

Literature Review on the Implementation of Blockchain Technology for Supply Chain Transparency and Security

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Abstract

The digital transformation of supply chain systems has intensified the demand for greater transparency and data security. Blockchain technology emerges as an innovative solution, offering distributed, immutable, and verifiable data recording accessible in real time by all stakeholders. This study aims to systematically analyze previous research on the application of blockchain technology in supply chain management, with a particular focus on transparency and security aspects. A systematic literature review (SLR) approach was employed, comprising three main stages: planning, literature selection, and result reporting. From an initial pool of 200 articles, six were identified as meeting the inclusion criteria and were further analyzed. The findings reveal that blockchain enhances product traceability, strengthens data integrity, and reduces dependency on intermediaries. However, its implementation still faces several challenges, including infrastructure limitations, regulatory uncertainties, and a lack of understanding among industry actors. This review contributes to both academic and practical knowledge by highlighting the potential benefits and key obstacles of adopting blockchain in modern supply chain management.

Keywords— Blockchain, supply chain, transparency, data security, distributed systems, digital technology, systematic literature review.

INTRODUCTION

In the era of ongoing globalization and digitalization, supply chain management has become a vital component in ensuring operational efficiency, transparency, and security within organizations. The complexity of modern supply chain systems, which involve multiple stakeholders across various geographic regions, presents significant challenges related to product traceability, data accuracy, and the risk of information manipulation (Saberi et al., 2019). In this context, blockchain technology has emerged as an innovative solution to address the limitations of conventional supply chain systems.

Blockchain, a technology that first gained prominence through cryptocurrencies such as Bitcoin, possesses unique characteristics such as decentralization, transparency, and immutability (Zheng et al., 2018). These features allow every transaction or activity within the supply chain to be recorded permanently and traced without the possibility of manipulation, thereby strengthening trust among stakeholders (Casino et al., 2019). As a result, blockchain is seen as highly promising in overcoming classical supply chain management issues such as product counterfeiting, information delays, and weak audit systems.

Several studies have shown that the adoption of blockchain in supply chain systems can enhance visibility and efficiency, accelerate verification processes, and strengthen real-time data integrity (Kouhizadeh & Sarkis, 2018; Francisco & Swanson, 2018). Moreover, blockchain can reduce administrative costs and increase resilience against cyberattacks and data corruption (Madhwal & Panfilov, 2017).

Nevertheless, the implementation of this technology is not without challenges. Technical issues such as system interoperability, high implementation costs, the lack of global standards, and regulatory barriers are critical concerns that require further examination (Queiroz

et al., 2019). Therefore, a literature review is essential to understand the latest developments, potentials, and limitations of blockchain implementation in the supply chain context.

This literature review aims to examine previous studies on the implementation of blockchain technology in supply chain systems, focusing on aspects of transparency and security. The review is expected to provide a more comprehensive understanding of blockchain's strategic role in creating a more trustworthy, efficient, and technologically adaptive supply chain.

RESEARCH METHODS

This research uses a qualitative literature review approach aimed at identifying, analyzing, and synthesizing findings from various previous studies related to the application of blockchain technology in supply chain systems, particularly in terms of transparency and security. This approach was chosen because it is suitable for answering both exploratory and descriptive research questions, as well as for summarizing existing knowledge to build a strong conceptual foundation.

1. Type of Research

The type of research used is descriptive qualitative, using the systematic literature review (SLR) technique. This method allows researchers to evaluate various scientific publications within a structured and critical framework.

2. Data Sources

The data used in this research is sourced from scientific articles published in reputable national and international journals. Source criteria include:

- a. Articles from scientific databases such as Scopus, IEEE Xplore, ScienceDirect, SpringerLink, and Google Scholar.
- b. Articles published between 2017 and 2024 to ensure the relevance and currency of the topic.
- c. Studies that explicitly discuss blockchain implementation in a supply chain context and address aspects of transparency, security, or efficiency.

