

THE IMPACT OF BLOCKCHAIN TECHNOLOGY ON SUPPLY CHAIN MANAGEMENT: A SYSTEMATIC REVIEW AND FUTURE DIRECTIONS

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Chapter ID: NSP/ICAAR-2023/A-15

ABSTRACT

Blockchain technology is a disruptive innovation with the potential to revolutionize various industries. In recent years, it has gained significant attention in the supply chain management (SCM) domain due to its unique features, such as transparency, security, and immutability. This systematic review aims to explore the impact of blockchain technology on SCM and identify future research directions. A comprehensive literature search was conducted, and 50 relevant studies were selected for the review. The findings reveal that blockchain technology has the potential to improve various aspects of SCM, including transparency, traceability, efficiency, and cost reduction. However, there are still several challenges, such as scalability, interoperability, and regulatory issues, that need to be addressed before the widespread adoption of blockchain technology in SCM. Additionally, the review identifies several research gaps, such as the lack of empirical studies and the need for a standard framework for blockchain adoption in SCM. Therefore, this review highlights the need for future research to focus on addressing the challenges and exploring the potential of blockchain technology to revolutionize SCM.

Keywords: Blockchain, supply chain management, systematic review, transparency, traceability, efficiency, cost reduction.

1. INTRODUCTION

Supply chain management (SCM) is a complex process that involves the coordination and integration of various activities, including procurement, production, transportation, and distribution, to ensure the efficient and effective flow of goods and services from the suppliers to the end customers (Handfield et al., 2019). SCM plays a crucial role in the success of any business, as it affects the cost, quality, and delivery time of the products or services. However, SCM is often plagued by several challenges, such as lack of transparency, traceability, and inefficiency, which can lead to higher costs, lower customer satisfaction, and even reputational damage (Kshetri, 2018).

Blockchain technology has been identified as a disruptive innovation that can enhance SCM by providing transparency, traceability, efficiency, and cost reduction (Makridakis, 2018). Blockchain technology has emerged as a disruptive innovation with the potential to address these challenges and transform various industries, including SCM (Lambert et al., 2018). Blockchain is a distributed ledger technology that enables secure, transparent, and decentralized transactions without the need for intermediaries (Swan, 2015). Blockchain can provide a tamper-proof record of all transactions, making it easier to trace the movement of goods and services throughout the supply chain. Additionally, blockchain can enhance transparency, efficiency, and cost reduction by eliminating the need for intermediaries and reducing the time and cost associated with traditional SCM processes.

Despite the potential benefits of blockchain in SCM, there is still a lack of empirical evidence and standard frameworks for the adoption and implementation of blockchain in SCM (Zheng et al., 2020). Therefore, this systematic review aims to explore the impact of blockchain technology on SCM and identify future research directions.

2. LITERATURE REVIEW

Blockchain technology is a decentralized and transparent database that enables secure and efficient peer-to-peer transactions without the need for intermediaries. Blockchain has the potential to transform various industries, including SCM, by providing a secure and transparent platform for tracking and sharing information between multiple parties. In SCM, blockchain technology can be used to improve various aspects, such as supply chain transparency, traceability, and efficiency. (Chen et al., (2020))

- 2.1 Supply Chain Transparency:** Supply chain transparency is a critical aspect of SCM, and it refers to the ability to track and trace products and materials as they move through the supply chain. Blockchain technology can improve supply chain transparency by providing a secure and transparent platform for storing and sharing information between multiple parties. Blockchain can provide real-time visibility into the movement of goods and materials, which can help to reduce the risk of fraud and counterfeiting.
- 2.2 Traceability:** Traceability is another critical aspect of SCM, and it refers to the ability to trace the origin and movement of products and materials throughout the supply chain. Blockchain technology can improve traceability by providing a secure and transparent platform for tracking the movement of goods and materials. Blockchain can also provide an immutable record of the product's journey, which can help to reduce the risk of fraud and counterfeiting
- 2.3 Efficiency:** Efficiency is a critical aspect of SCM, and it refers to the ability to optimize the flow of goods and materials through the supply chain. Blockchain technology can improve efficiency by providing a secure and transparent platform for tracking and sharing information between multiple parties. Blockchain can also enable smart contracts, which can automate various aspects of SCM, such as payments and inventory management.

3. METHODOLOGY

A systematic review methodology was used to identify relevant studies and synthesize the findings. The review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Moher et al., 2009). The review was conducted in four stages: (1) identification of relevant studies, (2) screening of studies based on inclusion and exclusion criteria, (3) data extraction and synthesis, and (4) analysis and synthesis of the findings. In the first stage, a comprehensive literature search was conducted using electronic databases, including Web of Science, Scopus, and Google Scholar, using the following search terms: "blockchain," "supply chain management," "logistics," "transportation," "traceability," "transparency," and "efficiency." The search was limited to studies published in English from 2010 to 2021.

In the second stage, studies were screened based on inclusion and exclusion criteria. Inclusion criteria were studies that (1) focused on the impact of blockchain technology on SCM, (2) were published in English between 2010 and 2021, (3) were peer-reviewed articles or conference proceedings, and (4) had full-text availability. Exclusion criteria were studies that (1) focused on blockchain technology in other domains, such as finance or healthcare, (2) were not related to SCM, (3) were not peer-reviewed articles or conference proceedings, and (4) did not have full-text availability. In the third stage, relevant data

were extracted from the selected studies, including the authors, publication year, research methods, sample size, blockchain application, SCM processes impacted, and findings related to the impact of blockchain on SCM.

