



Enhancing Supply Chain Transparency in Agriculture with Blockchain Technology: A Case Study of AgriDigital

Trisha Juneja*

trishajuneja@outlook.com

*Corresponding author

Accepted: 21/08/2024 Published: 31/08/2024



How to Cite:

Juneja T (2024). Enhancing Supply Chain Transparency in Agriculture with Blockchain Technology: A Case Study of AgriDigital. *Scientific Journal of Metaverse and Blockchain Technology*. 2(2), 68-71. DOI: <https://doi.org/10.36676/sjmbt.v2.i2.36>

1. Introduction

Agriculture supply chain transparency has attracted a lot of attention lately. The idea relates to how easily relevant information regarding the production, processing, and distribution of agricultural goods is accessible to all parties involved in the agricultural supply chain, from farmers to consumers. For several reasons, including environmental sustainability, ethical sourcing, and food safety, it is imperative to maintain openness. The intricate and disjointed nature of the agricultural supply chain has made it difficult to attain complete transparency. A possible way to deal with these issues is through the use of blockchain technology. Blockchain can improve agricultural product traceability and accountability by offering a decentralized, irreversible ledger of transactions. With the use of this technology, supply chain players may access and validate information instantly, lowering the possibility of fraud and increasing overall efficiency.

Over the past few decades, the idea of supply chain openness has undergone tremendous change. The agricultural supply chain has historically been typified by a lack of transparency and a large number of middlemen, which makes it challenging to follow items from the field to the table. The emergence of digital technology has initiated a transformation in this domain by providing novel instruments and approaches for overseeing and regulating supply chain operations. Blockchain technology, which was first created to facilitate virtual currencies like Bitcoin, is being used in fields other than banking. Its three main characteristics—transparency, immutability, and decentralization—make it a good fit for increasing supply chain transparency. Blockchain technology has the ability to permanently and impenetrably record every transaction and product movement in the agricultural industry. This can assist in guaranteeing regulatory compliance, enhancing recall procedures in the event of a food safety problem, and confirming the legitimacy of fair-trade and organic products.

It is impossible to exaggerate the significance of openness in agricultural supply networks. Today's consumers want more transparency into the production, distribution, and processing processes of products since they are more aware of the sources of their food and are worried about it. By ensuring that agricultural operations adhere to moral and environmental norms, transparency fosters consumer and producer trust. Transparency is also essential for the safety of food. In the case of an epidemic of foodborne illness, it is simpler to identify the source of contamination when there are thorough records of every step of the supply chain. This reduces the risk to one's health and potential financial losses by enabling quicker and more focused recollections. Additionally, transparency is essential for advancing ethical sourcing and fair trade. Blockchain technology can make a significant contribution to the fight against child labor and exploitation by offering verified information on the conditions under which





agricultural goods are produced. It also helps sustainability efforts by monitoring how farming operations affect the environment and promoting the use of environmentally friendly techniques.

Blockchain technology has the potential to improve supply chain transparency, but there are still a number of unanswered research questions. The dearth of thorough research on the application of blockchain technology in agricultural supply networks is one significant gap. Although there are pilot programs and theoretical frameworks for blockchain technology, there is no actual data about its scalability and efficacy in practical applications. The knowledge of the social and economic effects of blockchain implementation in agriculture is another research need. Further research is needed to fully understand the costs of using blockchain technology, how it would affect smallholder farmers, and how it can alter market dynamics. Additionally, there are logistical and technological issues that need to be investigated when integrating blockchain with the current supply chain technology and systems. By offering a thorough case study of AgriDigital, a business that has effectively incorporated blockchain technology into the agricultural supply chain, this research seeks to close these gaps. Through an examination of AgriDigital's projects' experiences and results, this study will provide insightful information on the real-world advantages and difficulties of blockchain implementation in the agricultural sector.

The growing need for supply chain transparency and the intriguing yet untapped potential of blockchain technology to address this need are the driving forces behind this study. Supply chains need to be more open and responsible as customers' concerns about food safety, ethical sourcing, and environmental sustainability rise. Although blockchain technology presents a workable alternative, agriculture has just recently begun to utilize it. This study will add to our understanding of how blockchain technology may be successfully incorporated into agricultural supply chains by analyzing the AgriDigital scenario. It will highlight best practices, point out potential roadblocks, and offer suggestions to stakeholders hoping to use technology to improve openness. The use of blockchain technology will also have wider ramifications that this study will investigate, including its effects on society, the economy, and technology.

