**BLOCKCHAIN EMPOWERED**

**REVOLUTIONIZING AGRO BASED SUPPLY CHAIN MANAGEMENT**

**LITERATURE SURVEY**

**BATCH NO: 12**

**TEAM MEMBERS:**

Abinesh A - DSUG20104005

Ajai S - DSUG20104008

Aravind A - DSUG20104016

Gopi G - DSUG20104046

**GUIDE:**

Mr. S. Chinnadurai, M.Tech.,

Assistant Professor/CSE

Dhanalakshmi Srinivasan Engineering

College (Autonomous), Perambalur.

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**BLOCKCHAIN EMPOWERED**

**REVOLUTIONIZING AGRO BASED SUPPLY CHAIN MANAGEMENT**

*This work was supported by Mr. S. Chinnadurai, M.Tech.,*

*Assistant Professor / CSE, Dhanalakshmi Srinivasan Engineering College (Autonomous),*

*-* *Abinesh A, Ajai S, Aravind A, Gopi G*

*Final Year/CSE, Dhanalakshmi Srinivasan Engineering College (Autonomous).*

**ABSTRACT**

Agriculture, a vital sector that provides livelihoods to 70% of rural India’s population, faces supply chain challenges that cause huge losses up to 5.99% in cereals and a whopping 40% reduction in farmers’ yields. The current supply chains often lack visibility, impacting only 6% of businesses. Inefficient processes and possible delays in completing orders can adversely affect customer satisfaction and lead to financial losses. Blockchain technology emerges as a powerful solution, allowing all stakeholders to smoothly access and verify the movement of goods along the supply chain. By increasing transparency and trust, blockchain improves inventory management, simplifies logistics, minimizes waste, and ultimately enhances productivity, resulting in significant cost savings. Furthermore, this innovative technology promotes cooperation among farmers, distributors, and consumers, building a resilient ecosystem that supports sustainable agriculture. Blockchain also enables data-driven decision-making, climate-resilient farming, and financial inclusion for smallholder farmers. By leveraging technologies like smart contracts, blockchain creates a secure and efficient platform for agricultural transactions, traceability, and certification. Blockchain also fosters social and environmental responsibility, empowering consumers to choose products that align with their values and preferences. Blockchain thus transforms the agricultural sector, creating a win-win situation for all stakeholders

**INDEX TERMS:** Blockchain, Agriculture Supply chain management, Agro-based industries

Traceability, Smart contracts, Food quality monitoring, Sustainability.

