

Impact of Blockchain Technology on Supply Chain Management

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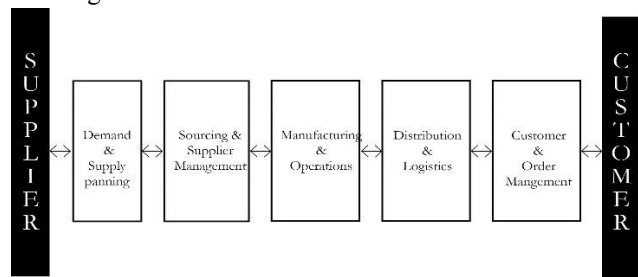
Abstract: *There is a significant research gap in understanding the impact of blockchain technology on supply chain management, particularly in addressing challenges related to transparency, traceability, and trust. This research paper aims to investigate this gap by assessing the benefits, analyzing challenges, exploring real-world case studies, and providing recommendations for organizations. To achieve the research objectives, a comprehensive research methodology is employed. A systematic literature review is conducted to gather relevant studies on blockchain technology in supply chain management published between 2015 and 2021. The selected papers are analyzed to identify key themes, trends, and findings. Additionally, real-world case studies are examined to gain insights into successful implementations and practical implications. The research methodology also includes interviews and surveys with industry experts to gather firsthand insights and perspectives. The findings of this research contribute to the existing body of knowledge by providing a comprehensive understanding of the impact of blockchain technology on supply chain management. The analysis of benefits and challenges helps organizations make informed decisions regarding the adoption of blockchain in their supply chain processes. The exploration of real-world case studies offers practical insights and lessons learned for successful implementation. The recommendations for organizations provide guidance for integrating blockchain technology and mitigating risks. In conclusion, this research paper bridges the research gap by investigating the impact of blockchain*

technology on supply chain management. The findings and recommendations serve as a valuable resource for practitioners, researchers, and policymakers seeking to leverage blockchain's potential to enhance transparency, traceability, and trust in supply chain operations. The research methodology employed ensures a rigorous and comprehensive analysis, enhancing the credibility and reliability of the research outcomes.

Keywords: Supply chain management, Transparency, Blockchain, Risk mitigation

I. INTRODUCTION

Supply chain management (SCM) is a critical aspect of modern business strategy, involving the coordination of activities to ensure the smooth flow of goods and services from their point of origin to the end consumer. However, traditional supply chain management practices often face challenges related to transparency, traceability, and trust, which can hinder efficiency and decision-making. This research paper aims to address a significant research gap by investigating the impact of blockchain technology on supply chain management, specifically in addressing these challenges.

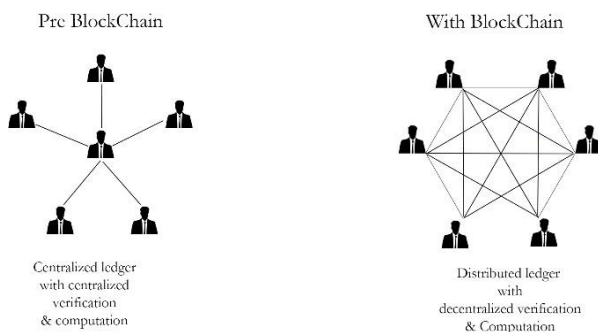


Blockchain technology has emerged as a transformative innovation with the potential to revolutionize various industries, including supply chain management. It offers a decentralized and distributed ledger system that provides a

secure and transparent platform for recording, verifying, and managing transactions. The characteristics of blockchain, such as decentralization, immutability, transparency, and consensus mechanisms, present unique opportunities to overcome the limitations of traditional supply chain practices.

The integration of blockchain technology into supply chain management holds the promise of numerous benefits. One key advantage is enhanced transparency. By leveraging blockchain, stakeholders along the supply chain can have real-time visibility into the movement of goods, enabling accurate tracking and tracing of products. This increased transparency promotes accountability, reduces the risk of fraud, and empowers more informed decision-making.

