

Blockchain-Based Supply Chain Management for Enhanced Transparency and Traceability

A Decentralized Framework for Improving Efficiency and Trust in Global Logistics

Authors

Dr. Arjun Malhotra

Professor, Department of Computer Engineering
Global Institute of Technology and Management
Email: arjun.malhotra@gitm.edu.in
Mobile: +91 98981 23456

Ms. Kavya Shah (*Corresponding Author*)

Research Associate, Department of Information Systems
Global Institute of Technology and Management
Email: kavya.shah@gitm.edu.in
Mobile: +91 97654 78901

Dr. Rohan Iyer

Associate Professor, Department of Business Analytics
Global Institute of Technology and Management
Email: rohan.iyer@gitm.edu.in
Mobile: +91 98234 56789

Authors' Designations

- Professor, Department of Computer Engineering
- Research Associate, Department of Information Systems
- Associate Professor, Department of Business Analytics

Authors' Institute

Global Institute of Technology and Management (GITM)

Address

Global Institute of Technology and Management
Innovation Valley Campus
Gandhinagar-Ahmedabad Highway
Gandhinagar, Gujarat 382421, India

Abstract

Modern supply chains involve multiple stakeholders, including manufacturers, suppliers, distributors, logistics providers, and retailers. The increasing complexity of these

networks often results in limited visibility, data inconsistencies, and challenges in product traceability. This study proposes a blockchain-based framework for supply chain management that enhances transparency, security, and operational efficiency through decentralized record-keeping.

The proposed system integrates blockchain technology with Internet of Things (IoT) sensors and smart contracts to enable real-time monitoring and automated verification of supply chain events. Every transaction and product movement is recorded on a distributed ledger, ensuring data immutability and reducing the risk of fraud, counterfeiting, and unauthorized modifications.

A prototype implementation was evaluated using a pharmaceutical supply chain scenario involving multiple stakeholders. Performance analysis demonstrated a 35% reduction in product verification time, a 27% improvement in inventory visibility, and a significant decrease in administrative overhead compared with traditional centralized systems.

The findings indicate that blockchain technology can transform supply chain operations by improving trust, accountability, and end-to-end traceability. However, challenges related to scalability, interoperability, regulatory compliance, and implementation costs must be addressed to enable widespread adoption.

Keywords

Blockchain, Supply Chain Management, Smart Contracts, Internet of Things, Traceability, Logistics, Distributed Ledger Technology, Transparency

References

- [1] Kshetri, N. (2018). "Blockchain's roles in strengthening cybersecurity and protecting privacy." *Telecommunications Policy*, 42(4), 303–309.
- [2] 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.
- [3] Casino, F., Dasaklis, T. K., & Patsakis, C. (2019). "A systematic literature review of blockchain-based applications: Current status, classification, and open issues." *Telematics and Informatics*, 36, 55–81.
- [4] Francisco, K., & Swanson, D. (2018). "The supply chain has no clothes: Technology adoption of blockchain for supply chain transparency." *Logistics*, 2(1), 2.
- [5] Queiroz, M. M., & Wamba, S. F. (2019). "Blockchain adoption challenges in supply chain: An empirical investigation." *International Journal of Information Management*, 46, 70–82.