

# The Exploration and Research on Big Data + Block Chain concerning Quality Safety Traceability of Agricultural Products

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**Abstract.** This paper mainly uses the combination of big data and block chain technology to trace the hidden danger of quality and safety in the process of production, processing and transportation of agricultural products. Establishing an omni-directional agricultural product monitoring system without dead angle in the supply and consumer side of the circulation channel to balance the needs of suppliers and consumers, providing a transparent, green trading environment to make sure the transaction is fair, safe and efficient. Big data are used to analyze the problems of fraud in the trade between farmers and consumers, and a series of problems associated with them. Using radio frequency technology, the production process (temperature and humidity, fertilization, drug use, field management, etc.), processing links (storage ring, processing link, etc.)<sup>[1]</sup> can be sold by radio frequency technology. The time division tracking is carried out to ensure the safety of the transaction process.

## Research Background

The safety of agricultural products is an important issue, and the concern of the market for food safety has been the national economy and the people's livelihood. At the same time, "people take food for heaven". What's more, China originally has a food culture, and with the consumption upgrade, consumers are more concerned about food,<sup>[2]</sup> and the demand for food is relatively high. How to solve the problem of agricultural product safety and how to solve the problem of agriculture?

In October 2017, the State Council issued the "guidance on actively promoting innovation and application of supply chain", and proposed the establishment of an important product quality safety tracing mechanism based on supply chain, and the data of agricultural production process into the traceability system, thus the source can be traced and traceable. However, the cost of application and maintenance are high, whereas the performance is poor<sup>[3]</sup>. The combination of the Internet of things and the block chain, the establishment of the agricultural product monitoring system, balance the supply side and consumer demand, reduce costs, and improve the intelligence and scale of the Internet of things concerning agriculture.

The application of block chaining technology to agriculture at home and abroad is just at the beginning stage:

In 2017, the agriculture pilot of Australian block chain was set up. China's first innovation alliance concerning global business district chain of village level was established in "Hao Sheng" village, Wenchang, Hainan.<sup>[4]</sup>

In 2018, Chuang Chuang town of Zhongguancun issued the "33333" program of block chain innovation and entrepreneurship, training 30000 practitioners of district chain industry, cultivating 3000 leader elite of block chain, incubating 300 block chain team, creating 30 unicorns for three years.<sup>[5]</sup>

## The Application of Block Chain Technology in Agriculture

**What is a Block Chain.** Block chaining technology is basically a decentralized record keeping system. In this framework, software is used to complete transactions such as bitcoin or sales. The block chain is a distributed database, which determines that all participants have complete data records and unilateral information modification can not be manipulate. <sup>[5]</sup> This point puts the participants' relationship in an equal position, the participants are both contributions and owners, and do not worry about the trust and interest. Product traceability information will not be modified. The main advantages of block chain are safety and instant verification.

**The Application of Block Chain Technology in Agriculture.** China's agricultural development has entered a new stage of equal emphasis on quantity safety and quality and safety, THE market concerns about food safety have always been a matter of national economy and people's livelihood. On the one hand, agricultural products producers and operators have weak quality and self-inspection capabilities. On the other hand, the construction of safety monitoring mechanisms such as production and sales of agricultural products is still insufficient, Most producers and operators have not been able to establish sound monitoring. <sup>[6]</sup>The process of professional quality inspection agencies is cumbersome and it is time-consuming for agricultural products in the transaction process. Using blockchain technology, database technology, electronic information and other comprehensive technologies, Maintain and update shared quality and safety information records for agricultural products through computer networks. Through decentralization, the trust-based approach collectively maintains a reliable quality safety traceability solution. The realization of this process involves the collection and monitoring of agricultural product quality and safety indicators. Reach source and fundamental transparency; Through decentralization, increase the credit degree for suppliers and sellers in the mobile payment process while reducing transaction costs, The business processes of supply chain transactions and financing are managed in real time, and the security of information resources is guaranteed.

## Existing Solutions and Problems

**How to Optimize the Database Technology.** the three achievements of the traditional database, the relationship model, the transaction processing, the query optimization, the database technology has been developing. In the future, how to solve the authenticity and effectiveness of data in a large-scale way with the establishment of agricultural big data collection system becomes a hot issue. With the introduction of database optimization, the establishment of large agricultural data collection system and the solution of the authenticity and effectiveness of the data in a large-scale way, it will be a difficult problem to solve the problem of system security in the agricultural block chain (difficult problem: the producers and the consumers are too scattered and weak, the two sides can not realize the information symmetry, can not directly dock, and can not determine the price).

