Agri food supply chain using blockchain

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Abstract. Supply chains are becoming into automated and extremely complicated networks, and they are becoming an increasingly important source of potential advantages in today's environment. In recent years, there has been a significant rise in customers' attention to concerns regarding food safety. However, tracking the source of all data and maintaining its traceability throughout the supply chain network is difficult. Traditional supply networks are centralized, and trading is done through a third party. It is a promising distribution system technology that has the potential to help agricultural supply chains by lowering transaction costs and speeding up processes while also boosting transparency and security. Blockchain for Agri-food supply chain has the potential to transform the agricultural industry by optimizing all stages of the supply chain and enabling for the tracking of products from the field to the retail shelf. The Agri-food supply chain also has the potential to be implemented digitally as a cost-cutting measure and yield accelerator for the food industry's supply networks.

Keywords: supply chains, blockchain, Agri-food

1. Introduction

Consumers nowadays are concerned about what they eat, where it comes from, and how it is manufactured. In case of traditional food supply chain, it fails at providing such clarity as it witnesses the participation of various stakeholders such as farmers, manufacturers, distributors and retailers before the food products finally reach the customer. In the food business, blockchain may be a huge stage with a lot of benefits and adaptability, particularly in terms of traceability, manufacturing, and financing. The supply chain is critical to the whole process's success [1,6].

For example: Assume you're going to the grocery shop to get some vegetables. The vegetables at the shop appear to be fresh, so the customer purchases them. But does the individual know if the food they are purchasing is safe to consume or not? What if the person could view the farms, refineries, storage facilities, and inspection facilities where the food is farmed, processed, and stored? It is now hard for customers to obtain information on food products [5,7,14]. To overcome the above mentioned problems our proposed system will give a solution using Blockchain. In today's world people are more curious to know about how the product which they are consuming is processed and they are so concerned about the product whether it is safe to consume or not. Agri-food supply chain using gives the complete traceability of the product by the means of smart contracts. The major scope of the project is to provide

quality assurance of food products to consumers and to ensure food safety. To build trust between the producer and the consumer [11,12].

2. Background

2.1. Blcokchain

Blockchain is a technology that allows you to store records in the form of blocks that are linked together in a chain. Confirmed transactions or records are grouped together in a block, along with a hash code. A blockchain is a digital ledger that is decentralized, distributed, and typically public, and is made up of records called blocks. It is used to record transactions [13, 15].

2.2. Traceability and supply chain

Food supply chain is that entire traceability of the product right from production to distribution the processing details till it reaches the customer will be traced using supply chain.

When it comes to transparency, the Agri-food supply chain includes many stakeholders, making it more complicated and harder to manage. Food quality and safety are affected by time as well as external variables like weather and transportation[1,4].

As with traditional food supply chains, information management is crucial, since it may contribute to transparency and confidence between customers and industry players in the conventional food supply chain. Food supply chain difficulties can be solved using a traceability system. The International Organization for Standardization (ISO) is an international organisation that sets standards.

In general, traceability system is based on some factors such as
•Data which is to be collected,
•One who owns the data,ily understandable
This work mainly focuses on Agri supply chain
•How the data should be collected and
•How to make the data available and easin, which influences and could be benefited by the consumers.

2.3. Blcokchain based Agri food traceability

Researchers are now using blockchain technology to attain traceability in the modern day. End-to-end transparency is achieved via blockchain technology, which also improves the validity of information. The supply chain with the most evaluated items by Dutta et al. is in the agriculture or food domain. [3,4].

3. Related work

When developing a product traceability mechanism for Agri-food items in ASCs, data on production, processing, storage, distribution, and retail should be gathered and documented [1]. Most traditional ASC traceability solutions, on the other hand, rely on a centralized system managed by a trusted third party, which may be vulnerable to single-node failure and security issues including data manipulation and information leakage [2,3]. Improved vertical traceability of goods and monitoring of their processing conditions at each level of the production/distribution chain, as well as process efficiency enhancements, are driving RFID use in the Agri-food industry [4].

The results demonstrate that the proposed agricultural business [5] resource blockchain has the potential to enhance not only the safety of financial transactions and the confidentiality of company data, but also the reliability of the public service platform and the effectiveness of the value chain as a whole. An examination of a value chain traceability system was performed using HACCP (Hazard Analysis and Critical Control Point), blockchain technology, and the Internet of Things [6]. In their proposed new decentralised traceability system [7], they employed HACCP to cut down on food risk occurrences and IoT and blockchain technologies to reliably and securely transmit massive amounts of real-time data about food to all parties in the value chain.