Improving agricultural supply chain transparency with blockchain technology is an important and relevant subject. With the agriculture industry coming under more scrutiny and pressure to be more accountable, blockchain provides a strong tool to guarantee traceability, foster customer confidence, and advance sustainable practices. In the end, this research on AgriDigital's use of blockchain technology seeks to enhance agricultural supply chains by offering a thorough examination of the advantages and difficulties related to this technology.

2. Objectives

- To evaluate the effectiveness of blockchain technology in enhancing supply chain transparency.
- To identify the benefits and challenges of blockchain adoption in agriculture.
- To analyze the economic and social implications of blockchain integration.
- To provide recommendations for effective implementation of blockchain in agriculture.

3. Blockchain Technology in Agriculture

Blockchain technology has attracted a lot of interest since it has the potential to completely transform a number of industries, including agriculture. Transparency is essential in an agricultural supply chain to guarantee customer trust, ethical sourcing, and food safety. Because traditional agricultural supply chains are sometimes complicated and disjointed, with several intermediates and phases, it can be difficult to keep accurate and easily accessible information. With its decentralized, transparent, and unchangeable ledger, blockchain technology presents a promising answer to these problems. In order to determine how well blockchain technology can increase transparency, this research looks at how





AgriDigital, a business that is leading the way in blockchain applications in agriculture, has used the technology.

A = Rabobank issues Australian dollar (AUD) token to the agent's Rabobank Facility under master agreement.

B = Grain delivered and registered at warehouse.

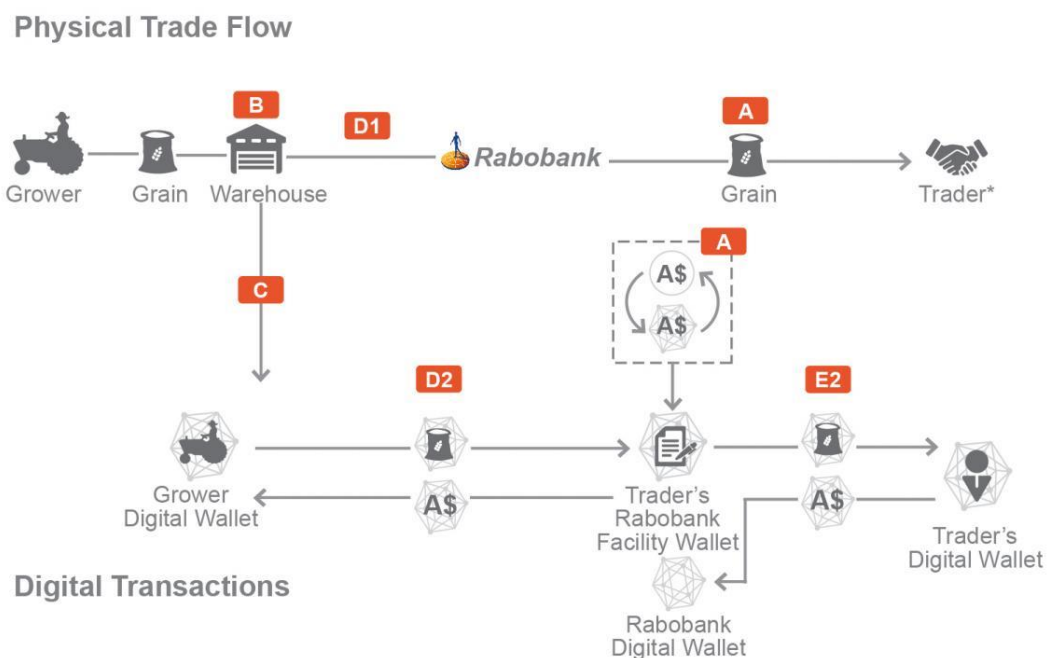
C = Digital title to the grain is issued to grower by site operator of warehouse, in this case the trader acting as site operator.

D1 = Grower allocates the grain to purchase contract with trader as agent for Rabobank.

D2 = Smart contracts execute payment from Rabobank to the grower in AUD token, ownership of digital title grain token transfers from the grower to Rabobank.

E1 = Trader requests to purchase the grain, which is the subject of the sale contract.

E2 = Smart contracts execute payment from trader to Rabobank and beneficiaries in AUD token. Digital



title transfers from Rabobank to trader.