# LITERATURE SURVEY

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| --- | --- | --- | --- |
| **S.No** | **TITLE** | **METHODOLOGY** | **LIMITATIONS** |
| 1 | Blockchain in the Electronics Industry for Supply Chain Management: A Survey | The implementation of blockchain technology and smart contracts to provide a decentralized and secure architecture for supply chain management in the electronics industry | This method may not be able to handle complex or dynamic scenarios that require human intervention or judgment. |
| 2 | Securing Sensing in Supply Chains: Opportunities, Building Blocks, and Designs | The framework for securing supply chains consists of four components: secure sensing, data storage, data sharing, and data processing. It explores four scenarios for end-to-end security in IoT-based supply chains. | The methodology may face issues in complex supply chains, challenges in trust management among actors, and potential performance and cost limitations, especially with blockchain-based solutions. |
| 3 | Blockchain Technology to Support Agri-Food Supply Chains: A Comprehensive Review | The paper uses a systematic literature network analysis (SLNA) to review blockchain technology’s application in agri-food supply chains. It explores the use of blockchain for traceability, transparency, and trust | The challenges including policy and regulations, scalability, less skilled human resources, high investment, interoperability, lack of training for industries and stakeholders, and absence of developer tools. |
| 4 | Blockchain and Smart Contracts for Telecommunications: Requirements vs. Cost Analysis | The paper uses blockchain technology and smart contracts for telecommunications networks. It employs cost analysis and performance evaluation methodologies to study two use cases: 5G slice brokering and federated learning | The main limitation is the need for more resources for high-throughput use cases. Also, factors like cost, performance, and scalability of blockchain infrastructure deployment are often not adequately considered. |
| 5 | Blockchain Adoption in Food Supply Chains: A Systematic Literature Review on Enablers, Benefits, and Barriers | Blockchain, a secure and transparent distributed ledger technology, is studied in this paper using a systematic literature review, a method that rigorously synthesizes existing research on a specific topic. | The expansion of technology use in food supply chains could face a major hurdle as scaling the technology to manage an increased number of transactions might prove to be a significant challenge. |
| 6 | Cross-Border E-Commerce Supply Chain Decision-Making Considering Out-of-Stock Aversion Risk and Waste Aversion Risk | The paper uses prospect theory and a Stackelberg game model to analyze risk preferences in cross-border e-commerce supply chains. It conducts a numerical analysis to examine the impacts of these risk preferences on decision-making | The model’s assumption of perfect information and accurate estimation of risk preference coefficients, which may not reflect real-world behavior. |
| 7 | An Examination of Distributed and Decentralized Systems for Trustworthy Control of Supply Chains | The paper uses blockchain technology, characterized by its distributed and decentralized nature, to ensure data integrity in Supply Chain Management (SCM). It analyzes existing research to uncover advancements in this area | A unique limitation is the model’s assumption of perfect information, which may not reflect real-world behavior in supply chains |
| 8 | Blockchain-Based Traceability for the Fishery Supply Chain | The paper proposes a private Ethereum blockchain-based solution for managing the fishery supply chain. It uses five smart contracts and ten algorithms for process automation, implementation, testing, and validation | The system can only handle a limited number of transactions per second due to the inherent constraints of blockchain technology. |
| 9 | User Interface of Blockchain-Based Agri-Food Traceability Applications: A Review | The paper reviews blockchain-based agri-food traceability applications. It analyzes user interfaces, data collection and visualization It identifies usability issues and suggests future research directions. | The paper identifies a lack of detailed user interface discussions and lower user involvement in blockchain-based research, which could lead to usability issues and underutilization of blockchain technology |
| 10 | Supply Chain Inventory Sharing Using Ethereum Blockchain and Smart Contracts | The paper suggests an inventory sharing method using Ethereum and smart contracts on a blockchain. This approach merges blockchain technology with decentralized storage, enhancing the transparency, trustworthiness, and security of supply chain transactions. | The limitations include challenges with system compatibility, issues related to confidentiality and trust, and inefficiencies in supply chain management due to the absence of smooth information flow |

**1. TITLE: Blockchain in the Electronics Industry for Supply Chain**

**AUTHORS:** Shruti Jadon, Anagha Rao, Thanushree R, Netra Jagadish, and Prasad B. Honnavalli.

**PUBLISHED YEAR:** 2024 **PUBLISHER:** IEEE Access

**DESCRIPTION:**

The paper presents a comprehensive survey on the application of blockchain technology for supply chain management in the electronics industry. The authors analyze existing Supply Chain 4.0 and focus on the usage of blockchain technology to provide a decentralized architecture. The paper compares several papers on the basis of different schemas like the type of blockchain network used, platform deployed on, security of frameworks, representation of unique identity, testing authenticity, working implementation, cost of implementation, etc. The pros and cons of various privacy and security methodologies are also explored and discussed. The paper provides a unique perspective on the potential of blockchain in transforming the electronics industry supply chain.

**ADVANTAGES:**

* Blockchain technology can result in an improvement to traditional supply chains.
* Blockchain-based traceability systems let producers improve their visibility.
* Consumers trust the products they buy and where they come from due to the transparency provided by blockchain technology.

**DISADVANTAGES:**

* Requires careful design to ensure compatibility
* less security across various services,
* complexity in system integration.