Blockchain-Based Soybean Traceability in Agricultural Supply Chain [4,5,8] reports that the Ethereum blockchain and smart contracts are utilised to trace, track, and perform transactions in soybean supply chains. When it comes to managing and securing the food supply chain, our system provides transactions and records with the highest possible levels of integrity and reliability, as well as security. A mining node can be any computer system that acts as a transaction collector, verifier, and executor. There are still problems with this technology's scalability, administration, identity registration, personal data security, standardisation, and regulation [9,10].

4. Proposed system

4.1. Methodology

Figure 1 depicts the basic methodology of blockchain based Agri food chain process. The production of raw materials begins in the farmers, who are the first link in the supply chain. We've developed a comprehensive, end-to-end system that will assist farmers maximise their profits from crop production and sales. It is possible for farmers to sell their goods to the processor at the local market. The quality inspector will assess the harvest and record his findings in the distributed ledger. The raw material's quality may be guaranteed by using this as a quality control measure by the processor. The final step is for the processor to sell their wares to a retailer. A record of each stage is recorded in the distributed ledger.

The full report from retailer to farmer may be made available to the customer when the goods is delivered. As a result of this change, the network is now fully transparent, and any instances of forgery throughout the supply chain can be quickly identified thanks to the recorded timestamps. This allows for complete product tracking from the factory to the consumer. With point-to-point updates over immutable chains, an efficient supply chain may be assured. Customers might select certain farms and goods based on their preferences. Smart contracts can help farmers and end users come to a better arrangement.
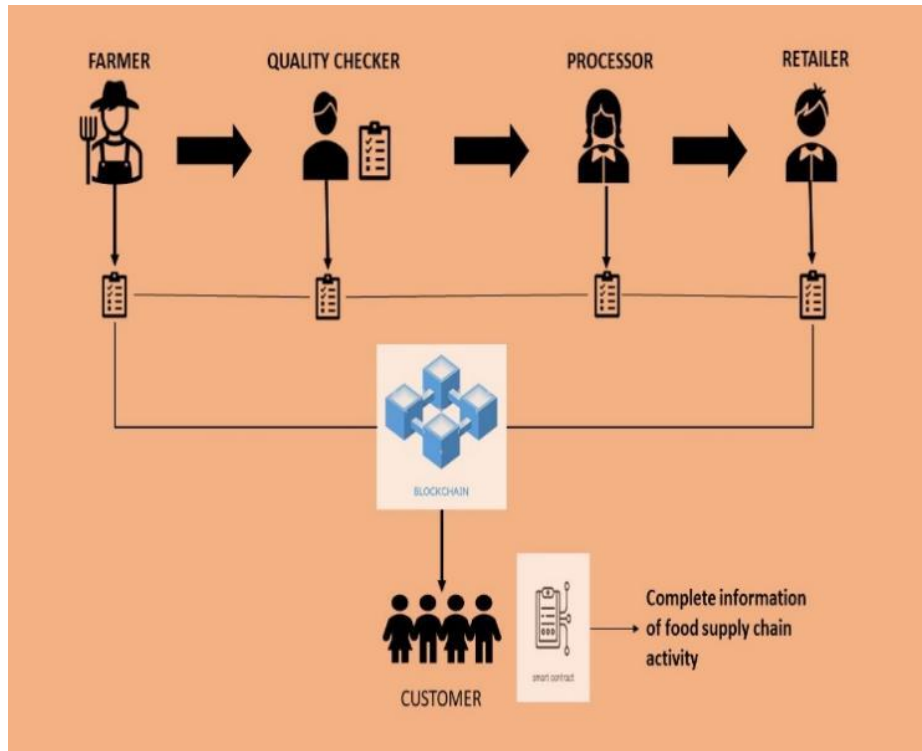
Figure 1. System methodology.

4.2. *Blockchain based Agri supplychain*

The production of raw materials begins in the farmers, who are the first link in the supply chain. We've developed a comprehensive, end-to-end system that will assist farmers maximise their profits from crop production and sales. At the wholesale market, farmers may sell their produce directly to manufacturers. The quality inspector will assess the harvest and record his findings in the distributed ledger. The raw material's quality may be guaranteed by using this as a quality control measure by the processor. The final step is for the processor to sell their wares to a retailer. A record of each stage is recorded in the distributed ledger.

