

Improving Supply Chain Performance Through Information Technology: An Integrative Approach

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Abstract

In an era of complex disruption, information technology plays a critical role in improving supply chain performance through operational transparency, efficiency, and collaboration between partners. This study aims to explore the impact of IT on supply chain performance, focusing on technologies such as the Internet of Things (IoT), Radio Frequency Identification (RFID), and cloud-based platforms. A systematic literature review method was used to analyze data from relevant journals, with inclusion criteria including articles discussing the impact of IT on key performance indicators, such as supply chain flexibility, innovation, and resilience. The results showed that IT implementation provides significant benefits, including reducing inventory management errors by up to 30%, improving response to disruptions, and distribution efficiency. IT also supports collaboration through real-time information sharing, which drives product and process innovation. However, challenges such as high investment requirements, technology skills gaps, and data security risks remain major barriers to its implementation. A phased adoption strategy and intensive training for human resources are recommended to overcome these barriers.

Keywords: information technology, supply chain, IoT, RFID, operational efficiency.

INTRODUCTION

In the era of globalization characterized by tight market competition and increasingly complex consumer expectations, the supply chain is one of the key elements in determining the success of a company. The supply chain includes a series of integrated activities, from raw material procurement, production, distribution, to product delivery to end consumers (Nabila & ER, 2019; Tannady et al., 2020). This complexity is increasing with the development of technology and globalization which creates a cross-border and diverse supply chain network. Therefore, effective supply chain management is essential to create sustainable competitive advantage.

One of the biggest challenges in supply chain management is uncertainty and disruption that can occur at any time. Factors such as natural disasters, political instability, pandemics, and market fluctuations pose serious threats to the sustainability of the supply chain. Previous studies have shown that such disruptions can result in decreased operational performance,

spikes in logistics costs, and failure to meet market demand (Atadoga et al., 2024; Firmansyah & Siagian, 2022). To overcome these challenges, the application of information technology (IT) in the supply chain has become a major focus in various industries.

Information technology enables companies to manage real-time information flows, strengthen communication between supply chain partners, and create greater operational transparency. Technologies such as the Internet of Things (IoT), Radio Frequency Identification (RFID), and cloud-based platforms have become key pillars in building more adaptive and resilient supply chain systems (Atadoga et al., 2024; Tan & Sidhu, 2022; Unhelkar et al., 2022). For example, RFID enables real-time tracking of inventory and movement of goods, while IoT helps monitor environmental conditions during transportation and storage (Tan & Sidhu, 2022). Furthermore, the application of IT in the supply chain also has a positive impact on improving operational performance. Research by Tannady et al., (2020) shows that IT readiness and information sharing significantly affect supply chain performance, especially in crisis situations such as the COVID-19 pandemic. In this context, companies that have integrated IT into their supply chain processes are able to adapt more quickly to changes in market demand and operational disruptions.

In addition, technology also strengthens collaboration between various actors in the supply chain. Firmansyah & Siagian (2022) highlighted that effective information sharing between suppliers, manufacturers, and distributors can increase innovation and flexibility in facing market dynamics. Meanwhile, Akoh Atadoga et al. (2024) emphasized the importance of digital platforms and cloud-based systems in supporting collaborative decision-making and responding to disruptions. However, although the benefits of IT in the supply chain have been widely recognized, its implementation is not without challenges. One of the main obstacles is the need for high initial investment and lack of understanding of technology among supply chain partners. In addition, there are data security and privacy risks that require serious attention in the implementation of digital-based technology (Unhelkar et al., 2022). Therefore, a gradual technology adoption strategy and human resource training are important solutions to ensure the success of IT implementation in the supply chain.

