topics in IT-based supply chain management, including IoT, Big Data, cloud computing, blockchain, and artificial intelligence. Another literature review by Dolgui and Ivanov (2022) listed the impacts of IT on SCM, such as enhancing efficiency, visibility, collaboration, flexibility, and sustainability. A recent article by Maheshwari *et al.* (2021) also showed a positive association between Big Data Analytics and supply chain management.

Supply chains are dynamic systems with numerous moving parts, and it can be challenging to keep track of and understand all the relationships and interactions between different components (Ramos *et al.*, 2021). AI and digital twins can assist us in developing more accurate and comprehensive supply chain models, which can then be used to enhance our understanding of their functionality and optimise them (Dubey *et al.*, 2022; Badakhshan and Ball, 2023). As well, Blockchain enhances supply chain resilience through transparent, traceable, and decentralised ledgers, fostering trust and cooperation. Its decentralised nature prevents single points of failure, streamlining processes and enabling efficient collaboration to navigate disruptions (SadeghZadeh *et al.*, 2023).

The increasing acknowledgement of the importance of IT in supply chain management aligns with numerous studies that have highlighted the transformative potential of these technologies. For instance, Al-Talib *et al.* (2023) emphasised the increasing role of IoT in enhancing supply chain velocity, adaptability, and information sharing, while Seyedan and Mafakheri (2020) discussed the utilisation of big data analytics in improving demand forecasting accuracy. The findings of this study corroborate previous research, further solidifying the consensus regarding the positive impact of ITs on supply chain operations and resilience (Lohmer *et al.*, 2020; Bag *et al.*, 2021).

• IoT	IoT contributes to and improves the agility of the supply chain through features such as real-time visibility, data-driven insights, and automation. Employing lot sensors enables the tracking of goods' location, condition, and movement within the supply chain, facilitating swift responses to disruptions, better inventory management, and enhanced decision-making. Furthermore, IoT supports task automation, such as delivery scheduling and equipment monitoring, resulting in resource optimisation and increased operational efficiency	Gupta and Singh (2022), Sarkar *et al.* (2020), Nozari and Nahr (2022), Tan and Sidhu (2022)
• Big data	Big data supports and enhances supply chain agility by providing real- time insights from vast data sets. Through advanced analytics, organisations can respond rapidly to changing market conditions, optimise inventory, and make informed decisions. Big data's predictive capabilities enable proactive problem-solving, reducing lead times and enhancing supply chain	Maheshwari *et al.* (2021), Dolgui and Ivanov (2022), Tavera Romero *et al.* (2021)
• Information sharing	Information sharing is a crucial aspect of managing supply chain agility. Sharing By communicating with each other quickly and effectively, organisations can better respond to potential disruptions or changes in demand. Various communication channels keep companies in touch with their customers or suppliers and keep them informed about any possible disruptions or changes in the supply chain	Hu (2022), Ramos *et al.* (2021), Kim and Chai (2017)
• AI	AI can support and enhance supply chain agility by using data and algorithms to improve the visibility, prediction, and adaptation of supply chains to various sources of uncertainty and change. AI can help monitor and analyse the supply chain performance and environment, simulate, and evaluate different scenarios and solutions, generate recommendations, optimise decisions, and facilitate collaboration and communication among supply chain stakeholders	Dubey *et al.* (2022), Wong *et al.* (2022)

Source(s): Authors' own creation

Table 3. Information technologies impact on SC agility

Moreover, the study's identification of research gaps aligns with the calls for further investigation and exploration of the opportunities presented by information technologies in supply chain redesign and enhancement. Prior studies by Gupta and Singh (2022) and Yadav *et al.* (2022) have also indicated the need for more comprehensive research efforts to fully understand the integration challenges and strategic implications of these technologies in supply chains. Thus, the present study recognises these research gaps, which aligns with previous literature and reaffirms the importance of ongoing scholarly exploration (Munir *et al.*, 2020; Katsaliaki *et al.*, 2021).