Figure: AgriDigital Flow (Source: <https://development.asia/explainer/transforming-agricultural-supply-chains-using-blockchain>)

3.1 Enhancing Supply Chain Transparency

Blockchain technology creates a decentralized platform where all product movements and transactions are tracked in real time, improving supply chain transparency. By putting blockchain into practice, AgriDigital hopes to provide all supply chain participants—from farmers to retailers—with access to a single, shared ledger that tracks each stage of the product's journey. This guarantees clear and verifiable information on the origin, processing, and distribution of agricultural goods. Because every transaction on the blockchain is time-stamped and irreversible—that is, it cannot be changed or removed—the likelihood of fraud and false information is greatly decreased.

3.2 Reliability and Verifiability of Information

In every supply chain, information veracity and dependability are critical. By guaranteeing that data cannot be altered after it is added to the blockchain, blockchain technology allays these worries. A



reliable digital record for every product may be created thanks to AgriDigital's usage of blockchain technology. For instance, the date, location, and quantity of a farmer's agricultural harvest are all documented on the blockchain. Every transaction that occurs after the product is manufactured, packaged, and distributed is likewise tracked as it goes through the supply chain. This establishes a continuous chain of custody that all parties involved can confirm, guaranteeing the accuracy and reliability of the information.

3.3 Data Accuracy, Accessibility, and Integrity

Integrity, accessibility, and accuracy of data are essential elements of a successful supply chain. By eliminating illegal changes and minimizing human error, blockchain technology guarantees great data correctness. Smart contracts, which are self-executing contracts with their terms encoded directly into code, automate a number of procedures in AgriDigital's system and guarantee that transactions are carried out exactly as intended. Errors and inaccuracies that might arise from human record-keeping are reduced by this automation. Accessibility is yet another noteworthy benefit of blockchain technology. Information in a typical supply chain is frequently kept in separate repositories by several partners. Blockchain offers a single, real-time platform where all parties involved may access the same data. Better decision-making and collaboration are possible across the supply chain because to this openness. For instance, retailers can quickly verify the authenticity of a product and its compliance with quality standards before it reaches consumers. The integrity of data on the blockchain is maintained through cryptographic security. Each block of data is linked to the previous block using a cryptographic hash, creating a chain that is secure and tamper-proof. Any attempt to alter a block would require altering all subsequent blocks, which is computationally impractical. This ensures that once data is recorded on the blockchain, it remains secure and unaltered.

3.4 Impact on Trust among Stakeholders

The capacity of blockchain technology to improve trust among supply chain stakeholders is one of its most important effects. In the agricultural industry, trust is crucial to guaranteeing that goods fulfill requirements for quality, safety, and ethics. Because blockchain technology creates an unchangeable, transparent record of every transaction, it promotes trust. Using AgriDigital's blockchain technology, stakeholders may independently confirm a product's provenance and path without depending on middlemen or ambiguous paperwork. This entails providing customers with trustworthy information about the origins and production processes of the food they eat. It gives farmers and other producers a means of verifying the legitimacy of their goods and methods. Retailers and distributors may rely on the safety and compliance of the items they handle with regulations. Overall, the transparency and reliability of blockchain build confidence and trust across the entire supply chain.

3.5 Evaluating the Effectiveness of Blockchain in Agriculture

AgriDigital's use of blockchain technology shows how it may greatly increase supply chain transparency in the agriculture industry. Blockchain guarantees accurate, verifiable, and accessible information on the origin, processing, and distribution of agricultural goods by offering a decentralized and immutable ledger. There is a significant improvement in data accuracy, accessibility, and integrity, which lowers the possibility of fraud and mistakes. Furthermore, trust is promoted among all stakeholders—from farmers to consumers—by the transparency that blockchain technology offers. It is imperative to acknowledge that the deployment of blockchain technology in agriculture is not without its hurdles. These include the requirement for technical proficiency, early implementation expenses, and possible opposition from stakeholders who are habituated to conventional approaches. Despite these challenges, the benefits of blockchain technology in creating a transparent, trustworthy, and





efficient agricultural supply chain are evident. As more stakeholders recognize the value of blockchain, its adoption is likely to increase, driving further improvements in supply chain transparency and trust.

4. Benefits and Challenges of Blockchain Adoption in Agriculture

4.1 Improved Traceability and Transparency

Blockchain technology has a lot to offer when it comes to increasing agricultural supply networks' transparency and traceability. Blockchain guarantees that every transaction and movement of goods is recorded and available in real-time by offering a decentralized and unchangeable ledger. With this degree of traceability, stakeholders can follow agricultural goods with never-before-seen accuracy from farm to table. Farmers, for example, can record the procedures and growing environments they utilize for their crops, while processors can record the handling and transformation of their goods. Retailers and distributors may guarantee adherence to safety and quality requirements by confirming the origin and caliber of the goods they offer. This comprehensive traceability not only enhances operational efficiency but also boosts confidence among stakeholders and consumers, who can trust that the information they receive is accurate and reliable.

