Fruits supply chain management using Blockchain: A theoretic operation

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Abstract

This study provides a decentralized blockchain-based traceability system that allows for the continuous integration of IoT devices from the producer to the end-user. This study developed a "Supplier-Consumer Network" - a hypothetical end-to-end fruit traceability programme - to help with implementation. The goal is to build a distributed ledger that can be accessed by all network members, resulting in more openness. Also, attempts to construct blockchain-based traceability for farmers and nutrients to reduce the loss and prevent fruits waste. Besides that, it used blockchain-based supply chain management for farmers. Besides that, experts review and farmers validation have been utilized. Blockchain-based traceability to the farmer represents an ultimate trace and explore the best possible way to dispatch to the seller before fruits rotten. This study contributed to the academic understanding of fruit supply chain management. Also, provide an inclusive idea to households and reduce fruit waste. Finding ways to reduce the fruit supply chain can be an effective method of waste prevention through tracing and distributing appropriate times for fruit supply chain management.

Keywords: Blockchain, SCM, Technology integration, Decentralized, Smart contract

1.0 INTRODUCTION

The farm development policy revolves around expanding agricultural production in order to achieve fruit security (David et al., 2022). Better farm productivity, better exploitation of farming inputs, organizational support, and a competent fruit system enhance agriculture's success (Powell et al., 2022). Fruit security is an issue for production and the supply chain (Friedman & Ormiston, 2022). It is involved in the production and enhances the supply chain (Bhat et al., 2022). However, the supply chain source must be traceable, including its producers' names, harvest and production dates. Bangladesh's agriculture system needs a significant overhaul to fulfil the growing demand (Shen et al., 2022). Bangladesh's agricultural issues are being addressed via the development of new technology (Dasaklis et al., 2022). Blockchain is the most recently developed technology based on cryptographic hashing (Wamba & Queiroz, 2022). It's a decentralized, encrypted ledger system for keeping transactions (Kumar et al., 2022). Transactions and user identities cannot be hacked because decentralized mining systems will prohibit any fraudulent

transactions from entering the encrypted chain if they occur.

Supply chain logistics is the most obvious use case for Blockchain technology (Ji et al., 2022). Blockchain technology opens up many possibilities for shipping data in the logistics industry (Oguntegbe et al., 2022). Tracking all of the products and items will help prepare for any delays due to unexpected circumstances (Yakubu et al., 2022). Using distributed technology can trace the supply of perishable items (Agi & Jha, 2022). It is possible to transfer assets in return for cash using Blockchain Technology (BCT). Information like quantity, raw materials, etc., made the fruits transaction more secure (Sahebi et al., 2022). Also, it provides tamper-proof records and periodic checks on a payout of claims during crop losses; crop insurance programmes utilize Blockchain Technology (Saini et al., 2022).

However, smart contracts may settle dealings with non-involvement of external agents (Callinan et al., 2022). This technology eliminates intermediaries' needs (Yousefi & Tosarkani, 2022). The current state of SCM management traceability in agriculture is a dynamic process (Wang et al., 2022). It also explains the effectiveness of fruit SCM. Besides that, this study outlines Blockchain's Methodology and Tokens by integrating NEO Virtual Machine (NeoVM) (Malsa et al., 2022). Finally, this study constructs supplier-consumer software with blockchain and the overall agribusiness process.

2.0 LITERATURE REVIEW

The study focuses primarily on tamper-proof and unchangeable records, fostering confidence and trustworthiness among untrustworthy peers in financial technology (Almutairi et al., 2022). When this notion

was introduced, several industries saw Blockchain Technology as a platform for model change (Elhidaoui et al., 2022). Proper validation, storage, and collection are all made possible by using blockchain technology by Prov-Chain. Tamper-proof records and confidentiality are two of its primary concerns (T. Hasan et al., 2022).

It is impossible to overstate the impact of radiofrequency technology in SCM, on every aspect of this operation, from the autonomous identification system to the delivery of goods (Júnior et al., 2022). To achieve the goal, the researcher investigated the use of RFID and NFC based devices. However, IoT and Blockchain are still in their infancy as a technology. One of the key areas of interest for a blockchain and RFID-based traceability system is the Chinese food sector (Paul et al., 2022). Sezer et al. (2022) mention that fruit tracking is essential, and it reduces fruit loss and increases fruit safety (Sezer et al., 2022). On the other hand did not conduct any performance evaluations as they described the various harvesting stages for retailers (Sumarliah et al., 2022). One of the essential characteristics of some Blockchain implementations is the capacity to complete autonomous transactions, referred to as "Smart Contracts".

