ISSN No:-2456-2165

AgroLink - Empowering the Agriculture Supply Chain

Meghashree N[1], Aditya Raj[1,*], Jaspreet Kaur[1], Himanshu[1] , Kumar Ankit[1]
[1] Atria Institute of Technology, Bangalore – 560 024, Karnataka, India.
*Corresponding Author

Abstract:- Supply chain globalisation makes its controlling, managing and quality assurance much more difficult and complex. To tackle these problems, Blockchain technology, as a scattered ledger technology which ensures transparency, traceability and security. This essay offers a critical analysis of blockchain technology, its implementation using Ethereum, and the creation and use of Solidity-language smart contracts. Using these technologies the application aims to realise - Supply chain openness ,Smart contracts , Data sharing & collaboration ,Quality assurance ,Reducing fraud and counterfeiting , Environmental impact tracking ,Auditing and compliance.

Keywords: Traceability & security, Distributed ledger technology, Ethereum ,Smart contracts , Solidity language

I. INTRODUCTION

AGROLINK application uses the Ethereum blockchain to solve various problems in the agricultural sector by leveraging the strength of blockchain technology. Ethereum's blockchain allows for transparent and immutable data storage. The application creates digital information at every step of the agricultural chain, from planting to distribution. Smart contract operation is important. Contracts with smart features are self-signed contracts with predefined rules and regulations. Using smart contracts in agricultural products can be utilised in various processes such as payments to farmers, business owners and other stakeholders. AGROLINK brings efficiency, transparency, and security to the agricultural industry, benefiting farmers, distributors, retailers, and consumers alike. Supply chain traceability, Blockchain can provide end-to-end visibility all through the chain by documenting every step of production and distribution. food security as well as quality assurance, The immutability of blockchain enables the creation of tamper-proof information regarding food safety and quality information. Counterfeit products, For verifying the authenticity and ensuring the quality blockchain is very effective. Smart Contracts for Payments and Confirmations, Smart contracts on blockchain platforms can process and secure various contracts and payments between farmers, suppliers, vendors and retailers. factors, including their relevance and significance. Regarding the hybrid methodology, extractive summarization plays a crucial role. It helps in pulling out sentences that are semantically common across multiple articles. By doing this, it ensures that the summary reflects the core content of the documents accurately. Extractive summarization acts as the foundation, providing the raw material that the hybrid methods refine and enhance to create meaningful summaries. Access to financial services: Blockchain can make it easier for farmers to receive financial services by providing secure and transparent information about assets and businesses. This can help small farmers access credit and insurance that is required for their growth and their livelihoods. Data Sharing and Collaboration: Blockchain allows stakeholders in the field of agriculture to securely share information such as weather data, pests and diseases, and optimal farm activities. This valuable data can be then utilized for effective decision-making and efficient resource allocation. Reduce Intermediaries, Blockchain can assist reduce The quantity of intermediaries within the chain of supply by working directly Among farmers and buyers. This could lead to fairer prices for farmers and lower prices for consumers. Fair Trade and Ethical Sourcing, Consumers of today pay extra emphasis on the ethical as well as environmental factors of their food. Blockchain is beneficial, farmers and producers attract good customers by providing proof of fair trade and ethical practices. Land ownership and insurance, In areas where proof of ownership is uncertain, blockchain can enable transparent and secure recording of land ownership and insurance, reduce land disputes and improve land management. Sustainability and environmental impact, To track and record land ownership and activities. Explore permaculture practices such as organic certification and carbon footprint reduction. This promotes more environmentally friendly agriculture. Police Insurance and Risk Management, Thanks to blockchain, crop insurance can be better managed and claims processed faster and more transparently, reducing fraud and increasing farmers' compensation for crop losses.

II. LITERATURE REVIEW

Here we discuss inventory information management throughout the supply chain through the use of ethereum blockchain within the application. Dujak and Sajter discussed the necessity of open connections in connected devices D. Dujak et al. [22]. They said open access to the information kept within the blockchain about the chain of supplies could bring benefits such as faster information, less direct communication and further details at the conclusion users. Actually, Maersk and IBM have developed transportation technologies, especially packaging materials and applications, to digitalize the global economy M. Linnet et al.[23]. To achieve this a partnership is required between IBM, Maersk and DuPont, Microsoft, and other companies to