**2. TITLE:** **Securing Sensing in Supply Chains: Opportunities, Building Blocks, and Designs Attacks, Challenges, and Countermeasures**

**AUTHORS:** Jan Pennekamp, Fritz Alder, Lennart Bader, Gianluca Scopelliti, Klaus Wehrle, and Jan Tobias Mühlberg

**PUBLISHED YEAR:** 2024 **PUBLISHER:** IEEE Access

**DESCRIPTION:**

The paper presents a comprehensive study of four scenarios that lead to end-to-end-secured sensing in complex IoT-based supply chains with many mutually distrusting actors. The designs ensure that sensed data is securely transmitted and stored, and can be verified by all parties. The work enables a notion of secure end-to-end sensing with minimal trust across the system stack, even for complex and opaque supply chain networks. The paper highlights relevant pitfalls and challenges, details that are still missing in related work. The authors evaluate the most elaborate design with regard to performance, cost, deployment, and also trust implications on the basis of prevalent misuse cases. The paper discusses the increasing complexity of supply chains, both technically in terms of devices and connectivity, and also anthropogenic with a growing number of actors. The authors address the challenges that are exacerbated by stringent requirements for shipping conditions or quality, and where actors may attempt to reduce costs or cover up incidents.

**ADVANTAGES:**

* Enables a notion of secure end-to-end sensing with minimal trust across the system stack.
* Addresses relevant pitfalls and challenges.
* Proves practical feasibility through performance, cost, deployment, and trust implications evaluation.

**DISADVANTAGES:**

* Implementation complexities
* robust security measures
* requires continuous updates to address evolving threats

**3. TITLE: Blockchain Technology to Support Agri-Food Supply Chains: A Comprehensive Review**

**AUTHORS:** Marco Fiore and Marina Mongiello

**PUBLISHED YEAR:** 2023 **PUBLISHER:** IEEE Access

**DESCRIPTION:**

The paper presents a comprehensive review of blockchain technology’s application in agri-food supply chains. The authors use a systematic literature network analysis (SLNA) to understand the state-of-the-art related to the application of Blockchain in the agri-food sector. The work takes into consideration the advantages and disadvantages of implementing such a paradigm, with an analysis of the role of industries. The main findings are related to research directions: they regard the lack of training both for industries and stakeholders, the involvement of additional technologies (i.e., Big Data, Edge Computing), and the absence of supporting tools for developers.

**ADVANTAGES:**

* Blockchain technology can result in an improvement to traditional agri-food supply chains.
* Blockchain-based traceability systems let producers improve their visibility.
* Consumers trust the products they buy and where they come from due to the transparency provided by blockchain technology.

**DISADVANTAGES:**

* The paper identifies several challenges, including policy and regulations, scalability issues, less skilled human resources, high investment, and interoperability.
* The paper also highlights the lack of training for industries and stakeholders.
* The absence of supporting tools for developers is also mentioned as a limitation.

**4. TITLE:** **Blockchain and Smart Contracts for Telecommunications: Requirements vs. Cost Analysis**

**AUTHORS:** Nima Afraz, Francesc Wilhelmi, Hamed Ahmadi, and Marco Ruffin

**PUBLISHED YEAR:** 2023 **PUBLISHER:** IEEE Access

**DESCRIPTION:**

The paper presents a comprehensive survey on the application of blockchain technology for telecommunications networks. The authors analyze existing Supply Chain 4.0 and focus on the usage of blockchain technology to provide a decentralized architecture. The paper compares several papers on the basis of different schemas like the type of blockchain network used, platform deployed on, security of frameworks, representation of unique identity, testing authenticity, working implementation, cost of implementation, etc. The pros and cons of various privacy and security methodologies are also explored and discussed. The paper provides a unique perspective on the potential of blockchain in transforming the electronics industry supply chain.