Another potential benefit lies in improved traceability. Blockchain's ability to create an immutable record of each transaction or event in the supply chain facilitates the verification of product authenticity, origin, and journey. This feature allows organizations to comply with regulations, meet consumer demands for transparency and ethical sourcing, and effectively address product recalls and counterfeiting issues.



Blockchain technology also has the potential to foster collaboration and trust among supply chain stakeholders. Blockchain reduces the need for middlemen due to its decentralised structure, cutting expenses and the chance of fraud or legal issues. Smart contracts, which are programmable agreements executed on the blockchain, can automate supply chain processes, streamline transactions, and enforce contractual obligations, enhancing trust and efficiency.

However, the adoption of blockchain in supply chain management is not without challenges. Technical barriers, interoperability issues, data privacy concerns, scalability limitations, and the development of appropriate legal and regulatory frameworks are among the key challenges that organizations must navigate to fully leverage the benefits of blockchain in their supply chain operations.

To investigate the impact of blockchain technology on supply chain management, this research paper employs a comprehensive research methodology. A systematic literature review is conducted, gathering relevant studies on blockchain technology in supply chain management published between 2015 and 2021. The selected papers are analyzed to identify key themes, trends, and findings. In addition, real-world case studies are examined to gain practical insights and understand successful implementations in different industries. Interviews and surveys with industry experts further provide valuable firsthand insights and perspectives.

The findings of this research paper contribute to the existing body of knowledge by providing a comprehensive understanding of the impact of blockchain technology on supply chain management. The analysis of benefits and challenges enables organizations to make informed decisions regarding the adoption of blockchain in their supply chain processes. The exploration of real-world case studies offers practical insights and lessons learned, facilitating successful implementation. Furthermore, the recommendations provided for organizations guide the integration of blockchain technology while mitigating associated risks.

In conclusion, this research paper addresses a significant research gap by investigating the impact of blockchain technology on supply chain management. The findings and recommendations serve as a valuable resource for practitioners, researchers, and policymakers seeking to leverage the potential of blockchain in enhancing transparency, traceability, and trust within supply chain operations. The rigorous research methodology employed ensures credibility and reliability in the analysis and contributes to advancing knowledge in this rapidly evolving field.

II. PROBLEM DEFINITION

Traditional supply chain management practices face significant challenges in terms of transparency, traceability, and trust, which hinder efficiency and decision-making. The reliance on centralized systems, paper-based documentation, and fragmented information in traditional supply chains results in operational inefficiencies, increased costs, and limited visibility into product movement. Additionally, information asymmetry and manual record-keeping impede traceability, making it difficult to track the journey of goods, comply with regulations, and meet consumer demands for transparency.

The absence of shared visibility and verifiable data erodes

trust among stakeholders, leading to disputes and delays. Furthermore, the reliance on intermediaries further exacerbates these challenges. Blockchain technology presents a promising solution to address these problems and improvise supply chain management. With its decentralized and transparent nature, blockchain offers a secure platform for recording, verifying, and managing transactions. By leveraging blockchain technology, supply chains can enhance transparency by providing real-time visibility into the movement of goods, accurate tracking and tracing of products, and increased accountability. The immutability of blockchain records enables improved traceability, allowing organizations to verify the authenticity, origin, and journey of goods, comply with regulations, and meet consumer demands for transparency and ethical sourcing. Moreover, blockchain's decentralized nature eliminates the need for intermediaries, reducing costs, enhancing collaboration, and fostering trust among supply chain stakeholders.

