Research on the Application of Blockchain Technology in the Field of Supply Chain

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ABSTRACT
This paper analyzes the development of China's logistics industry, combined with the characteristics, architecture and core technology of blockchain, and puts forward corresponding solutions. Blockchain technology removes many constraints in various system applications and provides technical possibilities for the realization of many ideas. This paper summarizes that blockchain technology has a good application prospect in the field of logistics supply chain, which can deal with the long-standing problems in the field of logistics and is expected to bring changes to the logistics industry.
Keywords: Blockchain, logistics, supply chain

1. INTRODUCTION

When mentioning the blockchain, it is necessary to mention the founder of this concept: Satoshi Nakamoto. Who proposed this concept in 2008.As soon as the concept of blockchain is put forward, it has attracted worldwide attention. It developed rapidly in just a few years, and became a very popular new technology in the market, which was highly valued by global financial institutions, commercial institutions and regulators[1].The industry generally believes that one of the most promising areas of blockchain is logistics supply chain. The modern logistics industry has developed rapidly under the high attention of the state. All in all, it is of great practical significance to study the application of blockchain in logistics supply chain.

2. BLOCKCHAIN

2.1. Definition of Blockchain

Blockchain was proposed by Satoshi Nakamoto in 2008.It is the core component of bitcoin. Among them, "block" refers to the information block with time stamp, which connects the information through time stamp to form a blockchain with chain shape. The existence of this time stamp makes the blockchain unable to be tampered with. Once these data are recorded, they will not be reversible in a block. From the perspective of technology, blockchain is not a unitary technology, but a composite technology. Through new technology or new structure, data is integrated, forming a new recording method and storage method[2].

2.2. Types of Blockchain

Blockchain can be divided into public chain, alliance chain and private chain according to admission mechanism, and the latter two are also called private chain in a broad sense. Public chain can be understood as the public sharing platform of blockchain. People can read data, confirm transactions and obtain query results at any time on the public chain. Participants all over the world can join in the process of consensus building.
Private chain is a concept opposite to public chain, which refers to the form of blockchain that is not open to the outside world but only used within the organization. Different from public chain, private chain needs identity authentication and authority management.
Alliance chain is a form of block chain between public chain and private chain, which is usually used in the environment of multiple member roles, such as payment and settlement between banks, logistics between enterprises, etc. In the industry alliance composed of many participants, some nodes are pre selected as accounting nodes, which together determine the generation and addition of blocks.

2.3. Data Structure of Blockchain

2.3.1. System architecture

The system architecture of blockchain can be divided into six parts. See Figure 1 for details.
The data layer represents a block rule used by the data. The network layer implement the P2P protocol to manage network node communications. The consensus layer solves the distributed continuity problem. The incentive level

controls the overall economic stimulus of the entire system. The contract layer provides development environment. The application layer provides a user programmable interface[3].
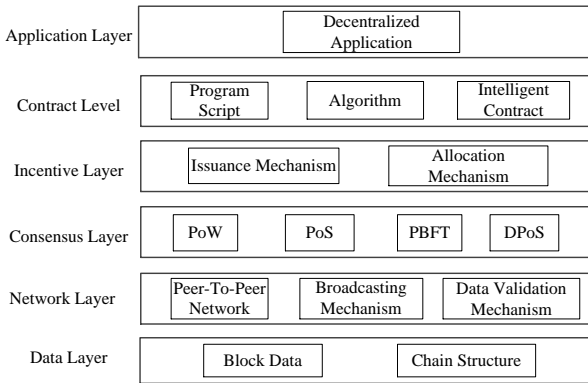