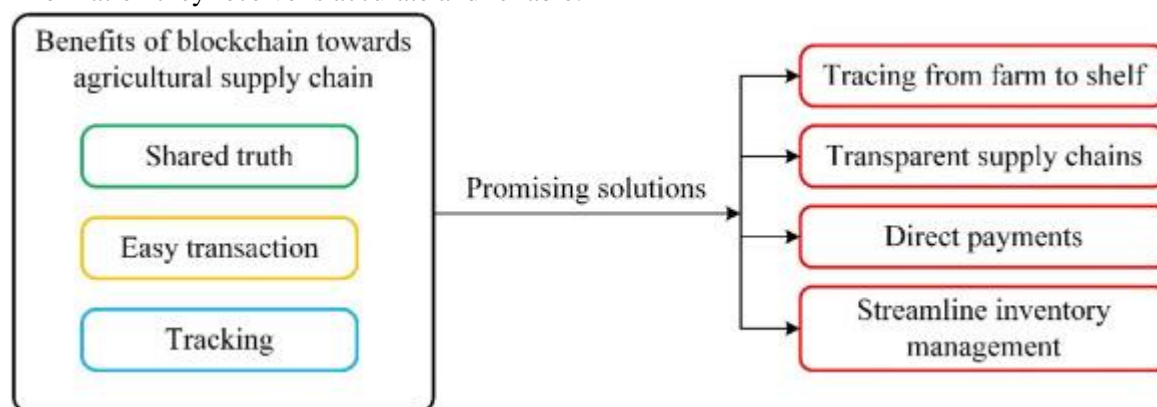


Figure: Benefits of blockchain towards agriculture supply chain (Source: Khan, et al 2022)

4.2 Enhanced Food Safety

Improving food safety is one of the most important benefits of using blockchain technology in agriculture. In the agriculture industry, foodborne diseases and contamination outbreaks are major problems. Blockchain technology has the potential to reduce these risks by offering an unalterable and transparent record of each step in the supply chain. Blockchain makes it possible to quickly identify the source of a contamination occurrence, facilitating focused and efficient recalls. As a result, there are fewer health hazards and financial losses for companies. Blockchain information may be used, for instance, to identify the individual farm and even the field where a batch of tainted product was grown. This precision not only protects consumers but also helps maintain the reputation of brands and retailers by demonstrating a commitment to food safety and accountability.

4.3 Greater Consumer Trust and Engagement

In the agriculture sector, customer trust is essential, especially as customers' concerns about the safety and provenance of their food grow. Blockchain provides clear and verifiable information about agricultural goods, which may greatly increase customer confidence. Blockchain technology gives customers access to comprehensive data about the goods they buy, such as where and how they were produced, distributed, and processed. This degree of openness encourages moral and environmentally friendly consumption while enabling customers to make educated decisions. Furthermore, blockchain technology has the potential to enable direct communication between farmers and customers, resulting in a stronger bond and comprehension of agricultural methods. When a product's QR code allows users



to view its complete supply chain history, for instance, consumers are more likely to trust and stick with firms that value transparency.

4.4 High Implementation Costs

Blockchain technology adoption in agriculture confronts a number of obstacles despite its advantages, with high implementation costs serving as a major deterrent. A significant investment in network capabilities, software, hardware, and other components of technological infrastructure is needed to develop and implement a blockchain-based system. There are also continuous expenses related to upgrading and maintaining the blockchain technology. These expenses may be unaffordable for smallholder farmers and small-scale agribusinesses, which would restrict their capacity to use blockchain technology. Additionally, the cost of integration blockchain with current systems and procedures may increase if more people and knowledge are needed. As a result, although big agribusinesses and international companies might be able to finance the shift, smaller firms would find it difficult, which might result in differences in the advantages of blockchain adoption in the agriculture industry.