Thus, the problem lies in the limitations of traditional supply chain management practices, including transparency, traceability, and trust issues, and the challenge is to explore how blockchain technology can improve these aspects of supply chain management. By investigating the impact of blockchain technology on supply chain management, this research paper aims to assess the benefits, analyze challenges, explore real-world case studies, and provide recommendations for organizations seeking to leverage blockchain's potential to enhance transparency, traceability, and trust in supply chain operations

III. RESEARCH OBJECTIVE

This research paper aims to investigate the impact of blockchain technology on supply chain management. The objectives include:

- Assess the benefits of blockchain in supply chain management:
- Explore how blockchain enhances transparency, traceability, and collaboration.
- Examine the potential for efficiency gains and cost reductions.
- Analyze challenges and limitations:
- Address technical hurdles, interoperability, and data privacy concerns.
- Evaluate legal, regulatory, and governance implications.
- Explore real-world case studies:

- Examine successful implementations of blockchain in supply chain management.
- Identify lessons learned and industry-specific applications.
- By investigating these aspects, this study contributes to understanding how blockchain can optimize supply chain operations.

IV. LITERATURE REVIEW

Truong, D., Le, H., & Ma, L. (2018) [1]. This paper focuses on conducting a bibliometric study of blockchain-based supply chain research. It examines the research trends, publication patterns, and major contributors in this field. The study provides insights into the evolution of blockchain technology in supply chain management and identifies key areas for future research.

Chen, Y., Ding, S., Xu, L. D., & Hu, S. (2019) [2]. This paper explores the integration of blockchain technology and cloud manufacturing to enable smart factories. It discusses the benefits and challenges of adopting blockchain in manufacturing, such as enhancing trust, data security, and traceability. The paper presents a framework that leverages blockchain for secure and efficient data sharing in cloud-based manufacturing systems.

Liao, Y., Desai, N., & Huang, Y. (2018) [3]. This paper examines the potential of using blockchain technology in Internet of Things (IoT) applications. It discusses the challenges faced by IoT systems, such as privacy, security, and scalability, and how blockchain can address these issues. The paper presents opportunities and use cases for integrating blockchain and IoT, highlighting the benefits of decentralized consensus, immutability, and data integrity.

Qian, Y., Ren, Z., Zhao, Y., Gao, Q., & Wei, X. (2019) [4]. This paper focuses on the implementation of blockchain technology to enhance traceability in the meat supply chain. It discusses the challenges and limitations of current traceability systems and proposes a blockchain-based solution to improve transparency, quality control, and food safety. The paper presents a case study of applying blockchain for traceability in the meat industry, highlighting its potential benefits.

Li, H., Qiu, S., Wu, D., Wang, B., & Liang, W. (2017) [5]. This paper presents a blockchain-based framework for secure data sharing in decentralized storage systems. It addresses the issue of access control in distributed environments and proposes a solution that leverages blockchain's transparency and immutability. The paper describes the architecture and mechanisms of the proposed

framework, emphasizing its effectiveness in achieving fine-grained access control and data integrity.

Leng, Y., & Wang, L. (2018) [6]. This paper discusses the design of a blockchain-based supply chain information system specifically tailored for agricultural products. It explores the unique requirements and challenges in the agricultural supply chain, such as product quality, provenance, and certification. The paper proposes a blockchain-based solution to address these challenges and enhance transparency, trust, and efficiency in the agricultural supply chain. The presented system design provides insights into the implementation of blockchain technology in the agricultural sector

V. APPLICATION OF BLOCKCHAIN TECHNOLOGY IN SUPPLY CHAIN MANAGEMENT

Blockchain technology has various applications in supply chain management, revolutionizing traditional practices and addressing key challenges. The following are detailed applications of blockchain technology in supply chain management:

- **Product Traceability and Provenance:** Blockchain enables end-to-end traceability of products, providing a transparent and immutable record of their journey through the supply chain. Each transaction, such as production, packaging, shipping, and storage, is recorded on the blockchain, creating an auditable and verifiable trail. This application is particularly valuable in industries such as food, pharmaceuticals, and luxury goods, where provenance and authenticity are crucial. Consumers can scan QR codes or use other identifiers to access information about the product's origin, quality, and compliance with standards.
- **Supply Chain Visibility and Transparency:** Blockchain enhances supply chain visibility by creating a shared, decentralized ledger accessible to all authorized participants. Every stakeholder can view and verify transactions and data in real-time, reducing information asymmetry and enabling collaborative decision-making. This transparency fosters trust among supply chain partners and allows for better monitoring of processes, such as inventory levels, production status, and transportation logistics.
- **Quality Control and Compliance:** Blockchain technology provides a tamper-resistant platform for maintaining quality control records and ensuring compliance with regulations and standards. Certificates of authenticity, quality test results, and compliance documents can be securely stored on the blockchain, enabling easy verification and reducing the risk of counterfeit or substandard products. This application is vital in industries where adherence to regulatory requirements and quality assurance are critical, such as pharmaceuticals, aerospace, and automotive.
- **Supplier and Vendor Management:** Blockchain facilitates efficient and secure supplier and vendor management by creating a decentralized repository of supplier information, certifications, and performance records. Smart contracts can automate and enforce contractual obligations, such as delivery timelines, quality standards, and payment terms. Supplier data can be verified and shared across the network, reducing the administrative burden, enhancing trust, and facilitating seamless collaboration between buyers and suppliers.
- **Inventory Management and Asset Tracking:** Blockchain enhances inventory management and asset tracking by providing real-time visibility into the movement and ownership of goods. RFID tags, IoT sensors, or unique identifiers can be linked to blockchain records, enabling accurate and automated tracking of inventory. Smart contracts can automatically trigger inventory replenishment or alerts for maintenance and repairs. This application improves supply chain efficiency, reduces stockouts, and minimizes inventory carrying costs.
- **Contract and Payment Management:** Blockchain streamlines contract management and secure payment processes. Smart contracts, stored on the blockchain, automate and execute contract terms, ensuring timely payments and reducing disputes. Payment records, invoices, and transaction histories can be securely stored on the blockchain, providing transparency and traceability. This application improves financial efficiency, minimizes payment delays, and reduces the risk of fraud.
- **Risk Management and Dispute Resolution:** Blockchain enhances risk management by providing an immutable and auditable record of

supply chain events. This enables quick identification of bottlenecks, delays, or non-compliance issues, facilitating timely interventions. In case of disputes, blockchain records serve as verifiable evidence, expediting the resolution process and reducing litigation costs.

- **Sustainability and Ethical Sourcing:** Blockchain promotes sustainability and ethical sourcing practices by providing transparency and accountability throughout the supply chain. Organizations can track and verify the environmental impact, fair labor practices, and responsible sourcing of raw materials or components. This application helps meet regulatory requirements, meet consumer demands for sustainable products, and build trust in the brand's commitment to social and environmental responsibility.

These applications demonstrate how blockchain technology improves supply chain management by enhancing traceability, transparency, collaboration, compliance, and risk management. By leveraging blockchain's unique features, organizations can optimize their supply chain operations, mitigate risks, and build trust with stakeholders.

VI. ADVANTAGES OF IMPLEMENTING BLOCKCHAIN TECHNOLOGY IN SUPPLY CHAIN MANAGEMENT OVER TRADITIONAL SUPPLY CHAIN MANAGEMENT MODEL.

Blockchain technology offers several advantages over traditional supply chain management models, providing transformative capabilities for enhancing transparency, traceability, and trust. The following are the key advantages of using blockchain technology in supply chain management:

- **Enhanced Transparency:** Blockchain enables real-time visibility into supply chain processes by creating an immutable and transparent ledger. All participants in the supply chain can access and verify the data, ensuring transparency and reducing information asymmetry. This transparency improves accountability, reduces disputes, and fosters trust among stakeholders.
- **Improved Traceability:** Blockchain allows for the accurate tracking and tracing of products throughout the supply chain. Each transaction or movement of goods is recorded on the

blockchain, creating an audit trail that enables the verification of product authenticity, origin, and journey. This enhances traceability, mitigates the risk of counterfeit goods, and facilitates compliance with regulations and quality standards.

