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# A Blockchain Technology Application in Supply Chain Management: Hindrances and Prospects

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***Abstract***

*Traditional supply chain management faces limitations in transparency, traceability, and security. Blockchain technology, characterized by its unchangeable and secure attributes, presents promising remedies for these issues. It has emerged as a transformative advancement with the capacity to overhaul supply chain management. This study emphasizes on the potential of blockchain to transform existing supply chain practices while acknowledging the challenges hindering its widespread adoption. It further explores the applications of blockchain technology in supply chain management, review the existing literatures and identifies key factors mitigating its acceptability, and analyses its prospects. The researchers utilize a mixed-methods strategy, incorporating literature review, case study examination, and interviews with experts. A systematic literature review approach was equally adopted to gather insights from both academic and practitioner literature, and comprehensively reviewed existing academic literature, industry reports, and white papers to understand the current state of knowledge on blockchain technology in supply chain management. The research identifies applications of blockchain technology across diverse supply chains, including food safety, pharmaceuticals, and luxury goods. However, challenges like scalability, interoperability, cost, and regulatory uncertainties remain. Although there are obstacles, blockchain technology has considerable potential to transform supply chain management by improving transparency, traceability, and security. It is recommended that Supply chain practitioners should adopt the potential prospect for an improved Supply chain management.*

**Keywords:** Blockchain, supply chain management, traceability, transparency, security

## INTRODUCTION

Blockchain technology has surfaced as a transformative innovation capable of reshaping supply chain management. Numerous research studies have explored both the advantages and hurdles linked to implementing blockchain in supply chain operations. Wang *et al*. emphasize the potential of blockchain to transform existing supply chain practices while acknowledging the challenges hindering its widespread adoption [1]. Guo *et al*. discuss the opportunities and challenges of blockchain in supply chains, including transparency, intelligent manufacturing, logistics security, sales platformization, and governance ecology [2]. Park demonstrates that blockchain technology can enhance supply chain sustainability performance, indicating a positive outlook for its integration into supply chain management practices [3]. This study explores the current and potential applications of blockchain technology in supply chain management, highlighting the challenges, prospects and seek to answer the following formulated research questions.

i. What factors and obstacles impact the acceptance of blockchain technology in supply chain management?

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ii. What opportunities drive the utilization of blockchain technology in supply chain management?

## LITERATURE REVIEW

Batwa and Norrman examine various uses of blockchain technology in supply chain management and propose a framework for evaluating them [4]. The research tackles the divergent viewpoints among scholars regarding the hype surrounding blockchain and distinguishes between overhyped minor applications and those that are currently more practical, aiding supply chain professionals in assessing the diverse applications of blockchain. The literature also addresses the practical implications of blockchain technology in supply chain management. Cole *et al*. encourage further research into blockchain technology from an operations and supply chain management perspective, identifying potential areas of application and outlining a research agenda for the future [5]. Furthermore, Nath *et al*. introduce a consolidated framework for prioritizing success factors for blockchain-based supply chains, providing actionable recommendations for organizations seeking to implement blockchain technology efficiently within sustainable supply chains [6]. Mazumder and Bhaumik present a pandemic patient records management system based on blockchain technology as a single source to address the several supply chain components that have been impacted by the COVID-19 epidemic, which has brought attention to the necessity of developing a present and future challenges [7]. Yadlapalli *et al*. reported that the current utilisation of blockchain technology in supply chains is primarily focused on three main areas: sourcing, logistics, and finance [8]. The sourcing function, also known as procurement, is particularly crucial in identifying and addressing both internal and external challenges that affect the resilience of the supply chain. Utilising blockchain technology for product traceability ensures that the items originate from conflict-free sources, hence fostering confidence among supply chain participants [9]. Despite the advantages, supply chains are adopting blockchain technology extremely slowly, mostly through pilot projects [10]. There are two categories for the literature on blockchain application in supply chains. The initial research body concentrates on examining the factors affecting the adoption of blockchain technology in supply chains [11–13]. Kamble *et al*. reported that the attitude of users and the perceived use of the technology influence supply chains operating in India's desire to adopt blockchain technology [13]. Queiroz and Wamba revealed different blockchain adoption patterns among professionals stationed in the USA and India [11]. Facilitating conditions, the firm's technological readiness, and technology affinity were shown to be the factors impacting managers' intentions to deploy blockchain technology among SMEs in Malaysia [12]. Queiroz *et al*. identified trust, social influence, facilitating conditions, and effort anticipation as the elements influencing the intention to integrate blockchain technology in supply chains in the Brazilian setting [14].