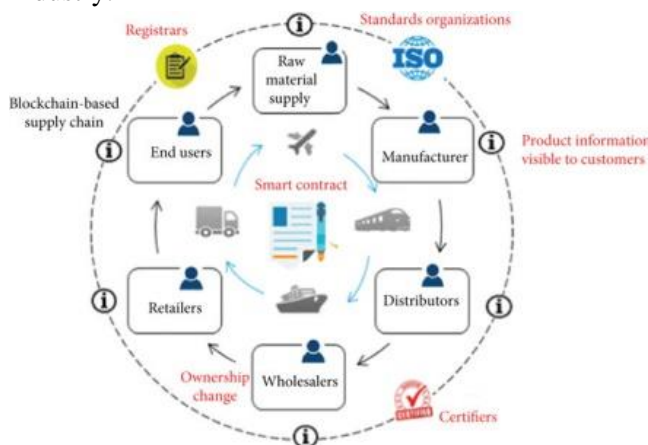


Figure: Advantages of Blockchain Technology in Food Supply Chain (Source: Awan, et al 2021)

4.5 Technical Complexities and Resistance to Change

The technological difficulty of blockchain use in agriculture is another obstacle. Due to its complexity and relative youth, blockchain technology need certain expertise and abilities for administration and implementation. It's possible that many agricultural stakeholders—

especially those in rural and underdeveloped areas—lack the technological know-how required to make good use of blockchain. Furthermore, resistance to change is common, particularly when using novel and unfamiliar technology. Due to the decades-long establishment of traditional supply chain management and agricultural practices, stakeholders could be reluctant to switch to a blockchain-based system. This opposition may stem from a lack of technological knowledge, worries about the security and privacy of data, or just a dislike of upsetting established routines. Addressing these technical and cultural challenges is crucial for the successful adoption of blockchain in agriculture.

4.6 Practical Implications for Stakeholders

The practical ramifications of blockchain technology adoption in agriculture extend to several stakeholders, such as producers, processors, distributors, and consumers. Blockchain provides farmers with clear and verifiable information about their methods, which can increase the value and marketability of their produce. More pricing and easier access to markets may result from this, especially for farmers that practice organic or fair-trade farming. Farmers must, however, carefully manage the expenses and technological demands of using blockchain. Increased productivity as well as lowered fraud and contamination concerns are advantageous to processors and distributors. Better coordination and traceability are made possible by blockchain, guaranteeing that goods fulfill legal criteria and quality standards. To properly use blockchain, they must, however, make the required infrastructure and training investments. For consumers, blockchain provides assurance about the safety, quality, and ethical sourcing of their food. This transparency can drive consumer loyalty and support





for brands that prioritize sustainability and accountability. However, consumers must also be educated about how to access and interpret blockchain information to fully benefit from this technology.

Blockchain technology use in agriculture comes with a number of advantages and difficulties. Although there are many benefits, like traceability, food safety, and customer trust, there are also many challenges, including high implementation costs, technological complexity, and reluctance to change. Realizing the full potential of blockchain technology to alter agricultural supply chains may be facilitated by a well-rounded strategy that takes into account the advantages while addressing the constraints. Blockchain has the potential to improve the agriculture sector's overall sustainability and resilience by offering a transparent, reliable, and efficient system.

5. Economic and Social Impacts of Integrating Blockchain Technology in Agriculture

Blockchain technology has the potential to change social and economic dynamics when it is used into agricultural supply networks. This thorough examination looks at how the implementation of blockchain affects market dynamics, labor practices, ethical sourcing, economic sustainability, and the decrease of exploitation.

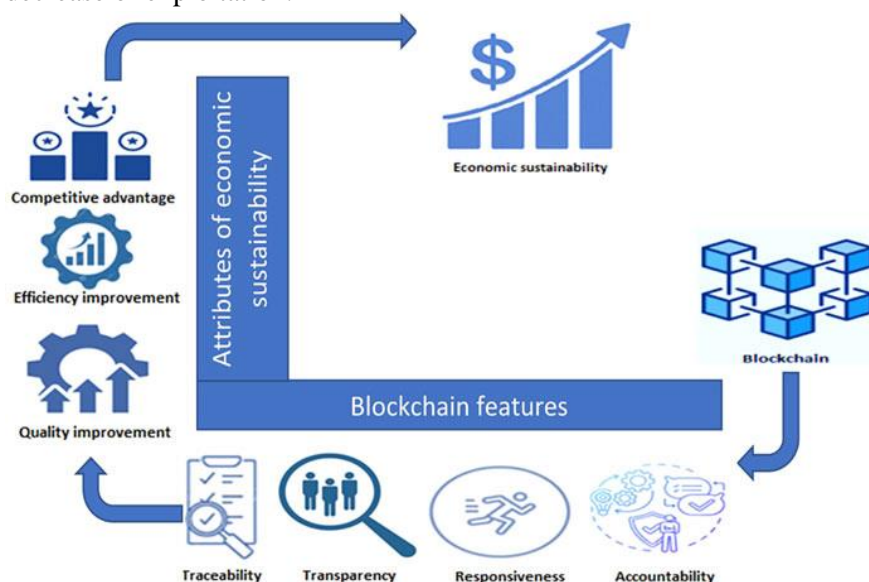


Figure: Conceptual framework of economic sustainability of the supply chain through blockchain. (Source Munir, et al, 2022)