This article aims to explore the impact of IT on supply chain performance through a systematic approach. The main focus of this study is to understand how technologies such as IoT, RFID, and digital platforms affect operational aspects, collaboration, and resilience in the supply chain. By analyzing case studies from various industries, this article hopes to provide practical and strategic insights for companies that want to leverage IT to improve their efficiency and competitiveness in the global market. As an initial conclusion, the implementation of IT in the supply chain is a strategic step to face the increasingly complex and dynamic challenges of the future. With technology, companies can create a more resilient, adaptive, and innovative supply chain, which ultimately supports business sustainability amidst increasingly fierce global competition (Atadoga et al., 2024; Tannady et al., 2020).

METHOD

This study uses a systematic literature review approach to explore the relationship between information technology implementation and improved supply chain performance. This method was chosen because of its ability to integrate findings from various relevant sources and provide in-depth insights into trends, best practices, and challenges in IT implementation in supply chains (Aityassine et al., 2022; Nabila & ER, 2019). The first stage in this method is data collection from indexed scientific journals that are relevant to the topic of information technology and supply chains. Literature searches were conducted through academic databases such as Scopus, Elsevier, and Emerald Insight. The main keywords used

include "information technology," "supply chain," "resilience," "information sharing," "Internet of Things (IoT)," and "Radio Frequency Identification (RFID)". Inclusion criteria include articles published in the last five years, discussing aspects of technology implementation in supply chain management, and available in English or Indonesian. Articles that are not relevant or do not meet the exclusion criteria, such as those focusing on non-industrial technologies, were excluded from the analysis.

The second stage involved thematic analysis to identify key patterns, concepts and trends emerging from the selected literature. Data were analysed using a descriptive approach to explore key performance indicators such as operational efficiency, flexibility, collaboration and supply chain resilience (Zaman et al., 2023). To enhance the validity of the results, several case studies were applied as additional materials in exploring the impact of IT implementation in various sectors, such as the manufacturing and logistics industries. The study also adopted IT-based analysis models, such as the use of SmartPLS analysis tools, to link information sharing, flexibility and innovation with operational performance. Overall, this approach provides a comprehensive understanding of how IT can be used to address supply chain challenges, enhance collaboration between partners and support operational efficiency across the supply chain network.

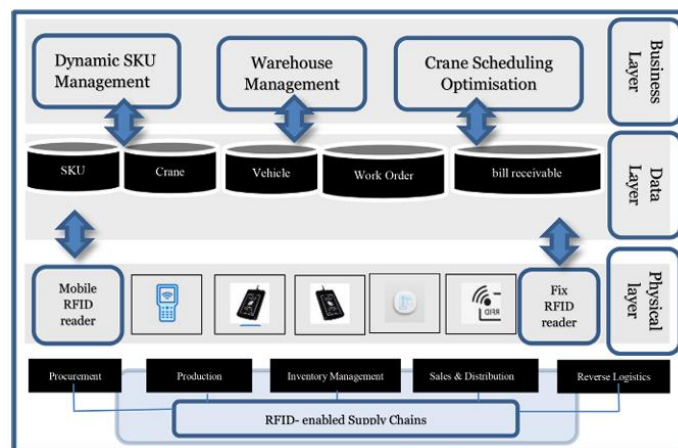


Figure 1. Schematic Representation of RFID-Enabled Supply Chain Optimization Model (Unhelkar et al., 2022)

RESULT AND DISCUSSION

Operational transparency generated by IT allows companies to monitor the supply chain holistically. With real-time information, companies can mitigate logistics risks and respond to market needs more quickly (Atadoga et al., 2024; Tan & Sidhu, 2022). Improving operational efficiency through IT technology shows a positive correlation with reducing operational costs. IoT and RFID, for example, not only reduce logistics time and costs but also improve inventory and delivery accuracy (Unhelkar et al., 2022). Research shows that IT-based collaboration strengthens a company's competitive advantage. By sharing information in real time, supply chain partners can strategize together to anticipate market demand and disruptions (Atadoga et al., 2024; Tannady et al., 2020). The application of IT-based predictive analytics allows companies to prepare for alternative scenarios in the face of disruptions, such as pandemics or natural disasters. A study by Tannady et al. (2020) highlighted that IT readiness plays a critical role in maintaining operational continuity during a crisis. Open information sharing enables collaboration in creating new innovations. For example, the

