Research on Agricultural Food Safety Based on Blockchain Technology

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Abstract. As a disruptive Internet technology, blockchain technology is more open, authentic, and traceable than traditional Internet technology. Compared with the traditional food safety tracing system, the food safety tracing system based on blockchain technology has the advantages of reducing costs, improving efficiency, and facilitating supervision by the regulatory department or the general public. However, due to the short development time of the blockchain technology, the food safety under the "blockchain + agriculture" model will still face challenges such as lack of infrastructure and talent, higher hazards of information and data leakage, and lagging of relevant laws and regulations.

1. Introduction
Food safety has always been a livelihood issue of great concern to governments of various countries. It is of great significance to ensure the health and safety of the majority of the people in our country, and it is also related to the establishment of a socialist harmonious society in my country and the establishment and improvement of the socialist market economic order. In recent years, especially before the promulgation of the Food Safety Law, the frequent occurrence of food safety incidents in our country has greatly harmed the physical and mental health of the people, and to a certain extent, deepened the people’s worries about China’s food safety issues, weakened Social confidence of the public. Especially in the context of the continuous development of my country's economy, the gradual improvement of people's living standards, and the increasingly diversified diets of consumers, food safety has received high attention from the public. As the latest technology in the Internet era, blockchain technology has the characteristics of decentralization, information tampering and openness at the bottom, which make information more open and transparent, which not only eliminates the asymmetry of information, but also eliminates the blind spots of consumers’ information. The field of food traceability and circulation in China provides a new development idea, and constantly supplements and improves China's food safety supervision system[1].

2. Blockchain technology
The safety traceability system is a system based on the history of agricultural products application and sales channels to restore the entire process of agricultural product production. The safety traceability process of agricultural products is generally divided into two types. The first is to follow the life cycle of agricultural products through the registered identification code, and carry out the whole process from planting to production and consumption. The second is a reverse traceability system that traces from the downstream link of the agricultural industry chain to the upstream link. The agricultural
product safety traceability system is based on the system of information exchange, logistics inquiry and safety responsibility implementation. To a certain extent, the problem of incomplete information between agricultural products from planting, transportation to consumption is alleviated. When there is a problem with the safety of agricultural products, it is conducive to the recall of agricultural products, accountability for vicious security incidents and the start of punishment mechanisms[2].

2.1. Features and advantages of blockchain technology
As a new Internet information technology, blockchain technology is a distributed data system formed by different information data nodes and data blocks composed of digital passwords. It uses time stamps, decentralization, non-tampering and digital encryption technologies to record information data in data blocks in chronological order, and stores data in a distributed form in the system through a consensus mechanism within the blockchain system, thus formed an information data query system that can be permanently saved and never changed irreversibly. Different nodes are connected end to end through encrypted data, and each node is a molecule with high credibility and equal participation at the same level, and they are all separate and interconnected to ensure the accuracy and availability of information. Simply put, the essence of blockchain technology is a distributed ledger, which stores data information in nodes within the blockchain system, and each node exists separately to ensure the traceability of information. At the same time, the data recording and reading within the blockchain system are subject to multiple machine language checks, so the authenticity of the data can be guaranteed[3].

The blockchain model is shown in Figure 1:

![Blockchain Model](image)
Blockchain technology, as a disruptive technology in the Internet era and an emerging format of traditional finance, has three major characteristics: openness, authenticity, and traceability. Blockchain technology has great advantages in creating business mechanisms, improving operational efficiency, and optimizing system structure. The openness of blockchain technology is conducive to more economic entities innovating and recreating it, and has a more innovative and unique business model. The record and storage mode of the blockchain technology determines that the blockchain system can be decentralized and establish a more secure value network than the Internet network. And every node within the blockchain has the same information advantage, and the information data within the system can be shared, thereby improving the overall operation efficiency.

2.2. Food safety traceability system under the "blockchain + agriculture" model
At present, my country's food safety traceability system cannot meet the food safety needs of consumers. The main reason is that there are many main bodies engaged in the food production industry and are relatively scattered, and they cannot be managed and operated in a centralized manner. At the same time, the data between the various regulatory entities and related entities such as food production and operations cannot be integrated, resulting in the problem of information islands between the various entities. The blockchain technology can rely on the distributed storage method and the common recognition mechanism within the blockchain to enable consumers to trace the cultivation process, processing process, quality inspection process, storage process, transportation process and sales process of agricultural products or food at any time. Or inquire, fundamentally solve food safety problems[4].

The food safety traceability system under the "blockchain + agriculture" model can be divided into four parts: data layer, technology layer, management layer and application layer. The data layer and the technical layer are the core of the security traceability system and the function realization layer of the security traceability system. The management is the guarantee for the function of the food safety traceability system. The application layer is the entrance for consumers to access the food safety traceability system. The role of the data layer is to collect all data related to food information. After the technical layer collects the data, the technical layer provides technical support for it. It can use blockchain encryption to store the data, then stamp the data according to the chronological order of the blockchain, and store it in the node according to the ledger. After the data is stored, the management classifies different foods according to relevant national requirements and regulations and enters the quality inspection procedures to obtain the final food safety information for consumers to choose. The functions of the food safety traceability system are all implemented at the application layer and open to consumers. Consumers can trace food safety on designated government websites or related enterprise websites.

