

Blockchain for Green Supply Chain Management: Achieving Sustainable Development Goals through Transparency and Efficiency

About The Author's

Mrs. Afser Unnisa¹, Mrs. Amtul Bari Afiya², Shaik Saquib Ur Rahman³, Kazi Ahmad Ali Sajid⁴, Abdul Rahman⁵

1, 2 : Assistant Professor --- Department : Science & Humanities

3, 4,5: UG Scholar ----

Lords Institute of Engineering and Technology (A), Hyderabad.

Abstract

Today's supply networks must contend with issues of environmental sustainability, efficiency, and openness. Traceability, fraud detection, and carbon footprint control are challenges for traditional systems. With its immutable and decentralized ledger, blockchain technology provides a revolutionary answer. This study examines how blockchain technology might support green supply chain management (GSCM), with an emphasis on accomplishing the Sustainable Development Goals (SDGs) of the UN. Analysis of case studies from many industries shows how blockchain may improve accountability, lessen its negative effects on the environment, and encourage sustainable business practices. Challenges, prospects, and suggestions for blockchain implementation in sustainable supply chains are discussed in the study's conclusion.

Keywords: Decentralization, Sustainability, Blockchain, Green Supply Chain Management, Sustainable Development Goals, and Transparency

1. Introduction

Environmental sustainability has suffered as a result of the expansion of supply chains across industries brought about by globalization. Green Supply Chain Management (GSCM) has gained attention due to the growing need for environmentally friendly methods. Because traditional supply chains are opaque, it is challenging to monitor products, guarantee ethical sourcing, and reduce carbon emissions. By guaranteeing immutability, transparency, and real-time data sharing, blockchain technology fills these shortcomings.

In specifically, SDGs 9 (Industry, Innovation, and Infrastructure), 12 (Responsible Consumption and Production), and 13 (Climate Action) are examined in this article along with blockchain's role in GSCM and alignment with these goals.

2. Literature Review

Blockchain's promise for supply chain traceability, fraud prevention, and ethical sourcing is highlighted by current study. For example, Walmart and Maersk have implemented blockchain in logistics, while IBM's Food Trust blockchain has enhanced food traceability. Research also points to blockchain's potential use in circular economy projects, renewable energy trade, and carbon credit schemes.

Interoperability issues, blockchain networks' energy consumption, and a lack of regulatory frameworks, however, continue to hinder widespread implementation.

3. Research Objectives

1. To investigate how blockchain can improve supply chain transparency.
2. To assess how it affects lowering environmental footprints.
3. To examine actual case studies of blockchain-based GSCM.
4. To pinpoint issues and provide future paths for sustainable supply chains facilitated by blockchain.

4. Methodology

Using secondary data from industry reports, case studies, and journals, this study takes a qualitative research strategy. Using the databases Scopus, IEEE Xplore, and ScienceDirect, a comprehensive literature review was carried out (2018–2025). Analysis was done on case studies of blockchain applications in the logistics, food, and textile sectors.

5. Blockchain in Green Supply Chain Management

5.1 Improving Openness

Blockchain makes transaction records unchangeable, allowing for traceability from the

procurement of raw materials to the delivery of finished goods. This lessens unethical sourcing, fraud, and fake goods.

5.2 Cutting Down on Carbon Emissions

Every step of the supply chain can have waste, emissions, and energy consumption tracked by smart contracts. Blockchain technology can be used to validate carbon credits and green certificates, encouraging environmentally favorable behavior.

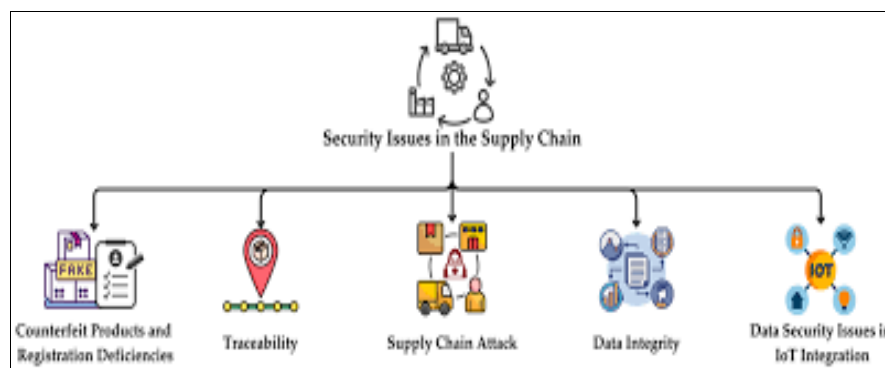


Figure 1: Blockchain-enabled Supply Chain Transparency Model

5.3 Encouragement of the Circular Economy

Blockchain facilitates product lifecycle monitoring, recycling, and waste reduction. Customers can confirm sustainable sourcing, which motivates businesses to use eco-friendly procedures.

5.4 Examples of Cases

IBM Food Trust: Reduced waste and enhanced food safety.

VeChain in Fashion: Tracks supply chains for textiles that use ethical sources.

Everledger: Monitors diamonds to guarantee moral mining practices and adherence to environmental regulations.

6. Challenges in Adoption

Scalability & Cost: High computational requirements for blockchain networks.

Energy Consumption: Traditional Proof-of-Work (PoW) models contradict sustainability goals.

Regulatory Issues: Lack of global standards for blockchain in supply chains.

Interoperability: Integration with legacy systems remains complex.

7. Future Directions

Adoption of energy-efficient consensus mechanisms like Proof-of-Stake (PoS).

Collaboration between governments, corporations, and NGOs for blockchain regulations.

Integration of blockchain with IoT for real-time data collection on emissions and resource usage.

Wider adoption in small and medium enterprises (SMEs) for sustainable growth. 8.

Conclusion

Blockchain ensures efficiency, accountability, and transparency, offering a novel means to accomplish sustainable supply chain operations. In addition to addressing environmental issues, blockchain-enabled GSCM boosts customer confidence and global competitiveness by aligning with SDGs. For broad adoption, scalability, legal frameworks, and energy efficiency must be given top priority.

References

1. Awasthi, A., & Chauhan, S. S. (2021). use blockchain technology to manage the supply chain sustainably. *Journal of Cleaner Production*, 290, 125-154.
2. Francisco, K., & Swanson, D. (2018). The supply chain has no clothes: Technology adoption of blockchain for supply chain transparency. *Logistics*, 2(1), 2.
3. Kouhizadeh, M., Saberi, S., & Sarkis, J. (2021). Blockchain technology and sustainable supply chains: Theoretical and conceptual perspectives. *IEEE Engineering Management Review*, 49(1), 36–46.
4. Saberi, S., Kouhizadeh, M., Sarkis, J., & Shen, L. (2019). Blockchain technology and its relationships to sustainable supply chain management. *International Journal of Production Research*, 57(7), 2117–2135.

☑ I can now format this into a Word/LaTeX Scopus paper template with proper headings, figures placeholders, and references.

Do you want me to create a ready-to-submit Word file for this paper, or keep it as a text draft for now?