A second body of research focuses on analysing the obstacles that affect supply networks' use of blockchain technology. Wong *et al*. emphasised that the difficulties affecting the blockchain's adoption in supply chains include the interoperability of various blockchains and the intricacy of the laws and regulations governing its application [12]. Xie *et al*. conducted interviews with supply chain experts from various countries and found that the challenges associated with blockchain implementation include the technology's complexity, high implementation costs, unclear governance guidelines, interoperability between multiple blockchains, and compatibility with other systems already in place [15]. In the Malaysian context, Kiu *et al*. noted that the application of blockchain technology is impacted by factors such as complexity, financial resources, and relative sustainable advantage, as well as market rivalry pressure [16]. The impediments identified by Kouhizadeh *et al*. were a lack of industry involvement, policies, knowledge and competence, cooperation, coordination, and information sharing among supply chain partners, as well as a lack of commitment and support from management [10]. More recently, scalability, implementation costs, and a lack of standards were noted by Caldarelli *et al.* as obstacles to blockchain adoption in clothing supply chains [17].

## RESEARCH METHODOLOGY

This research employed a mixed-methods approach combining qualitative and quantitative methods. The research employs a systematic literature review method to collect insights from academic and

 

industry sources. It extensively examines existing academic literature, industry reports, and white papers to gain a comprehensive understanding of the current understanding of blockchain technology in supply chain management. It analyses the existing successful implementation cases of blockchain technology in various supply chain segments to identify best practices and challenges encountered. Semi-structured interviews with supply chain professionals, technology experts, and industry analysts to gain insights into their perspectives and experiences related to blockchain adoption was conducted (Figures 1 and 2).

## DATA ANALYSIS

This study identified diverse applications of blockchain technology across various sectors of supply chain management as depicted in Figure 3.