2.3. The advantages of "blockchain + agriculture" food safety traceability system
The decentralized features of the blockchain are conducive to saving information data storage costs and improving its operating efficiency. At present, the traditional information data storage method depends on the data storage center, that is, the information of a system requires a data center to read, write and store uniformly. This will lead to an increasing pressure on the central data storage system as the amount of data continues to increase. In the blockchain system, because each participant follows the same rules and mechanisms, each node exists independently, presents a decentralized feature, and does not have to rely on the central system. Moreover, without the management of the central database, under the same rule mechanism, each node can be directly stored in the node when writing and reading, without having to go through the inspection of the central database, so its efficiency is higher[5].

Blockchain technology ledger distribution can reduce the cost of enterprises in food safety supervision and increase the enthusiasm of enterprises to participate in national food safety management. As a large-scale network infrastructure, the blockchain system can be constructed by government departments or large enterprises in the food industry. And those small food companies
with small enterprises and insufficient capital can completely connect their own food information through open source APIs or commercial APIs according to their own development status and national requirements. They can also complete the reading and storage of information to achieve food safety traceability and supervision.

Relying on blockchain technology can realize the transaction and sale of data, and help to broaden the financing path of enterprises and solve the financing problem of small and medium-sized food enterprises. At present, the data query in the blockchain system requires a key to verify, and companies or social entities want to obtain the key, must be obtained through purchase and other methods, indirectly realize the purchase and circulation of data, to increase the participation of blockchain. The income of the subject is of great significance. At the same time, the authenticity of blockchain storage data can help small and medium-sized food companies to improve their credit. Financial institutions can re-classify credit risk and develop corresponding financial products based on blockchain storage data to expand financing channels for small and medium-sized enterprises.

2.4. The development course of the "blockchain + agriculture" food safety traceability system
Since the reform and opening up, China's agricultural food safety traceability system has gone through the following two important stages: The first stage is that since the State Council issued relevant documents in 2005, it formally proposed to establish and gradually improve the agricultural food safety traceability system. During this period, China's agricultural food safety traceability system, its main feature of the traceability system is that the segmented management is the main method and the auxiliary method of variety management. The second stage is after the reform of the State Council’s institutions in 2013 and the transformation of the regulatory system functions. This vote marks the “full industry chain management” model in which my country’s food safety regulatory functions have officially entered the three links of production, consumption and circulation.

3. Problems

3.1. The popularity of blockchain infrastructure is difficult, and the mechanism needs to be improved
Blockchain, as a new Internet technology that integrates multiple disciplines such as cryptography and computer science, has a high demand for basic hardware equipment and software equipment. In terms of hardware, in addition to basic terminal equipment, such as blockchain node equipment, and core chips, such as information processing facilities. In terms of software, an operating system and browsing system suitable for blockchain operation are also required. At the same time, the distribution of the blockchain system and the P2P technology characteristics determine that the connection of the blockchain system needs a broader and larger-capacity IoT network support. From the current situation of the development of the Internet of Things in my country, it is obvious that it cannot meet the needs of blockchain technology. In addition, from the perspective of the characteristics of the blockchain technology, in the context of the current blockchain technology is not fully mature, the decentralized characteristics of the blockchain technology may conflict with the operating efficiency of the blockchain system, thereby reducing Advantages of blockchain technology.

3.2. Information security of the blockchain system cannot be guaranteed, and the risk of data leakage is higher
The openness of the blockchain technology shows that as long as the participants within the blockchain system can obtain all data backups within the blockchain system, that is, the data within the blockchain system is open and transparent. However, from a certain point of view, the openness of blockchain technology is not only the advantage of the blockchain system, but also the flaw of the blockchain system. As far as an enterprise is concerned, there is a lot of information data that it does not want to be obtained by other companies, and if the enterprise is in a blockchain system, there is no guarantee that the information data will be obtained by companies in the same industry. And in the context of the Internet era, due to the popularization of Internet technologies such as big data and the
Internet of Things, there are strong links between people, between people and things, and between things, so the blockchain system. The internal unsafe entropy (information entropy) is more risky and less secure than traditional information data storage methods. And the decentralization of blockchain technology shows that there is no unified organization in the blockchain system to protect and store data, so the risk of data leakage is also significantly increased compared to traditional information.