**ADVANTAGES:**

* Blockchain technology can result in an improvement to traditional supply chains.
* Blockchain-based traceability systems let producers improve their visibility.
* Blockchain can provide a decentralized marketplace solution for 5G slice brokering

**DISADVANTAGES:**

* The paper also highlights the lack of training for industries and stakeholders.
* The absence of supporting tools for developers is also mentioned as a limitation.
* Use cases requiring a higher throughput would need more computational resources

**5.TITLE:** **Blockchain Adoption in Food Supply Chains: A Systematic Literature Review on Enablers, Benefits, and Barriers**

**AUTHORS:** Abubakar Mohammed, Vidyasagar Potdar, Mohammed Quaddus, and Wendy Hui.

**PUBLISHED YEAR:** 2023 **PUBLISHER:** IEEE Access

**DESCRIPTION:**

The paper presents a systematic literature review on the adoption of blockchain technology in food supply chains. It discusses the enablers, benefits, and barriers of such adoption. The authors have analyzed various articles from 2016 to 2021 to identify these factors. The paper provides a unique perspective on the potential of blockchain in transforming the food supply chain. It also presents two case studies, one proposing a distributed marketplace solution for 5G slice brokering and another one on the decentralization of federated learning (FL) through blockchain1. The authors also developed a conceptual framework for blockchain adoption within the food supply chain.

**ADVANTAGES:**

* Blockchain-based traceability systems let producers improve their visibility1.
* Consumers trust the products they buy and where they come from due to the transparency provided by blockchain technology
* The technology can decentralize federated learning through blockchain

**DISADVANTAGES:**

* The lack of tools available for developers is highlighted as a constraint.
* The intricate nature of the food supply chain could hinder the application of blockchain.
* Stakeholders might oppose due to the transformative impact of blockchain.

**6. TITLE:** **Cross-Border E-Commerce Supply Chain Decision-Making Considering Out-of-Stock Aversion Risk and Waste Aversion Risk**

**AUTHORS:** XIN XU AND SHAOJIE ZHOU

**PUBLISHED YEAR:** 2023 **PUBLISHER:** IEEE Access

**DESCRIPTION:**

The paper applies prospect theory to understand risk preferences of a cross-border e-commerce platform and overseas warehouse, considering out-of-stock and waste aversion risks. A Stackelberg game decision-making model is constructed, with the platform as leader and warehouse as follower, making decisions on order quantity and pricing. Closed-form solutions for optimal strategies under four risk preference combinations are derived, and relationships between risk preference coefficients and optimal decisions are analyzed. The paper conducts a numerical analysis using an arithmetic case, and employs sensitivity and scenario analysis to examine impacts of risk preference coefficients and other parameters on optimal decisions and supply chain performance.

**ADVANTAGES:**

* The project provides a comprehensive model for decision-making in cross-border e-commerce supply chains.
* It incorporates out-of-stock aversion and waste aversion risks into the model.
* The use of prospect theory and the Stackelberg game enhances the understanding of risk preferences.

**DISADVANTAGES:**

* The model’s complexity and assumption of perfect information could limit its practical applicability.
* The model may not accurately reflect real-world behavior due to its assumptions.
* It overlooks other potential influencing factors like market competition, government regulations, and technological changes.

**7. TITLE:** **An Examination of Distributed and Decentralized Systems for Trustworthy Control of Supply Chains**

**AUTHORS:** Vinoth Kumar C and Poongundran Selvaprabhu

**PUBLISHED YEAR:** 2023 **PUBLISHER:** IEEE Access

**DESCRIPTION:**

The paper presents a comprehensive study on the application of blockchain technology for Supply Chain Management (SCM). The distributed and decentralized nature of blockchain is utilized to ensure the integrity of data storage and its distribution across a meticulously organized ledger. This approach addresses challenges in SCM such as increased counterfeit products, increased ocean transportation costs, bottlenecks in cargo flow, congestion, and complications in product accountability. The paper thoroughly analyses existing research and literature to uncover the latest advancements and potential future breakthroughs in this area. The methodology includes a detailed examination of the intricacies of SCM, exploring its motivations, contributions, and the practical applications of blockchain technology for SCM.

**ADVANTAGES:**

* Thorough examination of blockchain for SCM challenges.
* Leverages blockchain for data integrity and distribution.
* Explores practical blockchain applications for SCM advancements.

**DISADVANTAGES:**

* Assumes perfect information, not always realistic.
* Blockchain model complexity may limit applicability.
* Overlooks factors like competition, regulations, changes.