5.1 Economic Viability for Agricultural Operations

Significant financial ramifications result from integrating blockchain technology into agricultural supply

networks, especially for smallholder farmers. By offering transparent and verifiable data that can create new market possibilities, blockchain can improve the economic sustainability of agricultural enterprises. Smallholder farmers who use blockchain, for instance, might provide certification of organic farming or evidence of sustainable practices, which can draw premium customers and increase market pricing. Farmers may be able to take a bigger cut of the value chain thanks to this openness, which can also lessen their need on middlemen. On the other hand, smallholders may find the upfront expenses of adopting blockchain technology to be a significant obstacle. These expenses cover infrastructure expenditures in technology, training, and continuing upkeep. For smallholder farmers operating on thin margins, these expenses can be prohibitive without external support or subsidies. Additionally, access to the necessary technology and internet connectivity remains a challenge in many rural areas. To mitigate these challenges, government and non-governmental organizations can play a crucial role in providing financial assistance, technical training, and infrastructure development to ensure that smallholders can participate in and benefit from blockchain integration.

5.2 Influence on Market Dynamics

By enhancing transparency and decreasing information asymmetry in agricultural supply networks, blockchain technology has the potential to significantly alter market dynamics. Product quality,



provenance, and handling information are frequently opaque and under the control of a small number of middlemen in traditional supply chains. By enabling open access to all transactional data for all parties involved, blockchain upends this paradigm, democratizing knowledge and empowering both producers and consumers. Increased market efficiency and competition may result from this greater openness. Producers are able to set themselves apart from the competition with their products thanks to provable quality qualities like fair-trade practices or organic certification, and customers are empowered to make more informed purchases. Additionally, by enabling real-time tracking and verification of product movements, blockchain can decrease transaction costs, optimize supply chain procedures, and boost logistical effectiveness. However, the shift towards a more transparent market can also pose challenges. Smaller players may struggle to meet the stringent documentation and verification requirements imposed by blockchain systems. Moreover, the increased transparency might expose inefficiencies and malpractices, leading to disruptions and adjustments in the supply chain. Stakeholders will need to adapt to these new dynamics and potentially redefine their roles and relationships within the supply chain.

5.3 Changes in Labor Practices

The use of blockchain technology in agriculture has the potential to drastically alter labor patterns. Blockchain may ensure that labor laws and ethical standards are followed by improving work conditions by offering a transparent record of every transaction and procedure. Blockchain may be used, for example, to confirm that laborers receive fair compensation and that no child labor is utilized during the production process. By doing so, the general working conditions for laborers in the agricultural industry may be improved and exploitation can be addressed. Additionally, by automating payroll processes and guaranteeing correct and timely payments, blockchain can help improve worker management. Labor agreements may be enforced by smart contracts, which release money automatically when certain requirements are fulfilled. This reduces the risk of wage theft and delays, which are common issues in traditional agricultural labor practices. However, the integration of blockchain technology may also lead to the displacement of certain jobs, particularly those involved in manual record-keeping and intermediary roles. As blockchain automates these processes, workers in these positions may need to be retrained and upskilled to adapt to new roles within the digital supply chain. Stakeholders must consider these potential impacts and implement strategies to support workforce transition and minimize negative effects on employment.

5.4 Improvements in Ethical Sourcing

Blockchain technology has the ability to greatly enhance agricultural supply networks' ethical sourcing practices. Blockchain can assist in ensuring that agricultural goods are obtained ethically and sustainably by offering a transparent and verifiable record of production processes. This entails confirming adherence to social responsibility norms, environmental laws, and fair-trade principles. Blockchain, for example, can trace a coffee bean's journey from the farm to the customer, recording each step along the way. This enables customers to confirm that the coffee they buy comes from growers who follow fair-trade guidelines and give their employees a living wage. Retailers may utilize this data to promote ethical products and make better-informed sourcing selections. However, implementing and maintaining these ethical standards through blockchain requires collaboration and commitment from all stakeholders in the supply chain. Farmers, processors, and distributors must accurately and consistently record their practices, and consumers and retailers must be willing to support products that meet ethical standards, even if they come at a premium price. This collective effort is essential to realize the full potential of blockchain in promoting ethical sourcing.





