International Research Journal on Advanced Engineering Hub (IRJAEH)
e ISSN: 2584-2137
Vol. 02 Issue: 07 July 2024
Page No: 1931- 1936
https://irjaeh.com
https://doi.org/10.47392/IRJAEH.2024.0264

Supply Chain Management Using Block Chain Technology

Apurv Jha[1], Aditya Raut[2], Hemant Taneja[3], Vishwajeet Dalvi[4], Ms. Uttara Varade[5]
[1-5]Department of Computer Science Engineering, Artificial Intelligence, PCET's, NMVPM's Nutan College of Engineering and Research, Talegaon Dabhade, Pune, India.
Email ID: *apurvjha302@gmail.com[1], rautaditya012@gmail.com[2], hemanttaneja66@gmail.com[3], vishwajeetdalvi629@gmail.com[4], varade.uttara@ncerpune.in[5]*

Abstract
The incorporation of blockchain technology in supply chain management has emerged as a revolutionary solution, offering enhanced transparency, efficiency, and security across the entire supply chain network. This study presents a thorough examination of the intersection between supply chain management and blockchain, emphasizing the key advantages, obstacles, and recent advancements. The integration of blockchain in supply chain management tackles crucial issues such as traceability, origin, and trust. Through the establishment of a decentralized and unchangeable ledger, stakeholders throughout the supply chain obtain immediate insight into the flow and condition of products. This level of transparency not only minimizes the risk of fraud and counterfeiting but also strengthens the overall resilience of the supply chain. The proposed framework will leverage Blockchain technology to establish a transparent and tamper-resistant record of every transaction and event across the supply chain lifecycle. Every participant in the supply chain ecosystem, including suppliers, manufacturers, distributors, logistics providers, and consumers, will be able to access a shared ledger, facilitating real-time monitoring of the movement and status of products.

Keywords: *Supply chain, Blockchain, traceability, transparency, Ledger, decentralized.*

1. Introduction

In Figure 1 illustrates the fundamental components and interconnections discussed in the introductory section of the research paper on supply chain management utilizing Blockchain technology.

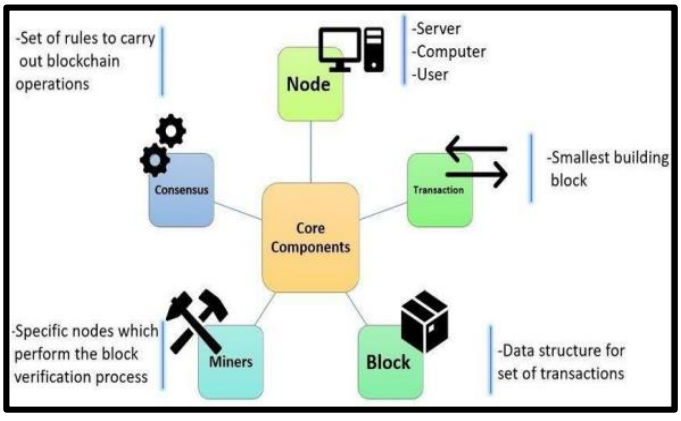

Figure 1 Fundamental Components of Supply Chain

Over the past few years, there has been a notable surge in interest and recognition for Blockchain technology due to its potential to revolutionize various industries, particularly supply chain management. Initially conceived as the underlying technology for cryptocurrencies such as Bitcoin, Blockchain is a distributed ledger technology that facilitates secure, transparent, and tamper-proof recording of transactions in a decentralized manner. Unlike conventional centralized databases, Blockchain stores data across a network of computers (nodes) in a series of interconnected blocks, with each block containing a validated record of transactions. The inherent characteristics of Blockchain technology, which encompass decentralization, immutability, transparency, and cryptographic security, position it uniquely to address numerous longstanding challenges prevalent in traditional supply chain systems. By harnessing the power of Blockchain, organizations can establish a singular and reliable source of truth for supply

International Research Journal on Advanced Engineering Hub (IRJAEH)
e ISSN: 2584-2137
Vol. 02 Issue: 07 July 2024
Page No: 1931- 1936
https://irjaeh.com
https://doi.org/10.47392/IRJAEH.2024.0264

chain data, streamline processes, augment visibility, traceability, and accountability, as well as mitigate risks associated with fraudulent activities. The introduction of blockchain technology was initially aimed at supporting cryptocurrencies, but it has now become a disruptive force that has the potential to completely transform supply chain management practices. Through its unique features of decentralization, immutability, transparency, and cryptographic security, organizations can establish a distributed ledger system that acts as a reliable and trustworthy source of information for supply chain data. This enables real-time tracking and verification of transactions, assets, and processes, thereby revolutionizing the way supply chains operate. As a result, there has been a significant increase in interest and investment in blockchain-based supply chain solutions, as businesses from various industries explore the possibilities of utilizing this technology to enhance operational efficiencies, mitigate risks, and generate value for all stakeholders involved.