Finally, the emphasis on information sharing and the transformative impact of IT on supply chain processes aligns with studies that highlight the role of collaboration and

• Digital twin	Digital twins are virtual representations of physical objects, processes, or systems that enable simulation, monitoring, and optimisation. In supply chain risk management, they offer advantages such as heightened visibility for faster risk detection, scenario analysis for assessing risk impacts, data-driven insights for resilience, and enhanced collaboration among stakeholders	Ivanov and Dolgui (2019), Wong *et al.* (2022)
• Big data	Big data serves as an asset in supply chain risk management by offering insights into supplier performance, customer behaviour, and potential cost-saving avenues. Through the utilisation of big data analytics, organisations can aptly recognise and address risks, enhance operational transparency, and allocate resources with precision. To conclude, big data stands as a strong resource enabling companies to streamline and optimise their supply chain management processes	Darvazeh *et al.* (2020), Ivanov and Dolgui (2021), Bui *et al.* (2021), Sheng *et al.* (2021)
• Information sharing	Information sharing plays a pivotal role in the management of supply chain risks. Through the exchange of information, organisations can bolster their readiness to tackle potential risks or disruptions, cooperate with their supply chain collaborators in pinpointing and alleviating risks, and cultivate a comprehensive grasp of the risks within their purview. In summary, proficient information sharing stands as a crucial element in fortifying supply chain risk management	Zhu *et al.* (2020), Kabadayi *et al.* (2020), Zhu *et al.* (2020), Birkel and Hartmann (2020)
• IoT	IoT enhances supply chain risk management through real-time visibility and data analysis. IoT devices deployed in the supply chain collect data on goods' location and condition, aiding risk identification and mitigation. For example, tracking goods can anticipate delays, while sensor data on trucks helps prevent breakdowns. IoT fosters collaboration among supply chain partners by sharing data, enabling better risk understanding and contingency planning	Sharma *et al.* (2020), Venkatesh *et al.* (2020)

Source(s): Authors' own creation

Table 4. Information technologies impact on SC risk management

data-driven decision-making. Research by Kim and Chai (2017) discusses the importance of information-sharing partnerships in achieving supply chain agility, while White *et al.* (2005) explore the role of digital technologies in enabling resilient supply chain networks. The present study focuses on the potential benefits and challenges of ITs, aligning with these insights and contributing to theoretical advancements in the field (Mensah and Merkuryev, 2013; He *et al.*, 2021).

In summary, the results of this study align with and expand upon the existing literature by emphasising the transformative potential of ITs in supply chain management. The study's findings corroborate previous research and add further depth and clarity to the theoretical implications, thereby contributing to a more comprehensive understanding of the subject.

• AI	AI enhances supply chain resilience by collecting and analysing data from diverse sources, creating predictive models, automating tasks, and collaborating with other technologies like lot and blockchain. This enables better disruption response, cost reduction, and increased customer satisfaction. Companies using AI for supply chain resilience are more likely to meet revenue goals and boost customer satisfaction. In summary, AI empowers companies to understand their supply chain, detect disruptions, and implement mitigation strategies effectively	Naz *et al.* (2021), Zamani *et al.* (2023), Belhadi *et al.* (2022), Modgil *et al.* (2022)
• Big data	By giving insights into historical data, real-time data, and predictive data, big data can help to support and improve supply chain resilience. This data can be utilised to detect future disturbances, assess their impact, and devise mitigation techniques. Big data can also be used to track supply chain partner performance, identify areas for improvement, and make smarter decisions. This data- driven strategy allows for the early detection of possible disruptions, forecasting of supply and demand changes, and optimal risk-mitigation decision-making	Bag *et al.* (2021), Sheng *et al.* (2021), Talwar *et al.* (2021)
• Blockchain	Blockchain technology strengthens supply chain resilience by providing a transparent, traceable, and decentralised ledger accessible to all stakeholders. This transparency builds trust and cooperation, like open communication among friends. Its decentralised nature prevents single points of failure, acting as a safety net during unexpected challenges. Blockchain also streamlines processes, enhancing efficiency and collaboration, crucial for navigating disruptions. Moreover, its reliable record-keeping opens doors to financing, providing support during tough times. These qualities have proven invaluable during global upheavals like the COVID-19 pandemic, where blockchain has emerged as a dependable ally in mitigating supply chain risks	Agrawal *et al.* (2023), Singh *et al.* (2023), Haji (2023)
• IoT	IoT can be used to improve supply chain resilience by providing real-time visibility into the status of goods and materials, enabling companies to identify and mitigate potential risks. IoT sensors can be used to track the location, condition, and temperature of goods, and this data can be used to create predictive models that can help companies to anticipate and respond to disruptions. IoT can also be used to automate certain supply chain processes, which can help to reduce costs and improve efficiency	Attaran (2020), Alotaibi (2019)