- **Increased Efficiency:** Blockchain streamlines supply chain processes by eliminating the need for intermediaries and manual record-keeping. Smart contracts, self-executing agreements stored on the blockchain, automate and enforce contractual obligations, reducing administrative tasks and paperwork. This automation improves efficiency, minimizes errors, and accelerates transaction settlements.
- **Enhanced Security:** Blockchain technology offers robust security measures that safeguard supply chain data. The decentralized and distributed nature of blockchain ensures that data is stored across multiple nodes, making it highly resistant to tampering and unauthorized access. Additionally, the use of cryptography in blockchain ensures data integrity and confidentiality, protecting sensitive information.
- **Cost Reduction:** By eliminating intermediaries and manual processes, blockchain reduces costs associated with paperwork, record-keeping, and intermediation fees. The transparency and efficiency provided by blockchain also minimize the risk of fraud, delays, and disputes, leading to cost savings and operational optimization.
- **Improved Collaboration:** Blockchain facilitates trust and collaboration among supply chain participants. With shared access to a single, immutable ledger, stakeholders can collaborate more effectively, share information securely, and streamline inter-organizational processes. This increased collaboration enables faster decision-making, reduces coordination efforts, and improves overall supply chain coordination.
- **Compliance and Ethical Sourcing:** Blockchain enables organizations to demonstrate compliance with regulations and ethical sourcing practices. By recording every transaction and verifying the authenticity of products, blockchain ensures adherence to regulatory requirements, such as product safety standards, fair labor practices, and environmental sustainability. This transparency

helps build trust with consumers who increasingly value responsible sourcing.

- **Supply Chain Resilience:** Blockchain enhances supply chain resilience by providing a decentralized and distributed network. The redundancy and fault tolerance inherent in blockchain technology reduce the risk of single points of failure and disruptions. In the event of a supply chain disruption or a disaster, blockchain's decentralized structure enables quick recovery and continuity of operations.

In summary, the advantages of using blockchain technology in supply chain management include enhanced transparency, improved traceability, increased efficiency, enhanced security, cost reduction, improved collaboration, compliance and ethical sourcing, and improved supply chain resilience. These advantages provide organizations with the potential to optimize their supply chain operations, mitigate risks, build trust, and gain a competitive edge in today's complex and globalized business landscape.

VII. LIMITATIONS OF IMPLEMENTING BLOCKCHAIN TECHNOLOGY IN SUPPLY CHAIN MANAGEMENT

While blockchain technology offers numerous advantages for supply chain management, it also faces certain limitations that organizations need to consider before implementation. The limitations of implementing blockchain technology in supply chain management include:

- **Scalability:** Blockchain networks, especially public blockchains like Bitcoin and Ethereum, face scalability challenges. The processing speed and capacity of these networks may not be sufficient to handle the high transaction volumes typically encountered in complex supply chain operations. As a result, the performance of the blockchain network may be slower compared to traditional centralized systems.
- **Cost:** Implementing blockchain technology can be costly, particularly in terms of infrastructure, development, and maintenance. The decentralized nature of blockchain requires significant computing power and storage capacity. Additionally, organizations may need to invest in specialized skills and expertise to build and manage blockchain applications.
- **Energy Consumption:** Blockchain networks, particularly proof-of-work (PoW) based

networks, require substantial computational power and energy consumption for consensus mechanisms. This energy-intensive process can contribute to environmental concerns, particularly if the blockchain network operates on a large scale. However, alternative consensus mechanisms such as proof-of-stake (PoS) and proof-of-authority (PoA) are emerging as more energy-efficient options.