**8. TITLE:** **Blockchain-Based Traceability for the Fishery Supply Chain**

**AUTHORS:** Pratyush Kumar Patro, Raja Jayaraman, Khaled Salah, and Ibrar Yaqoob.

**PUBLISHED YEAR:** 2022 **PUBLISHER:** IEEE Access

**DESCRIPTION:**

This paper proposes a blockchain-based traceability system for the fishery supply chain, which aims to enhance the transparency, security, and efficiency of the seafood industry. The system uses a hybrid blockchain architecture that combines a public blockchain for storing immutable records of fish transactions and a private blockchain for managing sensitive data of supply chain participants. The system also employs a smart contract mechanism to automate the verification and execution of business rules and agreements. The paper presents the design and implementation of the system, as well as a case study and a performance evaluation to demonstrate its feasibility and effectiveness. The paper also discusses the challenges and future directions of applying blockchain technology to the fishery supply chain.

**ADVANTAGES:**

* Traceability is improved with immediate monitoring of fish from origin to buyer.
* Blockchain technology guarantees the authenticity of data and deters alterations.
* Auditing becomes more efficient with unchangeable and readily available logs.

**DISADVANTAGES:**

* Initial costs can be high due to the need for blockchain integration.
* Specialized knowledge is necessary for the system’s setup and upkeep.
* The verification process of blockchain can cause transaction delays.

**9. TITLE:** **User Interface of Blockchain-Based Agri-Food Traceability Applications: A Review.**

**AUTHORS:** Atima Tharatipyakul and Suporn Pongnumkul

**PUBLISHED YEAR:** 2021 **PUBLISHER:** IEEE Access

**DESCRIPTION:**

This paper focuses on the user interface aspects of blockchain-based agri-food traceability applications. The analysis covers target user groups, data collection methods, data visualization methods, and other user interface aspects. The paper also compares blockchain-based and non-blockchain-based applications in terms of user involvement for evaluation. It identifies potential benefits of blockchain technology for the agri-food supply chain, as well as challenges and limitations in terms of usability and user adoption. The paper concludes with a discussion of research gaps and future directions for user interface design of blockchain-based agri-food traceability applications.

**ADVANTAGES:**

* Real-time tracking of agri-food from farm to consumer.
* Blockchain ensures data authenticity and prevents alterations.
* Addresses usability issues in blockchain applications.

**DISADVANTAGES:**

* Lack of user interface details for usability assessment.
* Less user involvement in blockchain-based researches.
* Difficulties in widespread adoption by farmers and systems

**10. TITLE:** **Supply Chain Inventory Sharing Using Ethereum Blockchain and Smart Contracts**

**AUTHORS:** Ilhaam A. Omar, Raja Jayaraman, Mazin S. Debe, Haya R. Hasan, Khaled Salah, and Mohammed Omar

**PUBLISHED YEAR:** 2021 **PUBLISHER:** IEEE Access

**DESCRIPTION:**

This paper proposes a novel approach to facilitate inventory sharing among supply chain partners using Ethereum blockchain and smart contracts. The approach consists of three main components: a blockchain network, a smart contract, and a web application. The blockchain network is used to store and verify the inventory data of the partners, as well as to execute the smart contract that implements the inventory sharing logic. The smart contract defines the rules and conditions for inventory sharing, such as the minimum and maximum inventory levels, the sharing ratio, and the incentives. The web application is used to interact with the blockchain network and the smart contract, as well as to provide a user-friendly interface for the partners to monitor and manage their inventory. The paper demonstrates the feasibility and benefits of the proposed approach through a case study of a pharmaceutical supply chain. The paper also evaluates the performance and scalability of the approach using experiments and simulations.

**ADVANTAGES:**

* Reduces inefficiencies in supply chain.
* Economical and commercially viable.
* Improves information connectivity securely

**DISADVANTAGES:**

* System interoperability issues.
* Confidentiality and trust concerns.
* Inefficiency in managing operations.