3.0 METHODOLOGY

Two networks make up the NEO Platform. You can also have a private key and an address associated with your account. The second type of account is a Smart Contract account, which is run entirely by computer code. NEO Virtual Machine (NeoVM) compiles and runs each node's code. Transactions refer to the exchange of information between contracts. An individual smart contract can be updated

and seen in its current state without dealing with the entire system. It is designed on top of NEO's network to provide worldwide access to transaction execution in real-time.

A. Tokens

The NEO ecosystem follows a feedback system among users. It is a token framework used to build digital tokens on the NEO network (Braidotti, 2022). It also provides a Supplier-Consumer create assets that support and non-fungible token standard. Besides that, it helps to integrate the supplier-consumer with the NEO Platform. All the digital assets are built on their own using the NEO standard.

B. Phases in shifting asset

An Internet of Things (IoT) gadget initiates a transaction through a mobile app. The NEO contract provides security for the tokens on the blockchain (Malsa et al., 2022). Private keys are assigned to the parties involved in each transaction using the supplier-consumer software. Using NnoVM contracts, a mobile app can run on several devices (Suwa, 2022). Additionally, it serves as a layer of abstraction between the IoT device and the end-user.

4.0 FINDINGS AND DISCUSSION

4.1 Blockchain Technology in Fruit Supply Chain

Mango, jackfruits, lichee, pineapple, banana, sugarcane, Guava, Amar, hog plum, vegetables, and many more key fruit crops are all grown in Asia (Hrouga et al., 2022). In the fruit supply chain (FSC), farmers are willing to accept a wide range of technological innovations (A. Hasan et al., 2022). In order to deal with supply chain issues, such as a sudden spike in demand and the supply running out of stock, there is a need for fruit supply chain management (Zhou et al., 2022). Supply Chain Management can also help improve customer satisfaction (Niu et al., 2022). As shown in Fig.1, the supply chain, which encompasses all processes, items, information flow, etc., comprises a variety of parties who must work together to deliver a product to the customer that meets their requirements (Parmentola et al., 2022). This method relies on centralised technologies such as cloud databases and IoT to enable traceability but does not provide transparency and exposes companies to security risks, data tampering and loss (Latino et al., 2022). As a result, the typical supply chain has several limitations.

1. Less fruit security
2. Tempered information
3. Lacking detection

Fig. 1. Traditional Supply Chain

Blockchain technology preserves secure records and provides safety. It primarily lowers transaction costs while simultaneously enhancing product quality (Singh & Sharma, 2022). User trust is increased as a result of this product's cryptographic approach. It employs encryption techniques to verify users'

identities and blocks (Manupati et al., 2022). It is the chain's ledger that dates back to the genesis block. A hash value in each block serves as a pointer to the block before it (Mukherjee et al., 2022). Users and transactions can be authenticated through the network's peer-to-peer system (A Raja Santhi & P Muthuswamy, 2022). This approach uses the Proof-of-Stake (POS) consensus mechanism to generate user-validated challenges that are then included in the block if they are valid.

4.2 Smart Contracts

In the context of blockchain technology, traditional contracts do not work well (Abirami Raja Santhi & Padmakumar Muthuswamy, 2022). There may also be less efficient tracking and stealing in conventional supply chains because of the enormous amounts of paper documentation (Lin et al., 2022). The predetermined circumstances can help to solve the

problems of traceability, competence, and safety (Song et al., 2022). This eliminates the need for intermediaries or significantly reduces their role. A smart contract will self-execute if the predetermined requirements have been met (Jamil et al., 2022). As long as the agreement terms are met, the contract will automatically execute the agreed-upon activities (such payments) without needing a third-party intermediary. This feature is one of the most important distinguishing NEO from other blockchains (Neo et al., 2022). When consumers acknowledge receipt of their package, a smart contract can release the money to the carrier. Using a smart contract, one can write code that does not require a third party to execute it. Efforts and resources are saved as a result. Additionally, no third parties are involved in the transaction process. Therefore, there is no risk of user error or fraud.
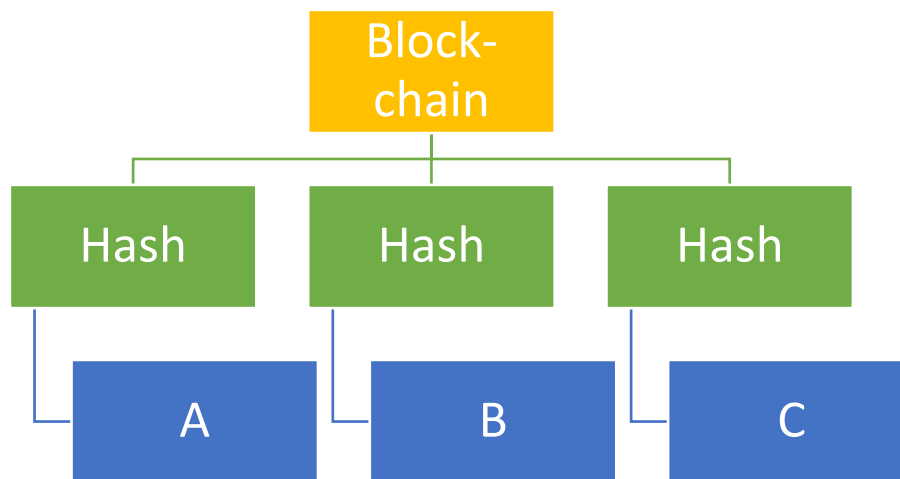