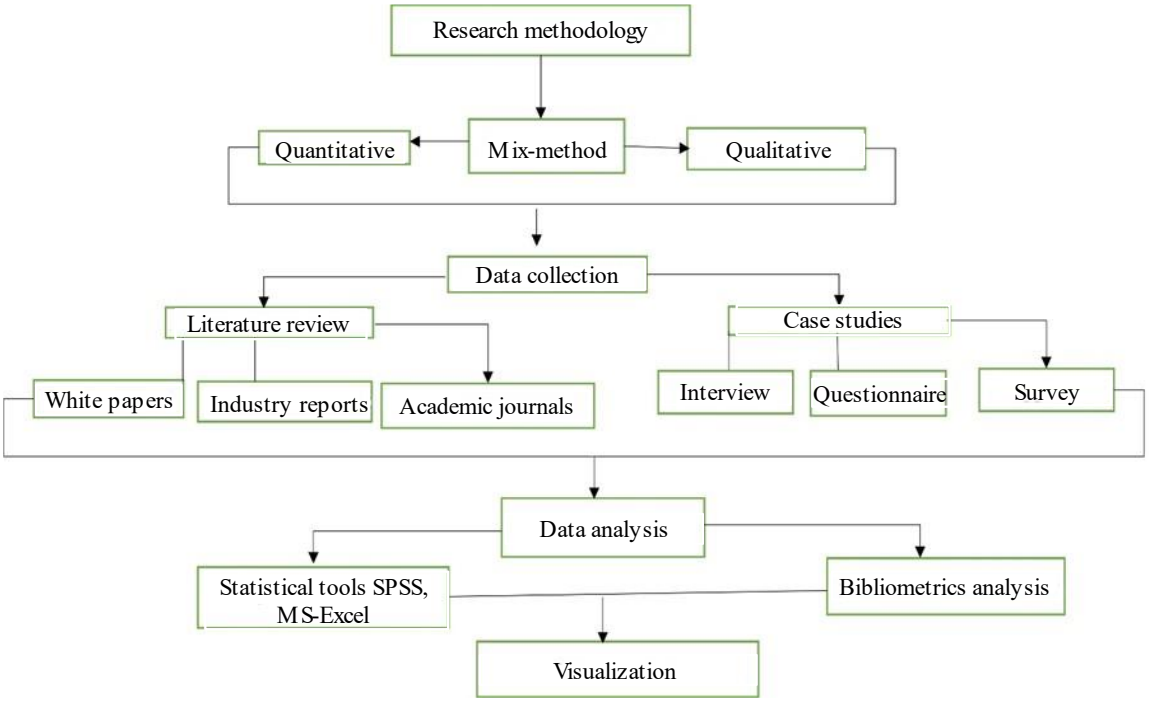


**Figure 1.** Research Methodology Workflow [4].

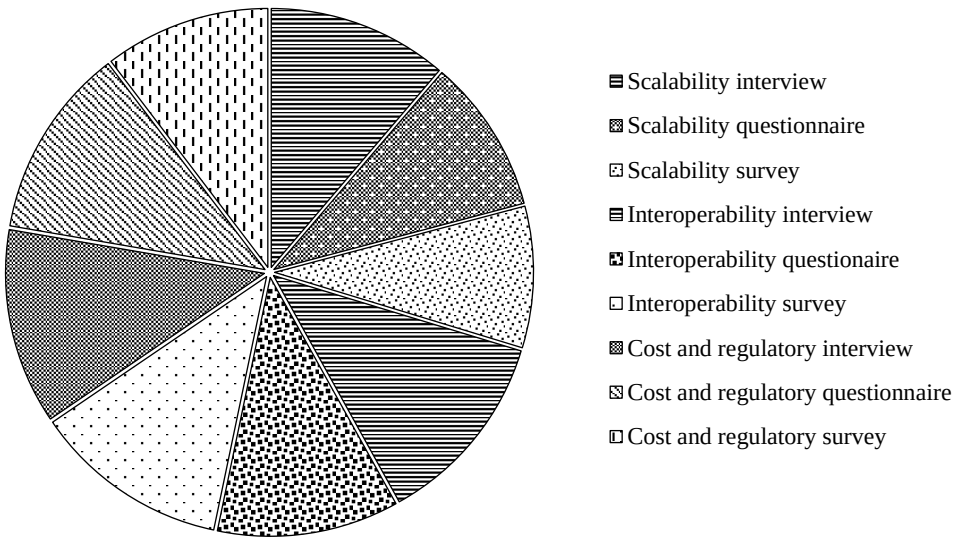


**Figure 2.** Challenges in Adoption of BT in SCM [11].

 