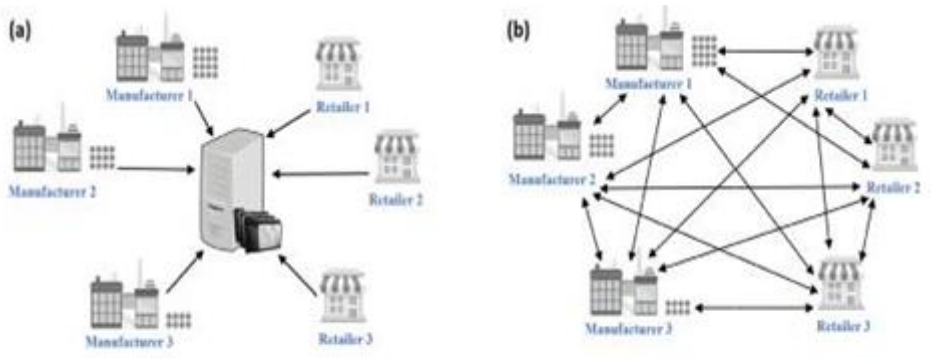
safeguard transactions and produce tamper-proof documents utilising an open blockchain regulations for the whole global shipping industry. The price of preparing documents and information for delivery containers can be in the same proportion as the actual shipment M. Linnet et al .[23]. They can guarantee that each and every information and transactions occurring throughout the chain of supplies are open and understandable to all partners. A blockchain application is used for this that creates a digital workflow document containing credentials & details among all parties involved in the transaction and movement of the product, such as who issued or moved the product, when and where.

Thus, building a blockchain platform results in minimum to zero contact between local as well as global levels, removes mistakes, hold-ups, and other waste, additionally makes good information trading and indirectly makes business transactions smoother. chain. Inventory moves faster D. Dujak et al. [22]. Every piece of information is accessible and dispersed, reducing dishonesty and inaction. The key benefit for sea carriers, ports, airports, and intermediate carriers is the ultimate visibility into cargo, such as reliable and instant visibility, end-to-end equipment connectivity and better performance and planning within their business. Additionally, Rotterdam and Antwerp, Europe's two largest ports, are also aware of blockchain potential I. J. Orji et al. [24].

Blockchain technology has the ability to impact all types of businesses which require transparency, not just agriculture, transportation and logistics. For example, in conjunction with RFID systems in production to identify the key product, as tracking and visibility are better S.A. Abeyratne et al. [25]. Demand forecasting can also benefit from blockchain because the information It is unchangeable and dependable in the blockchain. Additionally, the technology helps prevent fraud because users need to confirm their identification. This function is especially helpful in pharmaceuticals and luxury goods because it can help reduce counterfeiting I. Haq et al. [26] ,L. E. Cartier et al. [27] . Lastly, employing smart contracts on-chain aids make transactions more flexible as it eliminates involvement of a third-party S.E. Chang et al. [28]. A more thorough examination of the current plans or announced smart contracts shows that agro solutions for Industry 4.0, supply chain management, and IoT are the best contracts in the market G. Prause. [29], Z. Wang et al. [30]. In the chain, blockchain integrates information, money and information necessary for Reorganising. Gold State Foods, a significant restaurant service provider, employs blockchain technology to monitor, track and trace its food. Additionally, Kohl's, Macy's, and Nike launched Chain Integration Pilot (CHIP) programs in 2017. CHIP successfully retrieved 223,036 serialized product data points from the product catalog, allowing partners to coordinate and cooperate as the information is accessible to everyone [30]. Ozer et al. The necessity of good information in knowledge sharing Ozer et al. [31]. When talking about military procurement, Zaerens K. Zaerens et al. [32] proposes smart contracts to monitor the balance and validity of information between participants. The research regarding the execution of blockchain in Agro-supply chain supervision is still in its infancy, It might be very helpful investigating resources that will enable the chain managers should make use of the platform as proxy physical evidence for shared information and data. We determine that the COVID-19 outbreak highlights the need for logistics transparency and production allowing to share inventory in situations such as shortages or increased demand.

III. ANALYSIS

All about efforts to create a blockchain-based shared solution. Some solutions do not support storage, such as M. Linnet et al. [23]. We also discovered that none of these answers provide DApp assistance. Conversely, Our resolution offers a way to manage transactions and collaborate on-chain using The blockchain of Ethereum and its intelligent contracts. Adding Dapps to our solutions will facilitate exchange of information between retailers and sellers while also supporting product sharing with stakeholders. Second, the DApp won't occur affected by the failure; Meaning all involved stakeholders easily access the stored data because The framework is not dependent on a single centralized application. Additionally, network partners do not have to rely on external stakeholders such as government agencies or developers to support their business.