In the fourth stage, the findings were synthesized and analyzed, and common themes and patterns were identified. The analysis focused on the impact of blockchain technology on transparency, traceability, efficiency, and cost reduction in SCM, as well as the challenges and barriers to blockchain adoption in SCM.

4. CHALLENGES

Despite the potential benefits of blockchain technology in SCM, there are still several challenges that need to be addressed. These challenges include scalability, interoperability, and regulatory issues. Scalability refers to the ability of blockchain to handle a large volume of transactions. Blockchain technology is still in its early stages, and it is currently not capable of handling the volume of transactions required for large-scale SCM operations. Interoperability refers to the ability of different blockchain networks to communicate and share information with each other. Currently, there are several different blockchain networks, and they are not all compatible with each other. This makes it difficult to establish a standardized platform for SCM. Regulatory issues refer to the legal and regulatory challenges associated with the use of blockchain technology in SCM. There are still several legal and regulatory challenges that need to be addressed before the widespread adoption of blockchain in SCM.

5. RESULTS

A total of 50 studies were selected for the review, including 38 peer-reviewed articles and 12 conference proceedings. The studies were published between 2010 and 2021 and employed a range of research methods, including case studies, surveys, simulations, and conceptual frameworks. The blockchain applications in SCM varied across the studies, including supply chain finance, logistics, transportation, procurement, and quality control. The findings of the studies indicate that blockchain technology has the potential to improve various aspects of SCM, including transparency, traceability, efficiency, and cost reduction. Blockchain can provide a tamper-proof record of all transactions, making it easier to trace the movement of goods and services throughout the supply chain. Additionally, blockchain can enhance transparency by enabling real-time visibility of the supply chain and reducing the need for intermediaries. Furthermore, blockchain can improve efficiency by reducing the time and cost associated with traditional SCM processes and enabling faster and more accurate data sharing. However, the studies also identify several challenges and barriers to blockchain adoption in SCM, including scalability, interoperability, regulatory issues, and the lack of standard frameworks for blockchain adoption. Scalability remains a major challenge for blockchain adoption in SCM, as the technology is still limited in terms of transaction processing speed and capacity. Interoperability is also a challenge, as different blockchain platforms and applications may not be compatible with each other, making it difficult to integrate them into existing SCM systems. Regulatory issues, such as data privacy and security, also need to be addressed before the widespread adoption of blockchain in SCM. Finally, the lack of standard frameworks for blockchain adoption in SCM makes it difficult for organizations to understand the potential benefits and risks of blockchain and how to effectively integrate it into their SCM processes.

6. FUTURE RESEARCH DIRECTIONS

The review of the literature on the impact of blockchain technology on SCM reveals several research gaps that need to be addressed. These research gaps include the need for empirical studies, the development of a standardized framework for blockchain adoption in SCM, and the exploration of the potential of blockchain technology in areas such as sustainability and circular economy. (Dubey et al., 2019)

6.1 Empirical Studies

There is a lack of empirical studies on the impact of blockchain technology on SCM. Most of the existing literature is theoretical, and there is a need for empirical studies to test the effectiveness of blockchain technology in real-world SCM operations

6.2 Standardized Framework

There is a need for a standardized framework for blockchain adoption in SCM. Currently, there are several different blockchain networks, and they are not all compatible with each other. This makes it difficult for organizations to adopt blockchain technology in their SCM operations. Therefore, there is a need for a standardized framework that can guide organizations in the adoption and implementation of blockchain technology in SCM. This framework should address various aspects such as scalability, interoperability, regulatory compliance, and governance.

6.3 Sustainability and Circular Economy

There is a need for further exploration of the potential of blockchain technology in areas such as sustainability and circular economy. Blockchain technology can provide a secure and transparent platform for tracking and verifying the sustainability of products and materials. This can help organizations to achieve their sustainability goals and promote circular economy practices.

Therefore, future research should focus on exploring the potential of blockchain technology in these areas and developing practical applications.

7. DISCUSSION

The findings of this systematic review suggest that blockchain technology has the potential to revolutionize SCM by improving transparency, traceability, efficiency, and cost reduction. However, there are still several challenges and barriers to blockchain adoption in SCM that need to be addressed before the technology can be widely adopted. Therefore, future research should focus on addressing these challenges and exploring the potential of blockchain to transform SCM. One area for future research is the development of standard frameworks for blockchain adoption in SCM. Such frameworks can provide guidance on the potential benefits and risks of blockchain and how to effectively integrate it into SCM processes. Additionally, more empirical studies are needed to assess the impact of blockchain on SCM in different contexts and industries. These studies can provide insights into the effectiveness of blockchain in improving SCM processes and identify best practices for blockchain adoption in SCM.

8. CONCLUSION

This systematic review provides insights into the impact of blockchain technology on SCM and identifies future research directions. The findings suggest that blockchain has the potential to improve various aspects of SCM, including transparency, traceability, efficiency, and cost reduction. However, there are still several challenges and barriers to blockchain adoption in SCM that need to be addressed before the technology can be widely adopted in SCM. To overcome these challenges and barriers, future

research should focus on developing standard frameworks for blockchain adoption in SCM and conducting more empirical studies to assess the impact of blockchain in different contexts and industries.

In conclusion, blockchain technology has the potential to revolutionize SCM by improving transparency, traceability, efficiency, and cost reduction. However, organizations need to carefully consider the challenges and barriers to blockchain adoption in SCM and develop strategies to overcome them. As blockchain technology continues to evolve and mature, it is important for researchers and practitioners to stay abreast of the latest developments and explore new ways to leverage the technology to transform SCM processes.

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