Infinity Engineering Journal
Vol. 1 No. 4, Nov (2025), pp. 99-104

ISSN 3090-5621 (online)
Published by Yayasan Cinta Negara Indonesia

Digital Transformation in Inventory Management System Design: a Systematic Literature Review of Global Innovations and Trends

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A R T I C L E I N F O

Article history:

Received: Nov 02, 2025
Revised: Nov 16, 2025
Accepted: Nov 25, 2025

Keywords:

Digital Inventory Systems
Digital Transformation
Information System Design
Smart Warehouse
Systematic Literature Review

ABSTRACT

Digital transformation has become a key element in the development of inventory information systems in various industrial sectors. This study conducted a Systematic Literature Review (SLR) to analyze trends, technological innovations, design methods, and the impact of implementing digital inventory systems. A number of selected studies were analyzed based on their relevance, quality, and contribution to the development of modern inventory systems. The results of the study show that technologies such as the Internet of Things (IoT), Radio Frequency Identification (RFID), cloud computing, artificial intelligence (AI/ML), and big data analytics dominate innovations in inventory systems, driving higher data accuracy, process automation, and real-time visibility in stock management. Additionally, design methods such as SDLC, Agile, prototyping, and hybrid models are widely used to produce more adaptive and integrated systems. This study also identifies key challenges such as data integration issues, information security, and implementation limitations in MSMEs. Overall, this SLR provides a comprehensive mapping of developments in inventory information systems and offers future research directions that include predictive AI integration, smart warehouse architecture, and blockchain-based inventory collaboration.

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1. INTRODUCTION

Digital transformation has become one of the most strategic factors in improving the effectiveness and efficiency of business processes, including inventory management. Inventory systems are a critical function that affects the smooth running of operations, stock data accuracy, cost control, and the quality of managerial decision-making. In the digital era, organizations are required to adopt more adaptive, automated, and integrated technologies in order to cope with increasingly competitive and volatile market dynamics. Therefore, the implementation of digital transformation in the design of the Inventory Management System (IMS) has become an unavoidable urgency.

Conventional inventory systems generally face various challenges such as data inaccuracy, time-consuming manual recording, risk of human error, and delays in information sharing between divisions. Most manual inventory management processes result in inconsistent information, duplicate records, and low supply chain visibility. These conditions impact operational efficiency, service speed, and an organization's ability to respond to market demand in real time.

Digitization and automation through the use of cutting-edge technologies such as the Internet of Things (IoT), cloud computing, machine learning, Radio Frequency Identification (RFID), and big

data analytics open up enormous opportunities for organizations to improve data accuracy, accelerate information flow, and optimize the procurement and distribution of goods. These technologies enable integrated and intelligent inventory systems, generating real-time stock information and supporting data-driven decision making.

Although various studies have discussed inventory systems and the application of digital technology separately, there is still a significant research gap, namely the lack of comprehensive studies based on Systematic Literature Review (SLR) that summarize innovations, global digital trends, and the implications of digital transformation on the design of Goods Inventory Information Systems. An SLR is needed to provide a structured mapping of scientific knowledge, clarify the contributions of previous studies, and identify opportunities for further research in the context of inventory management digitalization.

This study aims to: (1) identify emerging digital trends and innovations in inventory information system development; (2) describe the dominant system design approaches used in the literature; and (3) analyze the impact of digital transformation on data accuracy, operational efficiency, and decision-making quality.

Based on these objectives, this study formulates three research questions (RQ1): What are the dominant innovations and digital technologies used in the design of inventory information systems? RQ2: How do global trends in digital transformation affect the development of inventory systems? RQ3: What are the contributions and limitations of previous studies related to the implementation of digitization in inventory systems?

By answering these three questions, this study is expected to contribute scientifically in the form of mapping the latest literature and recommendations for developing a more effective and sustainable digital transformation-based inventory system.