5.5 Reducing Exploitation in the Supply Chain

Blockchain technology has the potential to significantly lessen exploitation in supply networks for agriculture. Blockchain technology can aid in the prevention of fraudulent, dishonest, and worker-exploitation activities by offering an unchangeable and transparent record of transactions. Blockchain, for instance, may guarantee that laborers and farmers receive their money directly, lowering the possibility of middlemen taking advantage of their position and withholding payments. Additionally, blockchain can improve traceability and accountability, which will make it simpler to find and deal with cases of exploitation. Stakeholders are able to promptly identify the source of a product and implement remedial measures if it is discovered to be linked to unethical actions. Along with safeguarding workers' rights, this openness fosters confidence among stakeholders and customers. However, the success of blockchain in reducing exploitation depends on the willingness of all parties to participate and maintain accurate records. There must be a concerted effort to educate and train stakeholders on the use of blockchain and the importance of ethical practices. Additionally, regulatory frameworks and enforcement mechanisms must be strengthened to support the effective implementation of blockchain and ensure compliance with ethical standards.

There are significant economic and societal ramifications when blockchain technology is used into agricultural supply networks. Transparency, efficiency, and ethical sourcing are just a few of the many advantages it provides; yet, there are obstacles to overcome, including high implementation costs, complicated technological requirements, and reluctance to change. Utilizing blockchain technology to its fullest potential in altering agricultural supply chains and advancing sustainable and fair practices requires a cooperative and balanced approach engaging all stakeholders.

6. Recommendations for Effective Implementation of Blockchain in Agriculture

Transparency, efficiency, and ethical behaviors in agricultural supply chains may all be greatly improved by implementing blockchain technology. This section offers stakeholders useful advice on how to properly adopt blockchain, get over obstacles, and reap its rewards.

6.1 Conduct a Thorough Feasibility Assessment

Prior to putting blockchain technology into practice, stakeholders had to carry out a thorough feasibility analysis. This entails assessing the state of the supply chain's present procedures, figuring out what problems blockchain can solve, and assessing the state of digital transformation as a whole. Gaining relevant insights may be achieved via consulting with other industries that have successfully incorporated blockchain, performing trial projects, and interacting with technical specialists. To comprehend the financial ramifications and possible returns on investment, a cost-benefit analysis should be included of the feasibility study. Having a clear understanding of these variables will enable stakeholders to decide whether and how to move forward with blockchain adoption.

6.2 Invest in Education and Training

Training and education are essential for the effective application of blockchain technology. All parties involved in the supply chain, including as growers, processors, distributors, and retailers, must comprehend the advantages and operations of blockchain technology. Offering seminars, training courses, and other materials can aid in the development of the requisite technical know-how. Tailored training sessions with an emphasis on useful applications and user-friendly interfaces are crucial for farmers and small-scale producers, who might not have had much exposure to digital technology. Any problems that develop both during and after the installation process may also be handled with the assistance of continuing support and troubleshooting services. Stakeholders can guarantee a seamless adoption of blockchain technology and optimize its potential advantages by allocating resources towards education and training.





6.3 Develop Robust Data Management Practices

A successful implementation of blockchain technology in agriculture requires efficient data management. Establishing strong procedures for data entry, verification, and collection is necessary for stakeholders to guarantee the integrity and correctness of data stored on the blockchain. Establishing uniform procedures for data entry, outlining precise roles and duties, and conducting frequent audits to confirm data correctness are all part of this. Many of these procedures may be automated with the use of smart contracts, lowering the possibility of human mistake and boosting productivity. Stakeholders should also place a high priority on data security and privacy, putting in place access restrictions and encryption to safeguard sensitive data. Through the establishment of robust data management protocols, interested parties may guarantee the dependability and credibility of the blockchain infrastructure.

6.4 Foster Collaboration and Partnerships

The effective use of blockchain technology in agricultural supply chains requires cooperation and collaborations. It is important for stakeholders to collaborate in order to establish a clear vision as well as standards and processes. Working together with technology companies, trade groups, authorities, and other supply chain players is part of this. Stakeholders may exchange best practices, pool resources, and solve shared problems by promoting a collaborative atmosphere. Forming alliances with IT companies might also make it easier to have access to the newest developments and technical assistance. Additionally, interacting with regulatory organizations may guarantee adherence to pertinent laws and rules, fostering a reliable and safe blockchain system. Stakeholders may work together to improve blockchain technology's effect and scalability in agriculture.