Fig. 2. Block-Chain

The smart contract is a commitment between parties to a transaction that makes each participant responsible for their involvement and ensures that the agreement is enforced (Sadayapillai & Kottursamy, 2022). It is now possible to build relationships in the supply chain through block-chain, improving supply chain transparency, traceability, and accountability. An address of 20 bytes is assigned to every intelligent contract ever created (Egwuonwu et al., 2022). Users do the transactions by the contract code cannot be modified after it is posted to the blockchain (Ali et al., 2021). Each network's consensus node will have to perform this transaction to reach a

consensus. A smart contract can be either deterministic or non-deterministic (Kayıkcı & Subramanian, 2022). There are no external parties involved in executing a deterministic smart contract (Bux et al., 2022). For example, a contract that relies on another party's database is a "nondeterministic" smart contract.

4.3 Fruit Blockchain Complete Development

An efficient database system with a distributed record that includes the supplier-consumer solution makes use of blockchain to offer widespread access and inspection of the data (Sharma et al., 2022). An opportunity exists thanks to blockchain technology.

Increasing Openness

- Error Reduction
- Prevents the delay of products
- Get rid of any unethical or illegal behaviour.
- More effective management
- Improving customer and supplier trust

Increasing customer demand necessitates a more efficient supply chain (Bhushan, Kumar, et al., 2022). Supply chains can benefit from adopting Blockchain technology to improve the marketing environment (W. Chen et al., 2022). The provider uploads information regarding the food item, such as when it was gathered and its cost (Sarah & Bergmans, 2022). After that, an RFID chip is attached to the food item through shipping tagged with the appropriate code (Y. Chen et al., 2022). There are numerous uses for the information on the tags (Alkhateeb et al., 2022). RFID scanners can read the tag's

data, which could include helpful information that could be very helpful in keeping the object in a good condition supply chain, such as:

ID number

- Each product has a unique serial number.
- Logs of where a person has been.
- Container number Product Origin
- Status
- What Makes It Up

Fig. 3 shows that radiofrequency gives the notification by the identification number and code. The system will leverage radio frequency information to automatically position and product transfers (Bhushan, Kadam, et al., 2022). By incorporating RFID into products and the correct characteristics of those products, avoiding the interruption of the supply chain. Using the Internet of Things easier the shipping process, enhancing the supply chain and logistics (Chowdhury et al., 2022). When an RFID-enabled supply chain network is fully exploited, it is possible to locate the product, ensuring security and prompt enforcement (Lee et al., 2022). Suppliers apply RFID tags, and then producers receive goods info and include a QR code on the packaging.

The distributor receives an automatic notification of the receipt of food products when shipped from the producer. Customers' demand date and identification are available to traders to choose an appropriate 3PL (third-party logistics) (Yoon & Pishdad-Bozorgi, 2022). The 3PL (distribution, warehouse, and fulfilment services) is then informed of the food product's origin and destination. It adapts to changing network conditions to provide the best possible throughput (González-Puetate et al., 2022). In addition to providing an

app for users, retailers are now using machine intelligence to estimate demand. Information about the product will not change. So when it's time for the goods to hit the shelves in the retail market. The store has no secrets in terms of shipping times (Balamurugan et al., 2021). They adjust orders, promotions, and so on in light of this. It's all done through the use of smart contracts. At each stage of the production process, the RFID is scanned, and the details are updated using a mobile app to the cloud-based blocks (Alawi et al.,

2022). As a result, storing blocks in the cloud is essential. It's all done through application software or cite to verify and trace etc. (Rejeb et al., 2022).