2. METHOD

Research Design

This study used the Systematic Literature Review (SLR) method based on the guidelines of Kitchenham (2004) and PRISMA 2020 (Page et al., 2021). This approach was chosen to compile a structured, transparent, and replicable literature review related to digital transformation in inventory information system design. The SLR process includes: formulating research questions, searching the literature using systematic strategies, selecting articles with inclusion-exclusion criteria, evaluating study quality, and synthesizing data. This research design ensures that all findings are comprehensive, objective, and relevant to the context of digital inventory system development.

Data Sources

This study uses a number of reputable scientific databases to ensure the quality and relevance of the literature analyzed. The main data sources include Scopus (Elsevier, 2025), IEEE Xplore (IEEE, 2024), ScienceDirect (Elsevier, 2024), SpringerLink (Springer, 2024), and Google Scholar, which are known as academic search platforms widely used in information systems and digital technology research. The publication year range was limited to 2013–2025 to capture the latest developments related to digital transformation in inventory management. The types of documents reviewed included journal articles, conference proceedings, and academic books, in accordance with the PRISMA 2020 standard (Page et al., 2021).

Search Strategy

The literature search strategy was systematically developed following the SLR guidelines recommended by Kitchenham (2004) and the PRISMA 2020 reporting guidelines (Page et al., 2021). The search process was conducted using a combination of keywords relevant to the topics of digital transformation and inventory information systems. The main keywords used include: “inventory management system,” “digital transformation,” “information system design,” “smart inventory,” “inventory automation,” and other related terms. To broaden the scope of the search, Boolean operators such as AND, OR, and NOT are used, as recommended in systematic search practices (Kitchenham, 2004). Examples of search combinations include:

a. inventory management system AND digital transformation
b. smart inventory OR automated inventory system
c. inventory information system AND technology adoption NOT agricultural inventory

This strategy ensures that all relevant and high-quality literature can be identified comprehensively and systematically.

Inclusion and Exclusion Criteria
The inclusion and exclusion criteria were determined based on the SLR methodological guidelines recommended by Kitchenham (2004) and the PRISMA 2020 reporting standards (Page et al., 2021). These criteria were used to ensure that only relevant, high-quality studies that were within the scope of the research were analyzed.

Inclusion Criteria
Research is included if it meets the following conditions:
1. The study discusses the design, implementation, development, or innovation related to digital inventory information systems, including technologies such as IoT, RFID, cloud, or automation (Kitchenham, 2004).
2. The study is in the form of empirical articles, conceptual models, or literature reviews relevant to digital transformation.
3. Articles are available in full-text and written in English or Indonesian (Page et al., 2021).

Exclusion Criteria
Studies were excluded if they met the following criteria:
a. Not related to supply systems or did not discuss digital/technological aspects.
b. Articles were not available in full text or were only abstracts.
c. The document type is an editorial, short conference abstract, poster, or non-academic material.
These criteria help ensure that all literature analyzed is directly relevant to the research objectives and meets SLR academic standards.

3. RESULTS AND DISCUSSION

General Description of the Reviewed Study
The final stage of the selection process resulted in a number of articles that met the inclusion criteria for in-depth analysis. These studies originated from various countries and were published between 2013 and 2025, reflecting the growing global attention to digital transformation in inventory information systems. The annual distribution shows a significant upward trend after 2018, in line with the widespread adoption of technologies such as IoT, cloud computing, RFID, and big data analytics in inventory management (Li et al., 2020; Yusuf et al., 2022).

Based on the country of origin of the publications, most studies came from Asia, Europe, and North America, which are regions with intensive implementation of industrial digitization (Zhang & Chen, 2021). In terms of research methods, the majority used empirical studies (experiments, case studies), followed by conceptual models, system design studies, and technical implementations, in line with the nature of research in the field of information systems and engineering technology (Kitchenham, 2004).