6.5 Implement Gradual and Scalable Solutions

Implementing scalable and gradual solutions is recommended for stakeholders looking to leverage the benefits of blockchain technology. Before a full-scale rollout, starting with pilot projects or small-scale implementations can assist identify possible concerns and improve procedures. By using a gradual approach, stakeholders may minimize interruption to ongoing activities while gaining trust and expertise with the technology. Stakeholders may gradually increase the scope and size of blockchain deployment as soon as the initial initiatives show promise. By adopting a gradual and scalable approach, stakeholders can effectively integrate blockchain technology and achieve sustainable and ethical agricultural practices.

7. Conclusion

The use of blockchain technology into agricultural supply chains offers a revolutionary prospect to improve trust, transparency, and traceability. This study has emphasized the noteworthy advantages and difficulties linked with this novel technology through an extensive examination of AgriDigital's blockchain deployment. Because blockchain technology creates a decentralized, irreversible ledger, every agricultural commodity transaction is precisely tracked and instantly available. By facilitating the prompt detection and remediation of contamination problems, this improved traceability not only increases food safety but also gives customers access to verified details on the provenance and management of their food. Because socially conscious customers are becoming more and more demanding ethical sourcing methods, blockchain's openness promotes higher consumer confidence.

In terms of the economy, blockchain can help smallholder farmers find new markets by enabling them to verify organic and sustainable farming methods, which will raise their pricing and draw in premium customers. However, there are substantial obstacles, especially for small-scale farmers and other rural stakeholders, due to the high implementation costs and technical complexity. In addition to significant investments in technological infrastructure, instruction, and training, addressing these issues calls on cooperation from all supply chain partners. The report also highlights the wider societal ramifications





of blockchain adoption, including the enhancement of labor practices through adherence to labor laws and ethical norms and the mitigation of exploitation through the provision of direct and transparent payment systems. These adjustments can support equitable and sustainable practices while improving the general working conditions for farm laborers. Stakeholders must take a balanced strategy that incorporates careful feasibility analyses, strong data management procedures, and scalable implementation techniques in order to effectively integrate blockchain technology. Collaborative efforts and partnerships can enable the exchange of resources and best practices, while education and training are essential for developing the technical skills and knowledge required for successful adoption.

In conclusion, there are obstacles to overcome before blockchain technology is fully implemented in agricultural supply chains, but there are also significant advantages to be gained in terms of efficiency, ethics, and transparency. Through the mitigation of financial and technological obstacles and the promotion of a cooperative atmosphere, interested parties may leverage blockchain technology to establish agricultural supply chains that are more transparent, reliable, and sustainable.

8. Bibliography

1. Awan, S., Ahmed, S., Ullah, F., Nawaz, A., Khan, A., Uddin, M.I., Alharbi, A., Alosaimi, W. and Alyami, H., 2021. IoT with blockchain: A futuristic approach in agriculture and food supply chain. *Wireless Communications and Mobile Computing*, 2021(1), p.5580179.
2. Khan, H.H., Malik, M.N., Konečná, Z., Chofreh, A.G., Goni, F.A. and Klemeš, J.J., 2022. Blockchain technology for agricultural supply chains during the COVID-19 pandemic: Benefits and cleaner solutions. *Journal of Cleaner Production*, 347, p.131268.
3. Mavilia, R. and Pisani, R., 2019. Scaling blockchain for agricultural sector: the agridigital case. *IT-Related Usage Of Cyrillic Script—A Study Carried Out At The Ict College Of Applied Studies, Belgrade*, p.55.
4. Munir, M.A., Habib, M.S., Hussain, A., Shahbaz, M.A., Qamar, A., Masood, T., Sultan, M., Mujtaba, M.A., Imran, S., Hasan, M. and Akhtar, M.S., 2022. Blockchain adoption for sustainable supply chain management: Economic, environmental, and social perspectives. *Frontiers in Energy Research*, 10, p.899632.
5. Website: <https://development.asia/explainer/transforming-agricultural-supply-chains-using-blockchain>
6. Prakash, M., & Pabitha, P. (2020). A hybrid node classification mechanism for influential node prediction in Social Networks. *Intelligent Data Analysis*, 24(4), 847-871
7. Xu, X., Weber, I., Staples, M., Xu, X., Weber, I. and Staples, M., 2019. Case study: AgriDigital: Blockchain technology in the trade and finance of agriculture supply chains. *Architecture for blockchain applications*, pp.239-255.