(a) Centralized supply chain (b) Decentralized supply chain

Fig 1 Supply Chain

IV. CONCLUSION

We discussed the importance of information exchange for our agro-supply chain to function as efficient and effective possible. Our solutions combine blockchain and decentralized storage technologies to increase trust, efficiency and openness in connected devices. It also helps improve collaboration between partners while cutting down on pointless pauses. It is possible to modify the solution to various products in the schematics, algorithms, system architecture, products, and conditions can be adjusted accordingly. Our resolution allows participants to communicate exclusively via smart contracts, thus protecting participants' integrity, trust and accountability. Smart contracts are accessible to the public on GitHub for study and community use. Solutions appeal etc. It should not contain honest information. We discussed its security from different angles. Different rates are offered to each participant. Our research shows that blockchain-based data sharing solutions can reduce efficiency, cost and economic efficiency, and enable stakeholders to access better information with trust and security. In the future, we aspire to develop business programmes that enable complete automation of other related procedures impacting every types of products. We also know that since blockchain research in its starting stages, in future issues such as scalability, governance, and performance are obvious problems needed to be addressed .

Table 1 Relative to existing technologies

Features	Guggenberger et al. [37]	IBM & Maersk [23]	Wang et al. [38]	Casino et al. [39]	our work
Inventory sharing	✓	✓	✓	✓	✓
Blockchain-based	✓	✓	✓	✓	✓
Smart contracts	✗	✓	✓	✓	✓
Decentralized storage	✗	✗	✗	✓	✓
DApps	✗	✗	✗	✗	✓
Publicly available	✓	✓	✓	✓	✓

REFERENCES

[1]. L. Sparks, ‘‘Supply chain management and retailing,’’ in Chain of Supply Forum: Int. J., volume 11, number 4, pp. 4–12, 2010.
[2]. N. Anand and N. Grover, ‘‘Measuring supply chain for retail performance,’’ Benchmarking: Int. J., vol. 22, no. 1, pp. 135–166, Feb. 2015.
[3]. "The impact of supply chain integration on performance: A contingency and configuration approach," by B. B. Flynn, B. Huo, and X. Zhao J. Oper. Manage., 27 (2018) 1 (1) pp. 57–71, 2010.
[4]. J. Li, M. J. Shaw, R. T. Sikora, G. W. Tan, and R. Yang, ‘‘The effects of supply chain information-sharing tactics performance,’’ College Commerce Bus. Admin., Univ. Illinois at Urbana-Champaign, Champaign, IL, USA, Sep. 2002. [Online]. Available: http://citebm. cba.uiuc.edu/B2Bresearch/ieee_em. pdf
[5]. M. M. Ali, M. Z. Babai, J. E. Boylan, and A. A. Syntetos, ‘‘Supply chain forecasting when information is not shared,’’ Eur. J. Oper. Res., vol. 260, no. 3, pp. 974–994, Aug. 2017.
[6]. H. Mendelson, ‘‘Organizational architecture and success in the information technology industry,’’ Manage. Sci., vol. 46, no. 4, pp. 513–529, Apr. 2000.
[7]. R. Croson and K. Donohue, ‘‘Behavioral causes of The bullwhip effect and the observed value of inventory information,’’ Manage. Sci., vol. 52, no. 3, pp. 323–336, Mar. 2006. [8] N. Ebrahim-Khanjari, W. Hopp, and S. M. R. Iravani, ‘‘Trust and sharing of information in supply chains,’’ Prod. Operations Manage., vol. 21, no. 3, pp. 444–464, May 2012. [9] A. T. Zadeh, S. Sahran, M. Mukhtar, Z. Lotfi, and "Information sharing in supply chain management,’’ Proc. Technol., vol. 11, pp. 297–304, Jan. 2013.
[8]. I. A. Omar, R. Jayaraman, K. Salah, M. Debe, and M. Omar, ‘‘Enhancing Supply chain operations for vendor-managed inventory utilising blockchain smart contracts,’’ Access IEEE, vol. 7, pages.. 172704–172719, 2020.
[9]. S. M. Wagner, ‘‘Intensity and managerial scope of supplier integration,’’ J. Supply Chain Manage., vol. 39, no. 4, pp. 4–15, Sep. 2003.
[10]. H. L. Lee and S. Whang, ‘‘E-business and supply chain integration,’’ in The Practice of Supply Chain Management: Where Theory and Application Converge. Boston, MA, USA: Springer, 2004, pp. 123–137.
[11]. P. M. Dunne, R. F. Lusch, and J. R. Carver, Retailing. Boston, MA, USA: Cengage Learning, 2013. [14] I. Plazibat and S. Brajevic, ‘‘Chain of supply in retail industry,’’ Bus. Logistics Mod. Manage., vol. 9, pp. 133–140, 2009.
[12]. F. Chen, ‘‘Information sharing and supply chain coordination,’’ in Handbooks in Operations Research and Management Science, vol. 11. Amsterdam, The Netherlands: Elsevier, 2003, pp. 341–421.
[13]. P. Fiala, ‘‘Information sharing in supply chains,’’ Omega, vol. 33, no. 5, pp. 419–423, 2005.
[14]. F. Longo, L. Nicoletti, A. Padovano, G. d’Atri, and M. Forte, ‘‘Blockchainenabled supply chain: An experimental study,’’ Comput. Ind. Eng., vol. 136, pp. 57–69, Oct. 2019.
[15]. S. Laaper, J. Fitzgerald, E. Quasney, W. Yeh, and M. Basir, ‘‘Using blockchain to drive supply chain innovation,’’ in Proc. Digit. Supply Chain Manag. Logist. Hambg. Int. Conf. Logist., vol. 1, Dec. 2017, p. 2013.
[16]. R. Azzi, R. K. Chamoun, and M. Sokhn, ‘‘The power of a blockchain-based supply chain,’’ Comput. Ind. Eng., vol. 135, pp. 572–592, Sep. 2019.