The full report from retailer to farmer may be made available to the customer after the goods has reached the customer.. So, by implementing this, transparency can be achieved where the forgery can be prevented. Customers will be able to obtain complete product traceability as a result of this. With point-to-point updates over immutable chains, an efficient supply chain may be assured. Customers may also have the option of selecting individual farmers for their own products. At the point where the product reaches the customers, smart contracts can enable a better agreement between farmers and consumers presented in Figure 2.
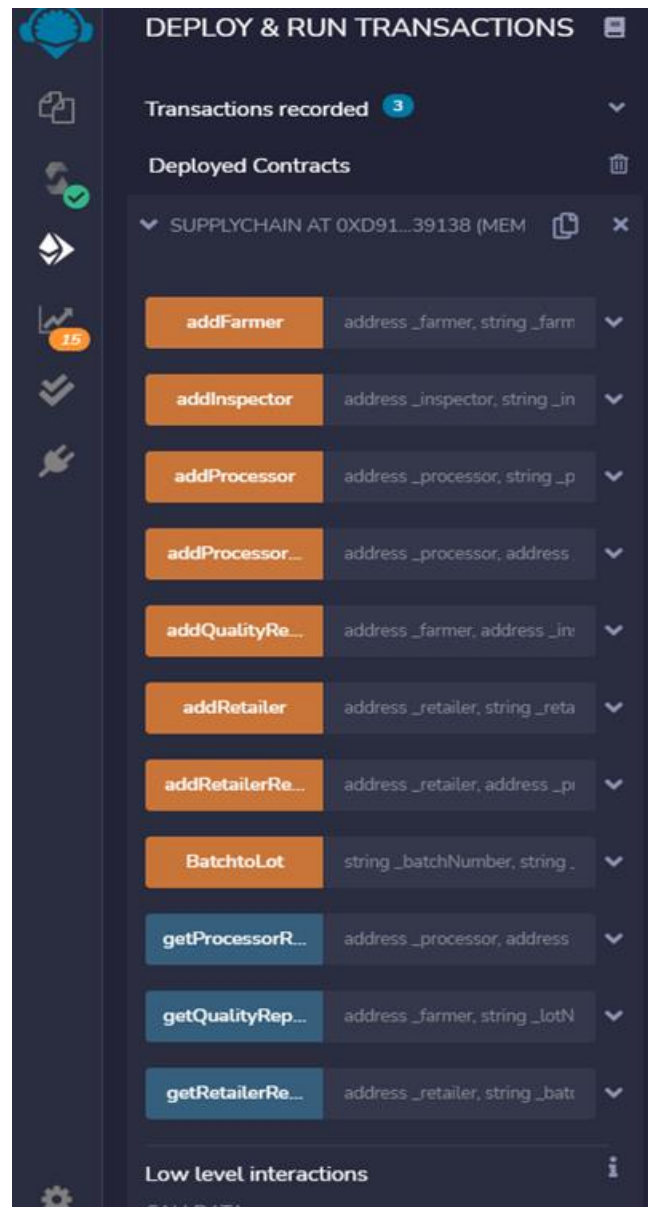

Figure 2. Deployed contracts.

4.3. Modules

4.3.1. User interface. Producer - Producers are farmers. They create the raw commodities that are the supply chain's inputs.

Processor – The duty of the processors is to check for the quality of the crops , verify and the report of the quality is stored in the blockchain network. The processor can then sell their product to the retailer.

Retailer - Acquires the product from the manufacturer for resale to consumers.

Consumer – Consumers are the users. They buy the target good from Retailers. They can view information on the product they are buying, it's source and journey, from farm-to-fork.

4.3.2. Smart contract. A smart contract is a blockchain based computer programme that executes when certain criteria are satisfied. The main benefits of using smart contracts are:
- ❖ Cheaper
- ❖ Trust
- ❖ Efficiency
- ❖ Secured data
- ❖ Backup
- ❖ Accuracy
- ❖ Speed
- ❖ Autonomy

5. Conclusion

Industry has gained various benefits as a result of the blockchain supply chain, including the ability to develop and progress toward autonomy. It allows information to be tracked all the way through the food distribution system, which helps to ensure that all products are safe to eat. Provides a secure means of storing and managing data, which is essential to progress. It preserves the relationship of trust between the product's vendor and customer. Smart contracts are critical in supplying end users with information starting from farmland and ending at the consumer's house. Smart contract performance guarantees that the solution is efficient and reliable. The suggested approach allows the consumer to be certain of the product's origin, manufacturing process, and quality. We have thus proposed a comprehensive blockchain-based solution for the agri-food supply chain.

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