It is only once the genesis block has been created, with all its associated data and the first transaction having been made, that the Blockchain will begin to function (Narayanaswamy et al., 2022). Customers can use an app to scan a QR code and view the product's origin, ageing, duration, expiration dates, and other information.
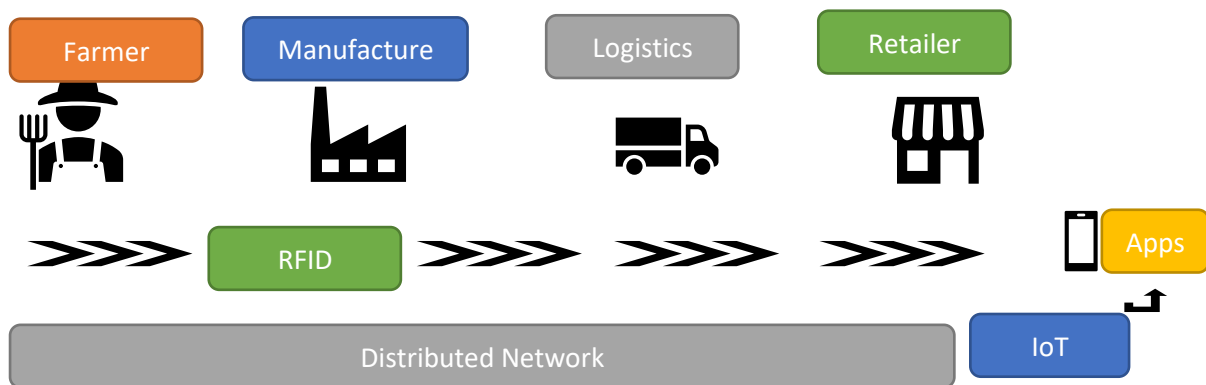

Fig. 3. Distributed Fruits Supply chain

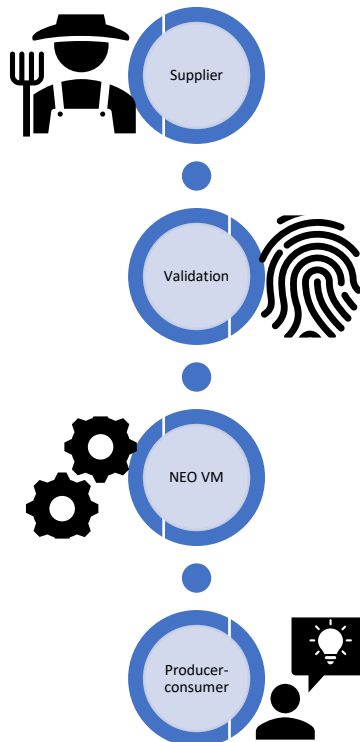Incorporation of producer-consumer software.

Fig. 4. Incorporation of producer-consumer software

Fig 4 explains the Agri farmer channel and its networks. Producers and consumers are defined to use the system for the supply chain—this study application software for consumers using NEO network for the consumer view.

In this case, NEO serves as a decentralised data storage platform. IoT, Server, and Provider consumer Software are all components of the forum. The Server links NEO-based nodes to the programme. The NEO and android library software can access all of the features of the blockchain virtual machine. Using the application software, engage and align the contracts.

Using communications each time a process is completed, a mobile app scans the RFID and updates the information saved in the cloud for each block. Blocks are stored in the cloud. It is all done via the app or website. Asset batches may be identified in seconds, and clients can be alerted to the dangers by sending out a push notification.

5.0 CONCLUSION

Fruit safety is dependent on the traceability of supply chain management. Customer satisfaction and productivity are also boosted by supply chain management. Because of centralized data storage, product quality, rate, and origin cannot be guaranteed. Because of this, there is a need for a decentralized system that is open and accessible to everyone involved, from producers to consumers, to ensure that everyone is satisfied. Using the digital technology known as the blockchain, tracking and viewing the entire supply chain is possible. Using this technology positively affects the relationship between different stakeholders and farmers. Besides that, the blockchain enhanced storage capacity, security, immutability, minting, and traceability of records.

Even though it is still in its infancy, blockchain technology has made significant strides in the last few years. This technology might be a game-changer for the state to help revolutionise agriculture, whose supply chains BCT can improve while also supplying traceability and security. Reduces corruption and boosts consumer happiness, significantly impacting the country's economic standing. The Provider-Consumer Network serves as a framework for putting together the components of such a system. It was explained how to use tokens and smart contracts in NEO to connect supply chain management nodes.

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