3.3. Blockchain-related laws are lagging behind, and their compliance operations cannot be fully controlled
As a kind of social resource allocation mechanism, laws and regulations have the functions of simplifying complex social relations, saving transaction costs, and assisting the stable operation of society. However, as a brand-new Internet technology, blockchain technology is bound to conflict with the original legal provisions, which poses great challenges to the current laws and regulations, mainly manifested in: how to protect the information data in the blockchain system, how The issue of pricing and the division of responsibilities after risks occur.

3.4. The lack of blockchain technology talents makes it impossible for market promotion
The success of a new technology depends on whether it can be marketed and operated, and the shortage of blockchain technology talents has become one of the important obstacles to whether blockchain technology can be widely applied and promoted. Due to the particularity of blockchain technology, talents who meet the development of blockchain technology often require higher knowledge of mathematics, computer, cryptography, and statistical analysis. Therefore, the blockchain industry requires higher comprehensive quality of technical personnel.

4. Suggestions
The food safety traceability system with blockchain technology as the underlying technology is a complex and huge project. In addition to the need to improve technical support capabilities, it also requires other factors such as a sound regulatory mechanism, a perfect legal system, and enterprise safety awareness.

First, speed up the progress of my country's blockchain infrastructure construction and improve my country's blockchain technology level. With the rapid development of China's Internet technology, China's agriculture and food safety industries have accumulated a certain amount of information data, but due to insufficient infrastructure construction for blockchain applications, the construction of data suitable for blockchain systems has been accelerated. The storage center is imminent. It is recommended that government regulatory departments or competent agricultural departments jointly build relevant test centers with technology enterprises, on the one hand, it can promote the development of my country's food safety traceability system, and on the other hand, it can also provide important technical support and guarantee for national strategic development.

Second, constantly strengthen the top-level design of the blockchain field and improve relevant system guarantees to provide a good development environment for the food safety traceability system under the "blockchain + agriculture" model. As a new type of Internet technology, the development and application of blockchain technology is inseparable from the government's policy support and sound system guarantees. For example, in terms of top-level design, relevant departments can refer to the practices of countries that have already carried out security traceability based on blockchain technology to formulate relevant development policies and plans. Specifically, it includes: establishing a sound and reasonable and effective incentive system to encourage food production enterprises to actively participate in blockchain projects and protect the actual interests of food production enterprises.

Third, strengthen the publicity of food safety and enhance the sense of responsibility of food production enterprises. Although the purpose of food production enterprises is to obtain profits, the premise of obtaining profits is to provide compliant and high-quality food to society or consumers, so it is necessary to enhance the social responsibility of food producers. At the same time, it is equally
important to raise public awareness of food safety and to encourage food companies to produce compliant products from the side.

5. Conclusion
Agricultural food safety is related to the healthy development of my country's food industry, and even more importantly to the establishment and improvement of the socialist market economic order and the smooth construction of my country's socialist harmonious society. Blockchain technology is a distributed data system and emerging Internet information technology that stores data information in nodes inside the blockchain system. The essence of the blockchain technology is a distributed ledger. The data recording and reading within the blockchain system are subject to multiple machine language checks, and each node exists separately. Therefore, the authenticity of data and the traceability of information can be guaranteed. Blockchain technology has great advantages in the recall of agricultural products, accountability for vicious security incidents and the initiation of punishment mechanisms.

"Blockchain + agriculture" food safety traceability system can reduce the cost of information data storage and improve operational efficiency, reduce the cost of enterprises in food safety management, and increase the enthusiasm of enterprises to participate in the national food safety management system. In addition, with the help of blockchain technology, data transactions and trading can be realized, and it can help expand the financing path of enterprises and solve the financing problem of small and medium-sized food enterprises. However, the current "blockchain + agriculture" food safety traceability system also has many development obstacles. For example, blockchain is a new Internet technology that combines cryptography, computer science and other disciplines. It is difficult to popularize infrastructure and the mechanism To be improved. The openness of blockchain technology is both an advantage of the blockchain system and a defect of the blockchain system. Therefore, it is necessary to accelerate the progress of my country's blockchain infrastructure construction and improve my country's blockchain technology level. Continuously strengthen the top-level design of the blockchain field and improve relevant system guarantees to provide a good development environment for the food safety traceability system under the "blockchain + agriculture" model. Strengthen the publicity of food safety society and enhance the sense of responsibility of food production enterprises.

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References
[1] Liu H. (2020) Research and empirical analysis of the storage supply of blockchain. J. Industrial Technology and Economy, 39(06): 103-110.
[2] Cai L. (2020) Discussion on the optimization of financial audit based on blockchain technology. J. Accounting and Communications, 11: 122-126.
[3] Jia X.Y. (2020) Research on supply chain management under the development of blockchain and big data. J. Business Economic Research, 10: 49-51.
[4] Li P. (2020) Research on the circulation safety of fresh agricultural products in my country from the perspective of blockchain. J. Commercial Economic Research, 10: 146-149.
[5] Liu L. (2020) Application of blockchain technology in the financial field and compliance supervision. J. Management Modernization, 40(03): 10-12.