**How to Implement the Data Acquisition and Transmission Protocol Revision Through the Zigbee Technology Monitoring System.** data collection methods in the production process of agricultural products, the classification of the collection objects, and the data transmission through the network to the terminal equipment. At the same time, tracking product production, processing and transportation process according to ZigBee technology monitoring system can find problems and solve problems in time, guaranteeing the quality of agricultural products and saving cost <sup>[7]</sup>.

**How to Improve the Performance of the System and Ensure System Security.** maintainability, scalability, contract, compatibility, traceability at the same time: the research of traceability data security storage mode, one is the user information assurance of the two parties, and two is the agricultural products on the platform (containing the timestamp, geographical stamp, and product marked by the block chain. " Three is the storage of massive data in the process of product trading; the establishment of the database is to establish a credit rating reference for farmers and consumers, and to ensure that the complete and transparent information is transmitted to the stakeholders. <sup>[8]</sup> The traceability database is set up to establish reference data for farmers and consumers' credit rating data, so as to ensure complete and transparent information transmission to

stakeholders.

**How to Design a Data Type Intelligent Contract.** an intelligent contract built by a block chain, the digital contract is stored in a transparent shared database, the contract is not controlled by anyone, but is controlled automatically by the contract code, and it is protected in the deletion, tampering, modification and so on. The distributed encryption is realized with the block chain technology. Accounting system, digital contract is stored in transparent shared database.<sup>[9]</sup> Each of these agreements will be protected in the course of deleting, tampering, and modifying. Let farmers and consumers avoid the risk of concerted action when interests converge.

**How to Design the Link of the Quality Safety Traceability System of Agricultural Products and the Interlocking Problems between Various Links.** a set of link of quality safety traceability system for agricultural products are needed to set up, The quality control links are the monitoring and communication problems in the production, processing and transportation of agricultural products and the main circulation link between the supply and consumer side are mainly passed through block chain tracking product information, the participants in the supply chain can not tamper with these information; through large data analysis of agricultural products in production, transmission, trading and other factors affecting the quality of agricultural products, and the use of block chain technology, maintain the foundation platform by the way of centralization and trust ,the use of theoretical analysis and software synthesis. The research method of joint testing is studied from the following step by step.

### **The Core Technology which Constitutes the Quality and Safety of Traceability System Concerning Agricultural Products.**

A virtual framework for traceability of quality and safety of agricultural products (as shown in Fig. 1):The block chain technology is the core technology which constitutes the quality and safety of traceability system concerning agricultural products, and it is formed by a variety of common technologies<sup>[10]</sup>. Therefore, the key technologies are cryptography, computer science and technology, economics, mathematics, network science, database technology, game theory, and so on. The core technology involved are various that constitutes the second factor( system performance, system security, maintainability, scalability, contract, compatibility, traceability) which need the support of relevant policies of the government ; third is a variety of removable language applications, which are the following:

JAVA is used to write desktop applications, Web applications, distributed systems and embedded systems.

C++ development language (bitcoin and ripple) undertakes the inherit and polymorphism of object-oriented programming.

GO development language (Ethereum) parallel, garbage collection, fast compilation, it is the type of language that combines language flexibility and dynamic .

Solidity is a high-level language for running intelligent contracts on Ethereum virtual machines.

The illustration shows that:

1- basic physical structure, 2- block chain technology, 3- data collection, 4- integrated large data  
6- bottom data collection node 1; 7- bottom data acquisition node n; 8- data analysis; 9- network; 10  
production processing; 11- transport..12- user; 13- traceability database;

①image; ②temperature and humidity; ③fertilization;④transaction contract;⑤Back to every link