General findings show that most studies focus on the development of digital system architecture, supply process optimization, IoT–RFID integration, and the use of machine learning for forecasting demand. The variety of methods and country contexts enriches the thematic synthesis and provides a comprehensive overview of the global evolution of supply technology.

Main Theme of SLR Findings
Can be divided into 3–5 themes:

Theme 1: Digital Transformation as the Foundation of Modern Supply Systems
Reviewed studies show that digital transformation is the main basis for the development of modern inventory systems. The integration of technologies such as IoT, cloud computing, RFID, and big data consistently improves data accuracy through automated recording and real-time tracking, while reducing human error (Li et al., 2020; Zhang & Chen, 2021). Digitalization also accelerates information flow and supports more accurate restocking decisions through predictive analytics (Yusuf et al., 2022).

Theme 2: Technological Innovation in Inventory Information Systems
The SLR results show that technological innovation is the main driver of the evolution of inventory information systems. Technologies such as IoT and RFID play an important role in automatic tracking

and real-time monitoring of goods (Zhang & Chen, 2021). Cloud computing enables cross-divisional data integration and more flexible system access, while AI and big data analytics are used for demand forecasting, stock optimization, and anomaly detection (Yusuf et al., 2022). In addition, blockchain is beginning to be adopted to improve transparency, transaction security, and inventory data authenticity in the supply chain (Kshetri, 2018). Overall, these technological innovations strengthen the reliability, efficiency, and integrity of digital inventory systems.

Theme 3: Commonly Used Inventory Information System Design Methods

The SLR results show that various system design methods are widely used in the development of digital inventory information systems. The System Development Life Cycle (SDLC) remains a classic approach that is widely used for large-scale projects due to its systematic and well-documented stage structure (Sommerville, 2016).

Meanwhile, the Agile approach is becoming increasingly popular because it is flexible, iterative, and allows development teams to respond quickly to changing requirements—especially in dynamic digital environments (Beck et al., 2001). Prototyping is also often used to accelerate user requirement validation, enabling earlier evaluation of interfaces and functions in the design process (Pressman & Maxim, 2020). In addition, several studies combine these approaches in the form of hybrid models, which combine the precision of SDLC with the speed of Agile or prototyping to produce more adaptive and efficient systems (Ibrahim et al., 2019).

Theme 4: Impact of Digital Inventory Systems Implementation

Reviewed studies show that the implementation of digital inventory systems has a significant impact on improving operational performance. Digital inventory systems have been proven to improve operational efficiency through the automation of recording processes and workflows, thereby reducing manual workloads and minimizing the risk of human error (Li et al., 2020). In addition, inventory digitization contributes to a reduction in operational costs, particularly through stock optimization and a reduction in overstock and stockouts (Yusuf et al., 2022).\

Technologies such as IoT, RFID, and cloud computing also enhance real-time visibility, enabling accurate and integrated monitoring of goods movements throughout the supply chain (Zhang & Chen, 2021). The implementation of big data-based reporting and analytics automation further accelerates decision-making processes, making inventory systems more responsive and adaptive to changes in market demand.

Theme 5: Challenges and Limitations in Digital Transformation

Although digital transformation offers many benefits, the studies reviewed indicate that there are a number of challenges that still limit the effectiveness of digital inventory system implementation. One of the main obstacles is the issue of data integration, especially when organizations have legacy systems that are incompatible with new digital platforms (Taroun & Yang, 2011).

In addition, information security is a major concern because digitization increases the risk of data leaks, cyber attacks, and inventory information manipulation (Kshetri, 2018). Other challenges include high implementation costs, including investments in IoT devices, RFID, cloud, and network infrastructure (Zhang & Chen, 2021). Equally important, organizations also face user resistance, especially from employees who are unfamiliar with new technologies or feel threatened by automation processes (Yusuf et al., 2022).

Overall, these challenges show that the success of digital transformation depends not only on technology, but also on organizational readiness, change management, and strong security policies.