Source(s): Authors' own creation

Table 5. Information technologies impact on SC resilience

3.2 Practical implications

The practical implications derived from this study receive strong support from various related research efforts in the field of supply chain management and the integration of information technologies.

Dolgui and Ivanov's study in 2022 uncovered significant enhancements in supply chain efficiency, visibility, and resilience through the application of IoT, big data, and ICT. The study's findings align with the current research, highlighting the positive influence of these technologies on operational aspects and risk mitigation.

The emphasis on understanding the opportunities presented by ITs in supply chain management resonates with existing literature. For instance, Tan and Sidhu (2022) emphasised the importance of IoT-enabled real-time tracking and monitoring to enhance supply chain visibility and responsiveness. Similarly, Seyedan and Mafakheri (2020) discussed the potential of big data analytics in improving demand forecasting accuracy. These studies support the suggestion of the present research that ITs can enhance delivery management and reduce risks.

Furthermore, the role of IT in enhancing supply chain visibility, collaboration, and decision-making is supported by the findings of Sarker's study in 2021. The study found that the implementation of IT technologies can lead to improved problem-solving capabilities and faster decision-making processes, supporting the notion that IT can enhance the overall performance of supply chains.

Moreover, Nozari and Nahr's study in 2022, which focused on the impact of ITs on supply chain performance and competitiveness, aligns closely with the holistic approach advocated by the present research. The development of a framework that integrates IT with supply chain analytics, intelligence, and innovation reflects the focus on strategically leveraging IT to drive overall improvements in the supply chain.

The outcomes of this study underscore the significant potential of AI, digital twin, and blockchain technologies to improve the efficiency, sustainability, and resilience of supply chains. These practical implications include enhancing supply chain planning, bolstering supply chain resilience, and acknowledging contextual nuances that could impact the effectiveness of these technologies. Blockchain technology, for instance, strengthens supply chain resilience by providing reliable record-keeping, which in turn facilitates access to financing during challenging periods. However, as these technologies continue to develop and become more accessible, further research is needed to comprehensively understand both the advantages and limitations associated with their adoption.

In summary, the practical implications outlined in this study are strongly supported by a variety of similar studies in the field of supply chain management. These studies collectively underscore the transformative potential of IoT, Big Data, Artificial Intelligence (AI), Digital Twins, and ICT in enhancing supply chain operations, reducing costs, improving customer service, and fostering collaboration among supply chain partners.

3.3 Potential research avenues

The research directions outlined in this study not only resonate with but also extend, the ongoing discourse in the realm of IT-enabled supply chain management. These suggestions are based on the current issues and enquiries that researchers have been addressing in the context of integrating information technologies into supply chain operations.

To begin, the first research avenue explores the obstacles associated with the adoption and implementation of IT, a subject that has received attention in numerous studies. For instance, Chen *et al.* (2019) shed light on the challenges organisations encounter, such as cultural resistance and the imperative need for effective change management strategies when embracing innovative technologies. This agreement emphasises that the problem of overcoming obstacles to IT implementation is widely acknowledged and supports the significance of our study's proposal.

Likewise, the second research avenue, which focuses on identifying critical success factors for integrating IoT, Big Data, and ICT into supply chain management, aligns seamlessly with

existing research. Drissi Elbouzidi *et al.* (2023), for instance, emphasised the importance of leadership commitment, strong technological infrastructure, and the development of employee skills in ensuring the successful integration of these technologies. This alignment highlights that the identification of critical factors conducive to effective integration remains a recurring theme in this field (Drissi Elbouzidi *et al.*, 2023). As well, the results of this study suggest that AI and digital twins have the potential to significantly improve the efficiency, sustainability, and resilience of supply chains (Alzoubi *et al.*, 2023; Li *et al.*, 2016). However, further research is necessary to fully comprehend the advantages of these technologies in various contexts.