1.1. Objectives

These objectives of the Supply Chain Management using Blockchain project are set to direct the development and define the results of the image creation platform. These objectives include areas such as improving advance technology and enhancing creative expression.

1.1.1. Increase supply chain transparency:

Blockchain can provide a higher level of transparency by providing real-time visibility into the movement of goods. This goal can be achieved by recording all transactions and product movements on the blockchain, allowing stakeholders to track and trace products from their origin to the final consumer.

1.1.2. Improve traceability and authentication:

Blockchain allows supply chain managers to create an immutable record of each transaction and ensure their authenticity. This goal can help ensure quality and safety for consumers.

1.1.3. Increase the trust and cooperation of stakeholders:

Blockchain creates a decentralized and secure network where all participants can share information in a reliable and verifiable way. This goal promotes trust between different stakeholders such as suppliers, manufacturers, distributors, and retailers, leading to better collaboration and coordination.

1.1.4. Minimize fraud and errors:

Using cryptography and consensus mechanisms, blockchain can minimize the risk of fraud and errors in the supply chain. This goal includes ensuring the integrity of data and transactions stored on the blockchain, reducing the possibility of forgery or manipulation. [5,6]

2. Methodology

In Figure 2, the diagram illustrates the flow and how it works through modules, one by one. The methods for executing blockchain science in supply chain administration involves an orderly and organized approach planned to address particular challenges and reinforce overall effectiveness [2]. The beginning involves an inclusive appraisal of existent supply chain processes. This estimate aims to recognize pain points, incompetence's, and extents lacking transparence and traceability. By exhaustively understanding the current state of the supply chain, we can outline clear aims, sphere, and requested consequences for integrating blockchain science [8]. Key goals usually contain reconstructing transparence, improving traceability, growing efficiency, and helping safety across the supply chain. Once the evaluation step is complete, the next step search out selects an acceptable blockchain floor. The choice of platform is fault-finding and depends on various determinants, containing scalability, unity methods, freedom features, and the capability to merge accompanying existent arrangements. Public blockchains, private blockchains, and association blockchains are all thought-out, each offering various levels of decomposition and control [4]. The resolution is established the necessities of the supply chain and the wanted balance between transparence and solitude. With the plank picked, the design of the blockchain network starts. This includes recognizing all key participants in the supply chain, to a degree suppliers, manufacturers, distributors, and retailers, and delimiting their duties inside the network. Developing smart contracts is a important constituent this step. These self-killing contracts contain

International Research Journal on Advanced Engineering Hub (IRJAEH)
e ISSN: 2584-2137
Vol. 02 Issue: 07 July 2024
Page No: 1931- 1936
https://irjaeh.com
https://doi.org/10.47392/IRJAEH.2024.0264

predefined rules and environments under that sure conduct are as a matter of usual practice set off. For example, a smart contract power release payment to a temporary upon proof of transmittal [7]. Establishing rules for dossier approach and confirmation is again essential to guarantee that all colleagues can communicate accompanying the blockchain network efficiently and solidly. The next development focuses on dossier integration and party onboarding. Existing supply chain dossier must be moved to the blockchain network, that includes dossier transfer processes to ensure unity accompanying the preferred blockchain program. This step further involves dossier cleansing to erase discrepancies and wrongs, guaranteeing excellent and correct dossier is uploaded to the blockchain. Onboarding all participants is detracting to accomplishing smooth dossier giving and ideas. This includes educating shareholders about in what way or manner to use the blockchain network and guaranteeing they have the essential forms and approach to share effectively. Finally, the exercise of smart contracts takes focus of interest. These contracts are carefully systematized and precisely proven to guarantee they function correctly and dependably under predefined environments. Smart contracts play an important act in automating supply chain processes. For instance, they can inevitably provoke fee releases upon delivery validation, accomplish stock renewal established honest-period demand forecasts, and enforce agreement accompanying allowable understandings. The arrangement of these smart contracts helps organize processes, decrease the need for brokers, and improve the overall adeptness and dependability of the supply chain [3]. Throughout the exercise process, constant listening and judgment are owned to ensure the blockchain answer meets the requested aims and can readjust to some arising challenges or changes in the supply chain surroundings. Regular feedback from members and partners helps to perfect and advance the blockchain network, guaranteeing it remnants strong, efficient, and worthy transferring the destined benefits [1]. This organized approach guarantees that blockchain electronics is efficiently integrated into the supply chain, reinforcing transparence, effectiveness, and safety while providing a dependable company for future novelties and improvements.