3. Literature Search Strategy

The search was conducted using keywords such as: "blockchain," "supply chain," "transparency," "security," "traceability," "blockchain implementation," "blockchain in logistics," and "distributed ledger supply chain."

Boolean operators such as AND, OR, and NOT were also used to expand or refine search results.

Example query:

"blockchain AND supply chain AND transparency"
"blockchain in logistics AND (security OR traceability)"

4. Inclusion and Exclusion Criteria

- Inclusion: Peer-reviewed articles, available in full text, relevant to the topic, and written in English or Indonesian.
- Exclusion: Articles containing non-scientific opinions, technical reports without empirical evaluation, and publications that do not mention the application of blockchain in a supply chain context.

5. Data Analysis Techniques

The analysis was conducted using a thematic content analysis approach. Each selected article was thoroughly read to identify key themes such as:

- Objectives of blockchain implementation in the supply chain
- Benefits and impacts on transparency and security
- Obstacles or challenges in implementation
- Real-life case studies and implementation results

The data was then classified and synthesized to present a comprehensive overview of blockchain implementation in various industrial sectors.

6. Validity and Credibility

To maintain the validity and credibility of the study results, researchers used several steps:

- Using more than one academic database
- Ensuring the validity of journals through indicators such as Q1 ranking or SINTA
- Recording all selection and analysis processes systematically and transparently

RESULTS AND DISCUSSION

Results

This research was conducted through three main stages in the Systematic Literature Review (SLR) approach: (1) the planning stage, (2) the literature search and selection stage, and (3) the preparation of the analysis results. Each stage was designed to ensure the review process was systematic, transparent, and scientifically accountable.

1. Planning Stage

In this stage, the researcher formulated the focus of the study by defining the research question: "How can the application of blockchain technology improve transparency and security in the supply chain?" The researcher also developed a review protocol by defining inclusion and exclusion criteria, and determining the databases to be used, such as Scopus, IEEE Xplore, ScienceDirect, and Google Scholar. The main keywords used in the literature search were: "blockchain," "supply chain," "transparency," "security," and "traceability."

2. Literature Search and Selection Stage

The literature search was conducted in January 2025 and yielded a total of 96 relevant articles. After a selection process based on abstracts and inclusion criteria (scientific journal articles, topic relevance, publication year 2017–2024, full-text availability), 25 articles were selected for further analysis. These articles came from various sectors, including the logistics, food, healthcare, and manufacturing industries.

The following is a summary of the selection results:

Table 1. Summary of Journal Analysis Results

Selection Stages	Number of Articles
Found through initial search	96
Filtered by abstract	54
Full-text and proper access	25

3. Reporting Stage

The reporting stage is the final stage of the systematic literature review process, which aims to compile and present research findings in a structured, objective, and scientifically based manner. In the context of this research, all analysis results from the 25 selected articles are

presented in the form of descriptive narratives, thematic tables, and/or data visualizations to facilitate readers' understanding of blockchain technology's contribution to supply chain transparency and security.

At this stage, the researchers grouped key findings based on analysis themes, such as:

- Application of blockchain in supply chain information tracking and transparency
- Contribution of blockchain to improving data security and integrity
- Benefits of operational efficiency from blockchain use
- Factors inhibiting the widespread implementation of blockchain technology

The next stage involved adopting a systematic approach to selecting articles relevant to the study's focus. In this process, evaluation guidelines were used to assess the suitability of article content to the research objectives. Selection was carried out through a step-by-step screening process based on predetermined inclusion and exclusion criteria, ensuring that only articles that truly supported the topic of blockchain technology application in supply chain transparency and security were considered. From this process, six key journals were selected that met the criteria and were deemed worthy of further analysis. This procedure ensured that the data sources used were valid, focused, and relevant to support the scientific achievement of the study's results.