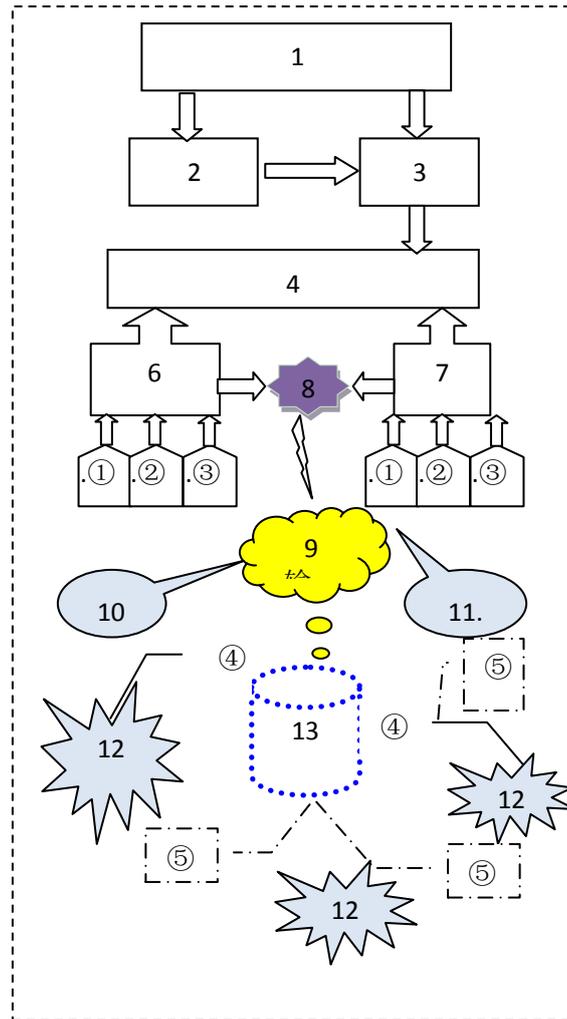


Figure 1. Finite Overall framework

### Forecast Analysis of Application Transformation

Block chain technology is considered to be the disruptive core technologies of the next generation after inventing steam power, electricity and the Internet. In fact, not only in the commercial field, but also in the field of science and technology, the agricultural sector has also welcomed the development of block chain. The application of the block chain will lead to the integration of other new technologies and agriculture, such as intelligent robots, field monitoring unmanned aerial vehicles, Internet of things and fine, intelligent agricultural products trading and agricultural insurance.

Agriculture is a big market. It is a big application scene of the block chain to stand stable agricultural scene, to centralization, save cost and improve efficiency.

**The Safety Traceability of Product Quality with Application Characteristic.** In the process of agricultural industrialization, the distance between the production and the consumption is far away. The information on the pesticide, chemical fertilizer used by the consumer and the additives used in the process of transportation and processing can not be understood, and the consumer's confidence in production is reduced. Based on the agricultural product traceability system of block chain technology, all data will not be changed once recorded on the account books of block chain, and the advanced technology relying on asymmetric encryption and mathematical algorithms fundamentally eliminates human factors and makes the information more transparent.

**The Application of Rural Finance.** Farmers' loans are generally difficult. The main reason is the lack of effective collateral. In the final analysis, there is a lack of credit guarantee mechanism. The properties of open and non tampered technology of block chaining provide possibility for

decentralized trust mechanism.

The use of block chain is to automatically record mass information by program algorithm, and store it on each computer in block chain network. It is transparent, difficult to tamper with, and low in cost. The government can consider how to use block chain technology to allocate and supervise the national budget of agricultural credit and agricultural subsidies.

**The Application of Agricultural Insurance.** The varieties of agricultural insurance are relatively small and the coverage is low. Therefore, fraudulent incidents occur frequently. After the combination of block chain and agricultural insurance, agricultural insurance will have a great improvement in agricultural intellectual property protection and agricultural property transactions. What's more, the process of agricultural insurance will be greatly simplified.

**The Application of Agricultural Disaster.** Intelligent contract is an important concept of block chain, so using the intelligent contract concept in the field of agricultural insurance will make agricultural insurance compensation more intelligent. In the past, if there was a large agricultural natural disaster, the corresponding claim cycle would be longer. When the intelligent contract is used in the block chain, once the agricultural disaster is detected, the compensation process will be automatically started, and the compensation efficiency will be higher.

To conclude, this paper starts from the application of the Internet of things in the field of agricultural food safety, from order agriculture, eco-tourism, ecological pension, and the government's public vegetable basket project, giving the detailed explanation.

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