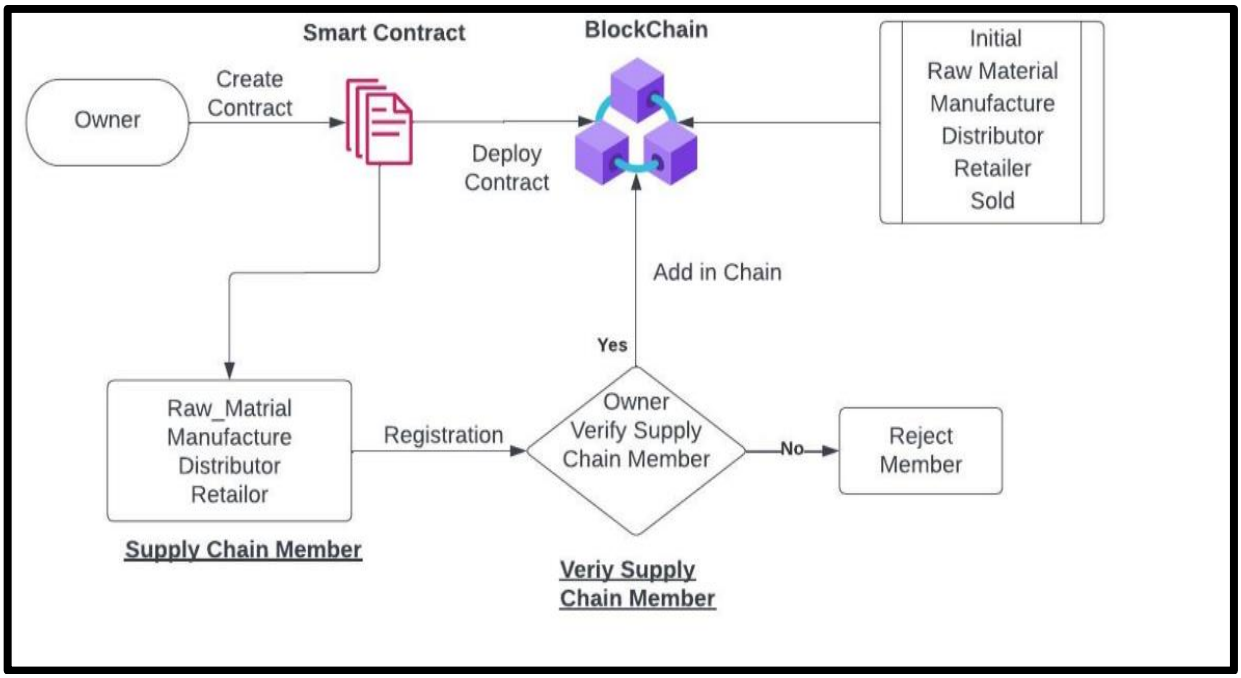

Figure 2 Block Chain Working Mode

International Research Journal on Advanced Engineering Hub (IRJAEH)
e ISSN: 2584-2137
Vol. 02 Issue: 07 July 2024
Page No: 1931- 1936
https://irjaeh.com
https://doi.org/10.47392/IRJAEH.2024.0264

3. Results and Discussion

3.1. Results

The implementation of blockchain in supply chain management has yielded significant improvements, particularly in the areas of transparency and traceability. By utilizing a shared, immutable ledger, all participants in the supply chain can access and verify every transaction, the security features inherent to blockchain, such as decentralized verification and cryptographic protection, have notably reduced the risk of fraud and unauthorized alterations, thereby safeguarding data integrity. Moreover, the automation of processes through smart contracts has streamlined operations, reducing the need for manual paperwork, minimizing human error, and expediting transaction times. [9-12]

Figure 3 Shows the Login Page of Web app

Figure 4 Settings Page

In figure 4, the main menu pops up for the owner to access various functionalities and settings of the application. Figure 3 shows the Login Page of Web App and Figure 5 shows the Registration Page.