development of new products that are responsive to market needs is done faster with data transparency throughout the supply chain (Firmansyah & Siagian, 2022; Zaman et al., 2023). Despite the many benefits, challenges in IT implementation, such as the need for large investments and lack of technological expertise, remain major obstacles. To overcome this, companies need to carry out gradual training and investment in technology adoption (Atadoga et al., 2024; Unhelkar et al., 2022).

Research shows that increased operational efficiency and transparency have a direct impact on customer satisfaction. Customers receive products faster, with better quality, and according to their expectations (Tan & Sidhu, 2022). The integration of digital technologies, such as blockchain and AI-based platforms, expands the opportunities for innovation in supply chain management. These technologies provide better data security and enable complete process automation (Atadoga et al., 2024). Research by Aityassine et al. (2022) shows that IT-enabled supply chain agility strengthens resilience by enabling companies to respond to market changes quickly and efficiently. Case studies in various sectors, such as manufacturing, logistics, and healthcare, show that IT technology can be applied with high flexibility, adjusting to industry-specific needs (Firmansyah & Siagian, 2022; Tan & Sidhu, 2022). With data-driven analytics, companies can identify potential risks early and develop effective mitigation strategies. Technologies such as IoT enable monitoring of environmental conditions to prevent product damage during distribution (Atadoga et al., 2024; Unhelkar et al., 2022).

Various technologies, including IoT and RFID, provide companies with sustainable competitive advantages by creating efficiencies that are not easily copied by competitors (Atadoga et al., 2024; Tan & Sidhu, 2022). Investments in IT provide long-term benefits, such as operational cost savings, increased customer loyalty, and business process efficiency (Atadoga et al., 2024; Unhelkar et al., 2022). The implementation of IT also has an impact on changing organizational culture, by encouraging closer collaboration between departments and supply chain partners (Atadoga et al., 2024; Firmansyah & Siagian, 2022). Data security is a major challenge in the implementation of digital technology. Therefore, technology-based security strategies such as blockchain are relevant to protect sensitive supply chain data (Atadoga et al., 2024). The gradual adoption of technology allows companies to overcome resource constraints and ensure successful implementation (Tan & Sidhu, 2022; Unhelkar et al., 2022). IT technology also supports sustainability initiatives by reducing waste and increasing the efficiency of resource use in the supply chain (Atadoga et al., 2024). Research shows that the integration of IoT and data analytics creates opportunities for further innovation in the future, including full automation of the supply chain (Atadoga et al., 2024; Firmansyah & Siagian, 2022). Employee education and training are important factors in ensuring the success of technology adoption (Firmansyah & Siagian, 2022; Unhelkar et al., 2022).

CONCLUSION

Information technology plays a key role in improving supply chain performance, transparency, and resilience amidst increasingly complex global challenges. The use of technologies such as IoT, RFID, and cloud-based platforms has been shown to improve operational efficiency, strengthen collaboration between partners, and enable rapid response to disruptions. The transparency resulting from IT implementation provides companies with the ability to make more accurate data-driven decisions, reduce risks, and ensure product delivery that meets customer expectations. In addition, IT drives innovation through more effective information sharing, enabling product and process development that is more

responsive to market dynamics. Despite the many benefits, challenges such as high investment requirements, technology skills gaps, and data security risks remain major barriers to its implementation. Therefore, a gradual adoption strategy and intensive training for human resources are needed to ensure the success of IT technology implementation. Overall, IT not only improves the efficiency and competitiveness of companies, but also provides adaptive and innovative solutions to address various challenges in the supply chain. Investment in this technology is a strategic step needed to face an increasingly dynamic and competitive future.

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