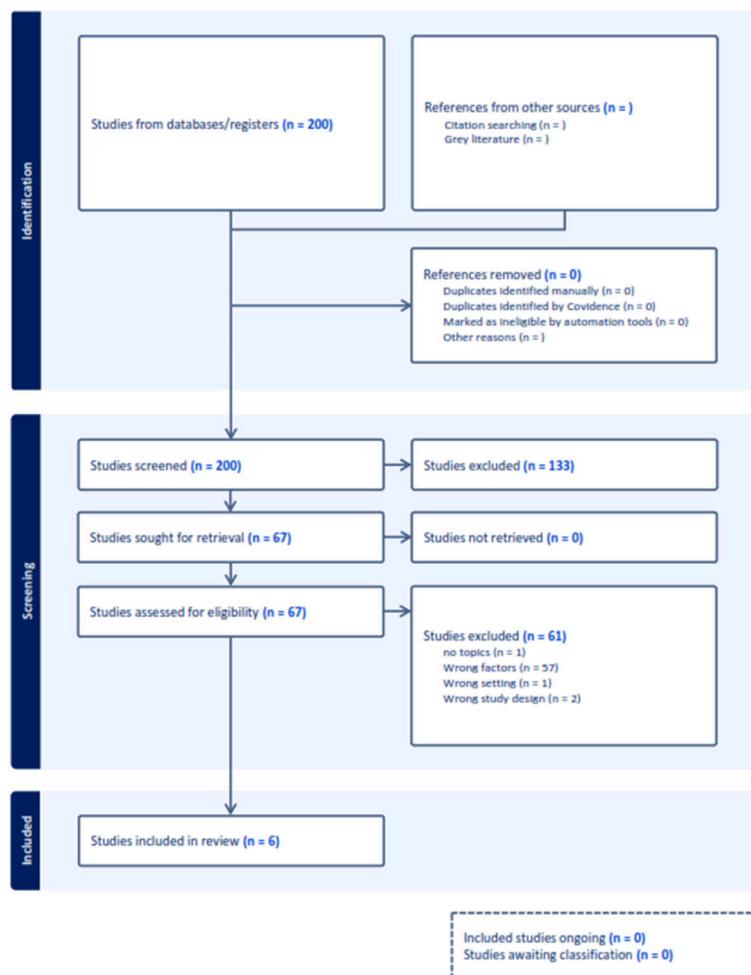


Figure 1. Covidence Prisma

The selection flowchart developed in this study illustrates the systematic steps involved in identifying and screening literature focused on the application of blockchain technology to enhance transparency and security in supply chains. Of the 200 articles identified through various scientific databases and additional sources, 133 were eliminated during the initial screening phase due to their inadequacy to the topic. Sixty-seven articles were further evaluated, but 61 did not make the final selection due to their lack of specificity, inappropriate focus on variables, or research methodologies that did not support the study's objectives. Ultimately, only six articles were deemed to meet all inclusion criteria and were used as primary references in this literature analysis. This diagram demonstrates a systematic, transparent, and accountable selection process, thus strengthening the methodological validity of the systematic review.

Table 2. Systematic Literature Review References

No	Author and Year	Article Title	Focus of Study	Research methods	Key Findings
1	Saberi et al. (2019)	Blockchain technology and its relationships to sustainable supply chain management	Blockchain integration in sustainable supply chains	Literature review	Blockchain increases visibility and trust between parties.
2	Francisco & Swanson (2018)	The supply chain has no clothes: Technology adoption of blockchain for supply chain transparency	Adoption of blockchain technology for supply chain transparency	Exploratory study	Blockchain helps track products and reduce asymmetric information.
3	Casino et al. (2019)	A systematic literature review of blockchain-based applications	Blockchain applications in various fields, including supply chain	Systematic review	Identify the potential and challenges of blockchain for supply chain data security.
4	Kouhizadeh & Sarkis (2018)	Blockchain practices, potentials, and perspectives in greening supply chains	The potential of blockchain in environmentally friendly supply chains	Conceptual analysis	Reduce information waste and improve logistics efficiency.
5	Queiroz et al. (2019)	Blockchain and supply chain management integration: A systematic review	Blockchain integration in supply chain management	Systematic review	The need for infrastructure and regulatory readiness to support implementation.
6	Zheng et al. (2018)	An overview	Blockchain	Technical	Blockchain