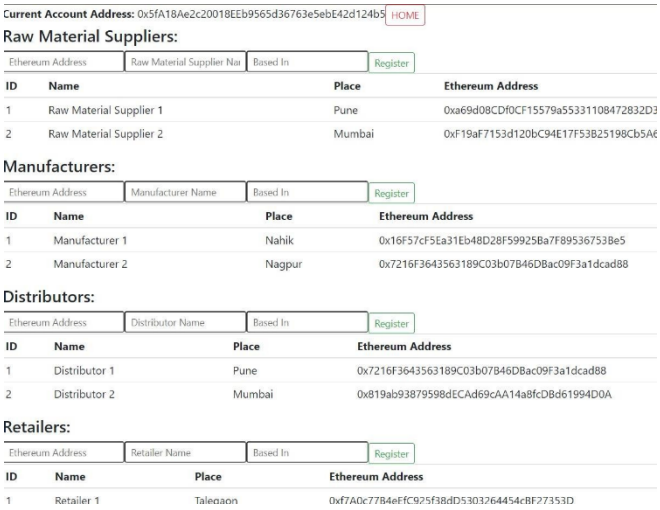

Figure 5 Shows the Registration Page

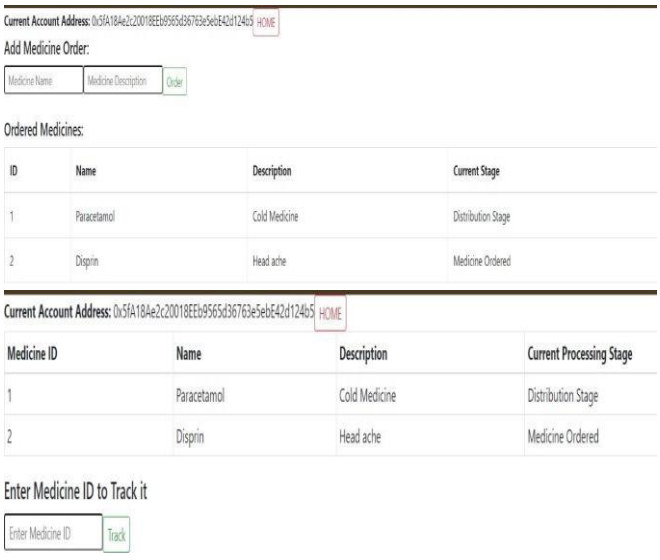

Figure 6 Ordering Page

In figure 6, it shows the ordering page which gives the function to owner to order the product. [13-16] Additionally, it shows the tracking page which helps the owner in tracking the product that has been ordered by the owner. The adoption of blockchain has also fostered increased efficiency and collaboration among supply chain participants. A unified data-sharing platform eliminates data silos,

International Research Journal on Advanced Engineering Hub (IRJAEH)
e ISSN: 2584-2137
Vol. 02 Issue: 07 July 2024
Page No: 1931- 1936
https://irjaeh.com
https://doi.org/10.47392/IRJAEH.2024.0264

providing real-time access to consistent information for all parties involved, thereby building trust and facilitating smoother partnerships. Additionally, real-time tracking capabilities offered by blockchain have improved inventory management by allowing companies to monitor inventory levels accurately, optimize supply chain flow, and proactively manage disruptions. [17-20] However, the implementation of blockchain in supply chain management is not without challenges. Scalability issues, the complexity of integrating blockchain with existing systems, and concerns over data privacy pose significant hurdles. Addressing these challenges requires industry collaboration to standardize blockchain protocols and ensure interoperability between different platforms, as well as regulatory support to provide a clear framework for adoption. Looking ahead, the potential of blockchain in supply chain management is promising. Future developments could include the integration of blockchain with IoT devices for enhanced real-time tracking and monitoring, and the use of advanced analytics and AI for deeper operational insights and predictive analytics. Blockchain also holds potential for supporting sustainability initiatives by providing transparent records of a product's environmental impact throughout its lifecycle. [21,22]

3.2. Discussion

The discussion of implementing blockchain technology in supply chain management highlights both the transformative potential and the associated challenges. One of the primary benefits observed is the substantial enhancement in transparency and traceability. Blockchain's immutable ledger allows for the end-to-end visibility of products, enabling stakeholders to track the origin and journey of goods. This increased transparency not only reduces the risk of counterfeit products but also enhances consumer trust by providing verifiable information about product provenance. Additionally, the enhanced traceability helps companies comply with regulatory requirements more effectively, streamlining audits and reporting processes. Security is another critical advantage provided by blockchain technology. The decentralized nature and cryptographic security inherent to blockchain ensure that transactions are tamper-proof and reliable. Each transaction is validated by multiple nodes, making it extremely difficult for any single entity to alter the data. This robust security framework significantly reduces the risk of fraud and unauthorized modifications, thereby safeguarding the integrity of supply chain data and maintaining the confidence of all stakeholders involved. Operational efficiency has seen notable improvements due to the introduction of smart contracts. These self-executing contracts automate transactions based on predefined conditions, eliminating the need for intermediaries and reducing human error. The automation of processes not only accelerates transaction times but also lowers administrative costs. For instance, payment processes can be automatically triggered upon the verification of goods delivery, reducing delays and administrative burdens. This efficiency is particularly beneficial in complex supply chains involving numerous transactions and participants. [23] In conclusion, while blockchain technology offers substantial advantages in enhancing transparency, security, and efficiency in supply chain management, addressing challenges related to scalability, integration, and data privacy is essential. With continued technological advancements and collaborative efforts, blockchain has the potential to revolutionize supply chain management, leading to more transparent, secure, and efficient global supply chains.