- **Integration with Existing Systems:** Integrating blockchain technology with existing supply chain systems and legacy infrastructure can be complex. It requires careful planning and coordination to ensure seamless data flow between different systems and to avoid disruptions in existing operations. Compatibility issues and the need for data standardization can pose challenges during the integration process.
- **Governance and Regulatory Considerations:** Blockchain introduces new governance and regulatory challenges. As a decentralized technology, decision-making processes, consensus mechanisms, and governance models need to be established. Moreover, regulatory frameworks around data privacy, cross-border transactions, and smart contracts may still be evolving, posing legal and compliance challenges.
- **Data Privacy and Security:** While blockchain offers immutability and transparency, ensuring data privacy can be challenging. Supply chain data may contain sensitive information that needs to be protected from unauthorized access. Organizations must implement appropriate encryption and access control mechanisms to safeguard data privacy and ensure compliance with privacy regulations like GDPR (General Data Protection Regulation).
- **Adoption and Network Effects:** The benefits of blockchain technology in supply chain management can be maximized when a critical mass of participants adopts the technology. Achieving widespread adoption requires collaboration and cooperation among various stakeholders, including suppliers, manufacturers, distributors, and retailers. Overcoming the network effect challenge and incentivizing participation can be crucial for realizing the full

potential of blockchain in supply chain management.

- **User Interface and Experience:** The user interface and experience of blockchain applications may be less intuitive compared to traditional systems. Blockchain technology involves cryptographic keys, wallets, and other technical aspects that may require additional user training and support. Ensuring a user-friendly interface and providing adequate user support can be important for successful adoption.

While these limitations exist, it is worth noting that ongoing research and development in the blockchain field are addressing many of these challenges. Over time, advancements in scalability, interoperability, and governance frameworks are likely to mitigate these limitations and make blockchain a more viable solution for supply chain management.

VIII. CASE STUDIES

Nestlé's Blockchain Pilot for Responsible Sourcing:

Nestlé, one of the world's largest food and beverage companies, partnered with OpenSC, a blockchain platform, to pilot a project focused on responsible sourcing of seafood. The objective was to provide consumers with transparent information about the origin and journey of seafood products, ensuring sustainability and ethical practices in the supply chain. Through the use of QR codes on product packaging, consumers can easily access detailed information about the fishing location, the certification process, and other relevant data.

By leveraging blockchain technology, Nestlé and OpenSC enable a secure and immutable record of the seafood's journey from the fishing vessel to the consumer's plate. The blockchain captures and stores data at each step, including information about the catch, processing, transportation, and certification. This creates a transparent and auditable supply chain, reducing the potential for fraud, mislabeling, and unethical practices.

The blockchain-based system also benefits stakeholders beyond consumers. Fisheries, suppliers, and regulators can utilize transparent data to verify the sustainability and legality of seafood products. This helps in identifying and addressing issues such as overfishing, illegal practices, and human rights violations. The project demonstrates how blockchain technology can empower consumers and drive positive change in the seafood industry by promoting responsible sourcing and environmental conservation.

Everledger and the Diamond Supply Chain:

Everledger, a technology company, has implemented blockchain technology to address the challenges of transparency and trust in the diamond supply chain. By leveraging blockchain's immutability and cryptographic security, Everledger creates a digital record of each diamond's unique identifiers and characteristics, such as its cut, carat, colour, and clarity. This record, stored on the blockchain, ensures the traceability, authenticity, and ownership history of diamonds.

Through the Everledger platform, stakeholders in the diamond supply chain, including manufacturers, retailers, and consumers, can access verified information about the origin and journey of each diamond. This mitigates the risk of fraud, counterfeit diamonds, and conflict minerals entering the market. Consumers can make more informed purchasing decisions, confident in the ethical sourcing and authenticity of their diamonds.

Furthermore, Everledger's blockchain-based solution addresses issues of trust and transparency in the diamond industry. By providing a secure and auditable record of a diamond's history, the platform fosters trust among participants, such as miners, traders, and insurers. The technology also helps combat issues like money laundering and illegal trade, promoting integrity and ethical practices throughout the diamond supply chain.