Additionally, the study by Chiang *et al.* (2021) identified three significant research gaps in the field of IT-enabled supply chain management. These gaps relate to the lack of empirical studies on the impact of IT on supply chain performance, the need for new theoretical frameworks to understand the complex relationships between IT and supply chain management, and the importance of exploring the ethical and social implications of using IT in supply chain management. Remarkably, these identified research gaps closely align with the potential research avenues outlined in our current study.

3.4 Future research directions

This study presents several promising research directions for future exploration of IT-enabled supply chain management. These avenues, derived from our comprehensive analysis, encompass investigations into how organisations can overcome obstacles that hinder the adoption and integration of IT within their supply chain operations. This includes identifying key factors that facilitate the smooth assimilation of IoT, Big Data, AI, Blockchain and ICT into supply chain management practices. Additionally, strategies are formulated to promote information sharing and collaboration among stakeholders, ultimately optimising the benefits derived from IT implementation.

Furthermore, future research should be focused on examining the impact and implications of IT in different sectors and stages of the supply chain. This would entail exploring how IT can enhance the efficiency, effectiveness, and resilience of various supply chain processes, such as procurement, production, distribution, and customer service. Moreover, future research should also investigate the potential challenges and risks associated with IT adoption and integration in different supply chain contexts, such as environmental, social, ethical, and legal issues. By doing so, future research can provide more comprehensive and nuanced insights into the role and value of IT in supply chain management.

In conclusion, the potential research directions revealed in this study not only align with but also reinforce the discussions found in similar studies. The propositions presented in this research align with previous findings and current concerns regarding IT-enabled supply chain management. This underscores their relevance and importance in guiding future research activities.

4. Conclusions

This research has presented a comprehensive literature review focusing on the intersection of supply chain entities and information technologies (IT). By analysing 177 publications spanning from 2013 to 2023, the paper has identified several opportunities for further research in this area. While some studies have explored topics such as supply chain disruption and supply chain uncertainty, the integration of ITs into the supply chain introduces both vulnerabilities and uncertainties that require further investigation.

To ensure a comprehensive and relevant review, future research should narrow the scope to specific IT applications in supply chain management, such as digital twins, IoT, or artificial

intelligence (AI). By focusing on these technologies, researchers can delve deeper into their potential benefits and challenges, contributing to a more comprehensive understanding of their impact on supply chain processes.

The outcomes of this paper significantly contribute to the field of supply chain management by providing a systematic overview of the opportunities presented by ITs in improving supply chain performance. The paper highlights key technologies such as IoT, Big Data, ICT, AI, Blockchain, Digital twin, and information sharing as potential enablers of enhanced supply chain processes. Understanding the challenges and opportunities associated with implementing these technologies is crucial for both practitioners and academics.

For academics, this research paper offers a valuable resource, summarising the current state of research on ITs and supply chains. By synthesising existing literature, it serves as a foundation for further investigations and scholarly discussions. Practitioners can also benefit from this paper by gaining insights into the potential benefits and challenges associated with adopting ITs in supply chain management.

Moreover, to address the limitation of potentially missing relevant publications, future research could focus on enhancing the keyword selection process. This can involve using alternative search strategies, including additional keywords related to supply chain and finance, to ensure a more comprehensive coverage of relevant literature. Researchers can explore various databases, employ advanced search techniques, and seek guidance from experts in the field to improve the selection of keywords. As well, future research can aim to provide more comprehensive coverage of the subfields within the broader topic.

In conclusion, this research paper provides a roadmap for future studies that focus on exploring specific IT applications and their impacts on supply chain entities. By delving deeper into these areas, researchers can uncover new insights and develop strategies for harnessing the full potential of ITs in optimising supply chain performance.

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