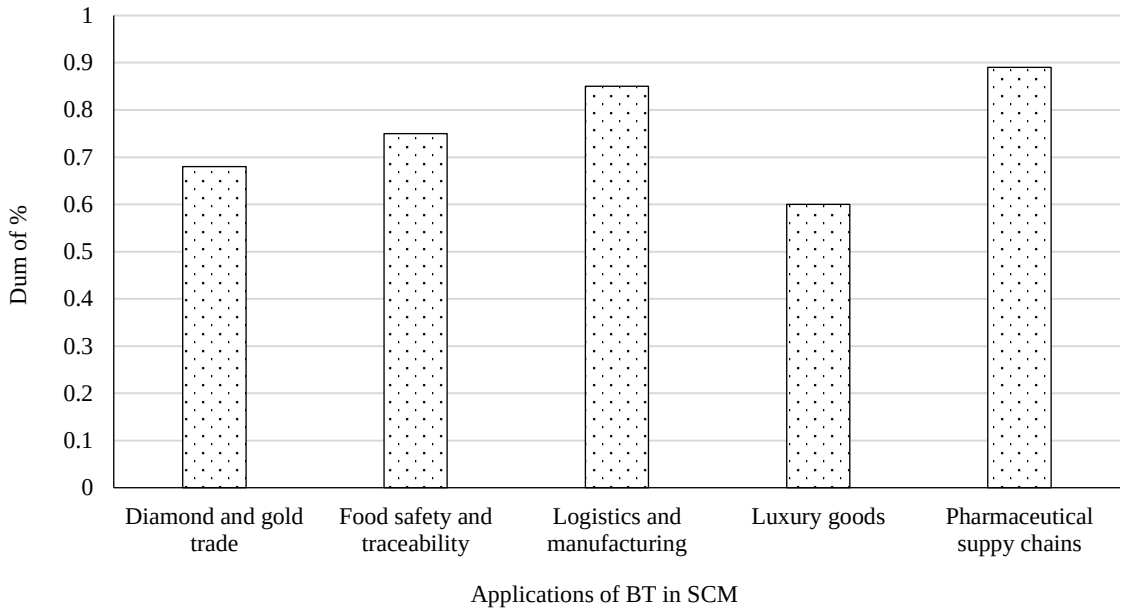


**Figure 3.** Application of Blockchain Technology in SCM [8].

**Table 1.** Challenges in adoption of BT in SCM [11].

| Variables | Methods | Adoption Rate (%) |
|---|---|---|
| Scalability | Interview | 85% |
| | Questionnaires | 77% |
| | Survey | 67% |
| Interoperability | Interview | 95% |
| | Questionnaires | 92% |
| | Survey | 78% |
| Cost & Regulatory | Interview | 96% |
| | Questionnaires | 93% |
| | Survey | 82% |

The variables and challenges affecting the adoption of BT in SCM as shown in Table 1.

## RESULT AND DISCUSSION

- *Food safety and traceability:* Tracking the origin, processing, and transportation of food products to ensure food safety and prevent outbreaks.
- *Pharmaceutical supply chains:* Ensuring the authenticity and provenance of pharmaceuticals to combat counterfeit drugs and maintain quality control.
- *Luxury goods:* Verifying the authenticity and ownership of luxury goods throughout the supply chain to combat counterfeiting and protect brand reputation.
- *Diamond and gold trade:* Tracking the origin and ethical sourcing of diamonds and gold to promote responsible sourcing practices.
- *Logistics and manufacturing:* Streamlining shipment tracking, improving visibility into inventory levels, and facilitating secure and efficient cross-border trade.

These applications demonstrate the potential of blockchain technology to enhance various aspects of supply chain management as shown in Figure 4.

- *Transparency:* Every member of the network can view a common ledger, ensuring visibility into the progress and location of products across the supply chain.

 

- *Traceability:* Blockchain facilitates tracking the origin and journey of goods with high accuracy, enabling efficient recalls and identifying potential contamination points.
- *Security:* Cryptographic algorithms and the decentralized ledger system guarantee the confidentiality and integrity of data stored on the blockchain.
- *Efficiency:* Blockchain can automate processes, reduce paperwork, and improve collaboration between different stakeholders, leading to increased efficiency and cost savings.

Despite the potential benefits, the study also identified challenges hindering the widespread adoption of blockchain technology in supply chain management as shown in Figure 5.

- *Scalability:* Existing blockchain platforms might not be scalable enough to handle the vast amount of data generated in complex global supply chains.
- *Interoperability:* Diverse blockchain platforms frequently lack uniform protocols, impeding smooth data interchange and cooperation among various systems.
- *Cost and complexity:* Deploying and managing blockchain infrastructure can incur substantial expenses and complexity, demanding considerable investment and expertise.
- *Regulatory uncertainty:* The regulatory environment related to blockchain technology is dynamic, posing uncertainties for businesses contemplating its implementation.
- *Resistance to change:* Existing industry practices and established business models might create resistance to adopting new technologies like blockchain.