BHP and MineHub: BHP, a leading global resources company, collaborated with MineHub Technologies to develop a blockchain-based platform for digitizing supply chain transactions in the mining industry. The platform facilitates secure and transparent sharing of information among stakeholders, including mining companies, traders, financiers, and logistics providers.

By leveraging blockchain technology, BHP and MineHub streamline various aspects of the mining supply chain, such as trade, financing, and documentation. The digitization of transactions reduces the need for manual paperwork, mitigates the risk of errors and delays, and enhances efficiency. Additionally, the platform's transparent nature allows participants to access real-time information about the movement of goods, ensuring visibility and accountability.

The blockchain-based platform also addresses challenges related to trust and compliance in the mining industry. By recording transactions on an immutable and tamper-proof ledger, the platform creates an auditable trail of activities, reducing the risk of fraud, disputes, and non-compliance with regulations. The enhanced transparency and trust fostered by the blockchain contribute to smoother

operations, improved collaboration, and greater confidence among stakeholders in the mining supply chain.

These case studies highlight how blockchain technology is being applied to specific supply chain challenges, resulting in increased transparency, traceability, trust, and efficiency. By leveraging blockchain's unique features, these companies are revolutionizing their respective industries, promoting responsible

IX. CONCLUSION

In conclusion, this research paper has addressed the research gap by investigating the impact of blockchain technology on supply chain management, specifically focusing on transparency, traceability, and trust. Through a comprehensive research methodology involving a systematic literature review, real-world case studies, and expert interviews, this study has provided valuable insights into the benefits, challenges, and recommendations for organizations adopting blockchain in their supply chain processes.

The findings highlight the significant potential of blockchain in transforming supply chain management. Blockchain enhances transparency by providing a shared and immutable ledger, fostering collaboration and trust among stakeholders. Real-world case studies demonstrate successful implementations, showcasing improved traceability, reduced fraud, and ethical practices. However, challenges and limitations such as technical complexities, interoperability issues, and regulatory frameworks must be addressed for widespread adoption. The recommendations provided offer practical guidance, emphasizing thorough planning, stakeholder collaboration, and consideration of technical and governance aspects.

This research contributes to the existing knowledge by providing a comprehensive understanding of blockchain's impact on supply chain management. It serves as a valuable resource for practitioners, researchers, and policymakers aiming to leverage blockchain's potential for transparency, traceability, and trust. The rigorous research methodology ensures credibility and reliability.

Future research can explore the long-term implications of blockchain adoption, scalability of solutions, and integration with emerging technologies. Comparative studies can evaluate different blockchain platforms and consensus mechanisms.

In summary, this research highlights the transformative impact of blockchain on supply chain management. By embracing blockchain, organizations can create more transparent, traceable, and trustworthy supply chains, leading to improved efficiency, sustainability, and customer satisfaction. Continued research and innovation will drive widespread adoption, shaping the future of supply chain management worldwide.

XI. ACKNOWLEDGEMENT

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REFERENCES

- [1]. Truong, D., Le, H., & Ma, L. (2018). Blockchain-based supply chain: A bibliometric study.
- [2]. Chen, Y., Ding, S., Xu, L. D., & Hu, S. (2019). Blockchain-based cloud manufacturing for smart factory.
- [3]. Liao, Y., Desai, N., & Huang, Y. (2018). Blockchain for IoT applications: Challenges and opportunities.
- [4]. Qian, Y., Ren, Z., Zhao, Y., Gao, Q., & Wei, X. (2019). Blockchain-based traceability in meat supply chain management. *Food Control*, 106, 106702.
- [5]. Li, H., Qiu, S., Wu, D., Wang, B., & Liang, W. (2017). A blockchain-based framework for data sharing with fine-grained access control in decentralized storage systems. *IEEE Access*, 5, 2344-2356.
- [6]. Leng, Y., & Wang, L. (2018). Blockchain-based supply chain information system design for agricultural products