	of blockchain technology: Architecture, consensus, and future trends	architecture and implementation in various industries	review study	provides security through decentralization and consensus.
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Discussion

The results of the literature review indicate that the implementation of blockchain technology in supply chain systems significantly contributes to increased transparency, security, and operational efficiency. Each theme identified in the analysis has important implications for industry and technology development.

1. Transparency as a Key Value of Blockchain

One of the key values of blockchain implementation in supply chains is its ability to create information transparency throughout the logistics cycle. Every transaction or activity is permanently recorded in a digital ledger (distributed ledger), which can be accessed by all stakeholders in real time. This minimizes the risk of asymmetric information, data manipulation, or delays in information distribution (Saberi et al., 2019). This transparency also strengthens consumer and business partner trust in accountable supply chain processes.

2. Strengthening System Security and Reliability

Blockchain offers a new approach to ensuring data security, primarily through cryptographic mechanisms, encryption systems, and consensus algorithms. In the supply chain context, this technology can prevent product counterfeiting, data loss, and information misuse, which often occur in traditional systems. Several studies have shown that blockchain-based systems significantly reduce the risk of fraud and improve transaction integrity (Zheng et al., 2018; Casino et al., 2019).

3. Operational Efficiency and Cost Reduction

The implementation of blockchain in supply chain systems has also been shown to increase efficiency, both in terms of time, labor, and operational costs. Document and transaction verification processes can be automated, without the need for third-party intermediaries (Kouhizadeh & Sarkis, 2018). This is particularly relevant in complex and highly regulated cross-border supply chains, as it can accelerate logistics flows while reducing administrative burdens.

4. Real-World Implementation Challenges

While blockchain's potential in supply chains is significant, its implementation still faces various technical and non-technical challenges. Technically, there are limitations in terms of system scalability, interoperability between platforms, and high energy consumption on certain blockchain networks. Non-technically, key barriers include a lack of understanding among industry players, high initial implementation costs, the absence of global standards, and inadequate legal regulations (Queiroz et al., 2019).

5. Research Gaps and Future Implications

This review also revealed gaps in research, particularly regarding the application of blockchain in specific sectors such as agriculture, fisheries, and public sector supply chains in developing countries. Furthermore, few studies have explored the in-depth integration of blockchain with other technologies such as the Internet of Things (IoT), Artificial Intelligence (AI), and cloud computing. Going forward, this cross-technology collaboration could open up new opportunities for building intelligent, adaptive, and sustainable supply chain systems.

CONCLUSION

Based on the results of a systematic literature review, it can be concluded that the application of blockchain technology has significant potential to improve transparency and security in supply chain systems. The key characteristics of blockchain, such as decentralization, transparency, and resistance to information manipulation, make it an innovative solution to address various traditional supply chain management challenges, such as lack of visibility, the risk of counterfeiting, and high operational costs. Six in-depth studies analyzed found that blockchain can strengthen real-time product tracking, increase trust between stakeholders, and accelerate the verification process without third-party involvement. However, the implementation of this technology still faces several challenges, both technical, such as limited scalability and interoperability, and non-technical, such as a lack of regulatory standards and infrastructure readiness. Therefore, a planned adoption strategy and collaboration between the government, industry players, and technology developers are needed. Overall, blockchain has the potential to become a crucial pillar in the future digital transformation of supply chains, especially when supported by the integration of other technologies such as the Internet of Things (IoT) and artificial intelligence (AI).

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