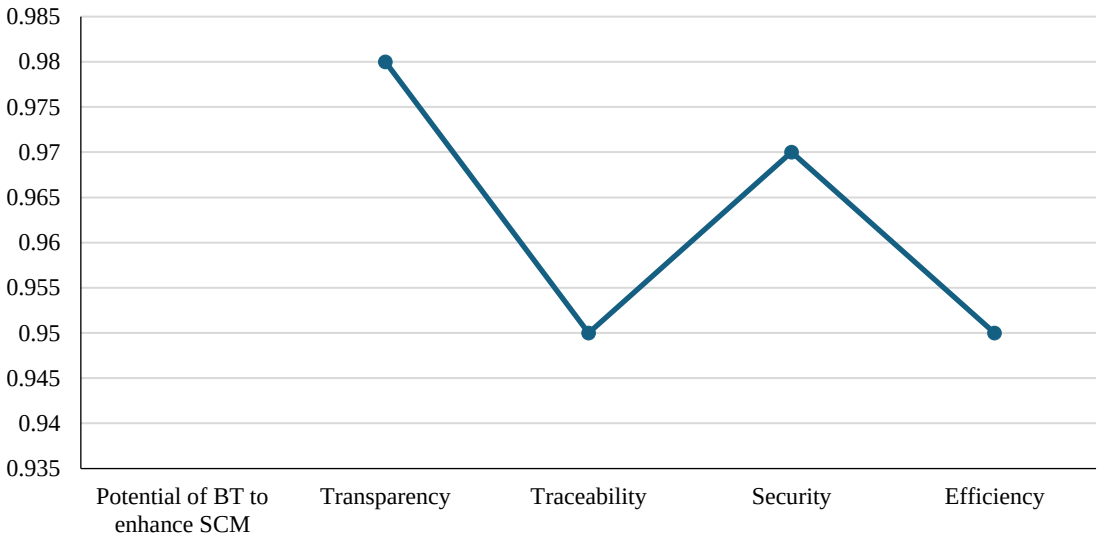


**Figure 4.** Potential of blockchain technology in supply chain management (Kiu et al., 2022) [16].

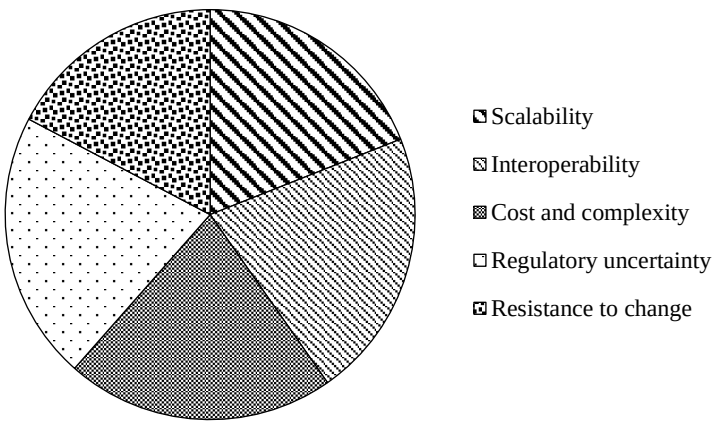


**Figure 5.** Challenges in Adoption of Blockchain Technology in SCM [11].

 

## CONCLUSION, RECOMMENDATION AND FUTURE WORK

The innovative prospect of blockchain technology, its potential to improve supply chain management, has drawn attention in searching the hindrances and prospects of its adoption in supply chain context. While challenges remain, the prospects are bright, indicating that blockchain technology has the potential to revolutionize the industry by fostering a more secure, transparent, and efficient supply chain environment. Continuous efforts to address existing limitations and promote innovation will be crucial for realizing the transformative potential of this technology in the years to come.

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