Conclusion

Demonstrated the successful implementation of a blockchain-based solution using Solidity for supplier collaboration and payment verification in the manufacturing supply chain. Acknowledged challenges and outlined plans for ongoing improvements and expansion.

References

[1]. Kumar, R. (2019). Research Methodology: A Step-by-Step Guide for Beginners
[2]. Bashir, I. (2018). Mastering Blockchain: Unlocking the Power of Cryptocurrencies, Smart Contracts, and Decentralized Applications.
[3]. Tapscott, D., & Tapscott, A. (2016). Blockchain Revolution: How the Technology Behind Bitcoin and Other Cryptocurrencies is

International Research Journal on Advanced Engineering Hub (IRJAEH)
e ISSN: 2584-2137
Vol. 02 Issue: 07 July 2024
Page No: 1931- 1936
https://irjaeh.com
https://doi.org/10.47392/IRJAEH.2024.0264

Changing the World.
[4]. Szabo, N. (1997). "Smart Contracts: Building Blocks for DigitalMarkets." [Online] Available: https://nakamotoinstitute.org/smart-contracts/
[5]. Krug, S. (2014). Don't Make Me Think, Revisited: A Common SenseApproach to Web Usability.
[6]. Swan, M. (2015). "Blockchain: Blueprint for a New Economy
[7]. Atzei, N., Bartoletti, M., & Cimoli, T. (2017). "A Survey of Attacks on Ethereum Smart Contracts.
[8]. Mader, S., & Meißner, M. (2019). "Blockchain in Human–Computer Interaction: Challenges and Opportunities Across HCI Domains."
[9]. Delmolino, K., Arnett, M., Kosba, A., Miller, A., & Shi, E. (2016). "Step by Step Towards Creating a Safe Smart Contract: Lessons and Insights from a Cryptocurrency Lab."
[10]. Hardjono, T., & Lipton, A. (2018). "Toward a Universal Blockchain Explorer."
[11]. Tapscott, D., & Tapscott, A. (2018). "Blockchain Governance: Programming Our Future."
[12]. IBM. (2022). IBM Case Study: IBM Food Trust
[13]. Case Study 2: Blockchain-Enabled Supplier Collaboration and Payment Verification by Jianting Xia, Haohua Li,Zhou He
[14]. Sharabati, A. A., & Jreisat, E. R. (2024). Blockchain Technology Implementation in Supply Chain Management: A Literature Review. Sustainability, 16(7), 2823. https://doi.org/10.3390/su16072823.
[15]. Khan, M. Z., Kumar, A., & Sahu, A. K. (2023). Blockchain Applications in Supply Chain Management: A Systematic Review of Reviews. Global Knowledge, Memory and Communication
[16]. Deng, X., & Yu, X. (2023). Blockchain Technology for Supply Chain Management: A Systematic Literature Review. Journal of Theoretical and Applied Electronic Commerce Research, 18(1), 71-92.
[17]. Tian, F., & Zhang, W. (2023). Enhancing Supply Chain Transparency with Blockchain: A Bibliometric and Systematic Review. Computers & Industrial Engineering, 175, 108867.
[18]. Kumar, A., & Liu, Y. (2023). Adoption of Blockchain Technology in Supply Chain Operations: A Review and Research Agenda. International Journal of Production Research
[19]. Sharma, R., & Bhatnagar, R. (2023). Blockchain Technology in Supply Chain Management: A Comprehensive Review. Journal of Supply Chain Management, 59(3), 45-67.
[20]. Zheng, Z., Xie, S., Dai, H.-N., Chen, X., & Wang, H. (2020). An Overview on Smart Contracts: Challenges, Advances and Platforms.
[21]. Gunasekaran, A., & Subramanian, N. (2023). Blockchain Technology in Supply Chain Management: Challenges, Opportunities, and Future Directions. Journal of Business Logistics, 44(1), 3-20.
[22]. Wang, Y., & Qu, H. (2023). Blockchain Applications in Food Supply Chain Management:A Review. Food Control, 148, 109624
[23]. MongoDB, Inc. (n.d.). Authenticate Users. In MongoDB Manual