4. DISCUSSION

Analysis of Global Trend Development

Global trends show a gradual shift from manual systems to digital inventory systems, which are now evolving into smart and intelligent inventory systems. Manual systems, which are prone to delays and errors, are being replaced by digitalization, which offers automatic recording and data integration (Zhang & Chen, 2021). The next stage is marked by the adoption of IoT, RFID, AI, and big data, which enable real-time monitoring, stock demand prediction, and automated decision-making (Li et al., 2020; Yusuf et al., 2022). This evolution confirms that digital transformation is the main foundation for improving the efficiency and accuracy of modern inventory systems.

Implications for System Design

SLR findings indicate that the design of modern inventory information systems must prioritize interoperability, so that systems can connect with various platforms such as ERP, SCM, and IoT devices without obstacles (Sommerville, 2016). In addition, scalability is an important aspect so that the system can adapt to future increases in data volume and operational growth. The design also needs to support the integration of new technologies such as AI, big data analytics, and cloud computing to enable real-time analysis, demand forecasting, and inventory process automation (Pressman & Maxim, 2020). Thus, the system architecture must be flexible, modular, and ready to accommodate evolving digital innovations.

Implications for Practitioners and Industry

The implementation of digital inventory systems has a tangible impact on industrial operations. Studies show that digital inventory systems can reduce operational costs through process automation, reduction of recording errors, and optimization of inventory levels (Li et al., 2020). In addition, the integration of technologies such as IoT, RFID, and data analytics can increase stock accuracy to over 95%, thereby minimizing the risk of stockouts and overstocking and improving the reliability of information for strategic decision-making (Zhang & Chen, 2021). For practitioners, this digitization also accelerates the audit process, increases supply chain transparency, and strengthens the company's competitiveness in the era of industry 4.0 (Yusuf et al., 2022).

Limitations of Previous Research

Previous studies have several limitations that need to be considered. First, there are still few long-term studies that evaluate the performance of inventory information systems on an ongoing basis, so the real impact on operational efficiency has not been fully measured. Second, a number of studies are still at the prototype stage and have not been tested in complex industrial environments, limiting their practical validity. Third, implementation challenges in MSMEs are still very dominant, especially those related to limitations in digital infrastructure, technical competence, and financial capabilities, so that the adoption of modern technology-based inventory systems has not been evenly distributed. These limitations indicate the need for further research that is more applicable, longitudinal, and focused on the context of MSMEs.

Future Research Directions

Future research should focus on several strategic developments to improve inventory information system capabilities. First, the integration of artificial intelligence-based predictive analytics needs to be deepened to predict demand, optimize reorder points, and reduce the risk of stockouts and overstocking more accurately (Zhang et al., 2020; Kumar & Singh, 2021). Second, blockchain-based inventory collaboration presents a significant opportunity to improve supply chain transparency, security, and reliability, especially in multi-stakeholder networks that require tamper-proof transaction validation (Wang et al., 2019). Third, the development of smart warehouse architecture needs to be explored further, including the integration of IoT, robotics, and real-time analytics to create a fully automated, adaptive, and autonomous decision-making inventory system (Lee & Park, 2022). This direction provides the foundation for the formation of a next-generation inventory system that is smarter, more efficient, and more responsive to modern business dynamics.

5. CONCLUSION

The results of the study show that digital transformation consistently drives innovation in inventory information systems, particularly through the use of technologies such as IoT, RFID, AI/ML, cloud computing, and big data. Global findings indicate a significant shift from manual inventory systems to automated, intelligent, real-time, and integrated systems, in line with the development of the smart supply chain and Industry 4.0 concepts. This SLR contributes by providing a comprehensive mapping of technological innovations, design methods, challenges, and the direction of inventory information system evolution. In addition, this study also offers practical recommendations for industry and academic recommendations for researchers to develop more adaptive, efficient, and future-oriented inventory systems. Thus, this research reinforces the importance of digital transformation as the main foundation in the development of inventory information systems in the digital era.

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