[17]. D. Dujak and D. Sajter, ‘‘Blockchain applications in supply chain,’’ in SMART Supply Network. Cham, Switzerland: Springer, 2019, pp. 21–46.
[18]. M. Linnet and K. Mosquera, ‘‘Maersk and IBM will collaborate to use blockchain technology to enhance international trade. digitalize supply chains,’’ Jun. 2017. [Online].
[19]. Available: https://newsroom.ibm.com/2017- 01-16-Maersk-and-IBM-to-Form-Joint-Venture-Applying-Blockchain-toImprove-Global-Trade-and-Digitize-Supply-Chains
[20]. I. J. Orji, S. Kusi-Sarpong, S. Huang, and D. Vazquez-Brust, ‘‘Evaluating the elements influencing the adoption of blockchain in logistics for goods industry,’’ Transp. Res. E: Logistics Transp. Rev., vol. 141, Sep. 2020, Art. no. 102025.
[21]. I. Haq and O. Muselemu, ‘‘Blockchain technology in pharmaceutical industry to prevent counterfeit drugs,’’ Int. J. Comput. Appl., vol. 170, no. 25, pp. 7–12, Mar. 2017. [24] L. E. Cartier, S. H. Ali, and M. S. Krzemnicki, ‘‘Blockchain, chain of custody and trace elements: An overview of tracking and traceability opportunities in the gem industry,’’ J. Gemmol., vol. 36, no. 3, pp. 212–227, 2017.
[22]. S. E. Chang, Y.-C. Chen, and M.-F. Lu, ‘‘Supply chain re-engineering using blockchain technology: A case of intelligent contracts based tracking process,’’ Technol. Forecasting Social Change, vol. 144, pp. 1–11, Jul. 2019.
[23]. G. Prause, ‘‘Smart contracts for smart supply chains,’’ IFACPapersOnLine, vol. 52, no. 13, pp. 2501–2506, 2019.
[24]. Z. Wang, Z. Zheng, W. Jiang, and S. Tang, ‘‘Blockchain-enabled data sharing in supply chains: Model, operationalization, and tutorial,’’ Prod. Oper. Manage., vol. 30, no. 7, pp. 1965–1975, 2021.
[25]. Ö. Özer, Y. Zheng, and K.-Y. Chen, ‘‘Trust in forecast information sharing,’’ Manage. Sci., vol. 57, no. 6, pp. 1111–1137, Jun. 2011.
[26]. K. Zaerens, ‘‘Concept for controlled business critical information sharing using smart contracts,’’ in Proc. 2nd Cyber Secur. Netw. Conf. (CSNet), Oct. 2017, pp. 1–7.
[27]. J. Benet, ‘‘IPFS–content addressed, versioned, P2P file system,’’ 2014, arXiv:1407.3561.
[28]. C. Cachin, ‘‘Architecture within the hyperledger blockchain fabric,’’ in Proc. Workshop Distrib. Cryptocurrencies Consensus Ledgers, vol. 310, no. 4. Chicago, IL, USA, 2016, pp. 1–4.
[29]. H. R. Hasan, K. Salah, R. Jayaraman, I. Yaqoob, and M. Omar, ‘‘Blockchain architectures for physical internet: A vision, features, requirements, and applications,’’ IEEE Netw., vol. 35, no. 2, pp. 174–171, Mar. 2021.
[30]. Gas Station. Accessed: Apr. 14, 2021.
[31]. Z. Wang, T. Wang, H. Hu, J. Gong, X. Ren, and Q. Xiao, ‘‘Blockchainbased framework for enhancing information sharing and supply chain traceability in precast construction,’’ Autom. Construct., vol. 111, Mar. 2020, Art. no. 103063.