Figure 1 Blockchain reference architecture

2.3.2. Data architecture

For realize the non tamperability of data, blockchain introduces a block based chain structure. Each block consists of block head and block body, in which multiple transactions occurred since the previous block are stored; Prevblockhash and nonce are stored in the block header[4].The detailed structure is shown in Figure 2.
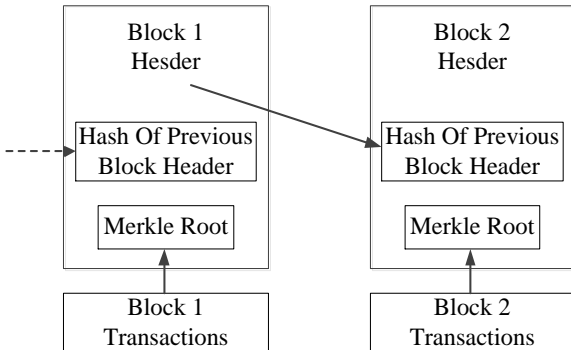

Figure 2 Blockchain reference data architecture

2.4. *Characteristics of Blockchain*

2.4.1. Decentralization

The blockchain database records and stores the data based on the distributed propagation mechanism, and the data recorded by each node will be shared to each other node of the blockchain in real time, and the storage process will be completed automatically. It can be seen that the blockchain

system does not have a third-party centralized management party, and each node is a separate administrator, responsible for the recording and maintenance of system data. In the blockchain system, each node has the same rights and undertakes the same obligations. Even if a node is attacked or accidentally causes the loss of account books, it can be quickly found through other nodes, without affecting other nodes to update information. This decentralized nature makes the security of blockchain system greatly improved.

2.4.2. Distrusted

With asymmetric encryption technology and distributed transmission and storage mechanism, blockchain system subverts the current mode of relying on the third-party centralized organization for credit endorsement in Internet transactions. In the blockchain, all transaction data will be automatically distributed and stored in each node, and the system will keep the whole process of recording transactions, so that it can complete the credit accumulation process and establish the trust foundation of both parties.

2.4.3. Fair and Transparent

Based on specific consensus algorithm, blockchain enables all nodes in the distributed system to verify the block data, so as to solve the trust relationship between nodes, which not only improves the accuracy of authentication, but also improves the transparency and openness of data[5].

2.4.4. Non Tamperability

If you try to modify or rewrite the transaction records in the blockchain system, the cost is very high. This is because distributed accounting technology enables each blockchain node to have a backup of trade info. A single node cannot misrepresent the data alone. If you want to modify it, you need 51% of the nodes in the whole network to agree.

3. THE CORE TECHNOLOGY OF BLOCKCHAIN

The core technologies of blockchain mainly include four categories: distributed ledger, asymmetric encryption, consensus mechanism and intelligent contract. Distributed ledger refers to the bookkeeping method that multiple nodes in the blockchain jointly complete the complete transaction accounts in different places. It has a unique supervision method and high legitimacy. Asymmetric encryption refers to the high encryption of account identity information through cryptography to guarantee the safety of trade info stored on the blockchain and the concealment of personal privacy. Consensus mechanism refers to four different ways of processing information given by blockchain to ensure

that all accounting nodes reach consensus. It is a medium to avoid tampering and identify the availability of records [6].In essence, intelligent contract is an executable program on a computer, which can be executed accurately as long as the conditions are met. However, it is not only a program, but also a participant of the blockchain network. It responds to the information sent by other users, can store the value units in the network, and can also send information and value to other users by itself [7].

4. THE DEVELOPMENT PROBLEMS AND SOLUTIONS OF CHINA'S LOGISTICS INDUSTRY

4.1. Main Problems

First of all, China's logistics costs are high, transportation efficiency is low, the level of intensification is not enough, the industrial support is not reliable, and the "soft power" of integrity, standards, talents, safety, environmental protection is not strong, which are all gaps with the modern logistics power.

Secondly, the overall market environment of logistics in China is of great risk, there are many small logistics enterprises, which are under great pressure of competition with each other. The profit of each logistics enterprise is small, and the operation time of the enterprise is short, which cannot adapt to the pace of the times.

Thirdly, there are unfair competition behaviors such as local protection and lack of credit system in China. Meanwhile, there is a relative shortage of funds and talents. The endogenous mechanism driven by innovation and the supervision and management mechanism of logistics industry are not perfect.

4.2. Solutions

First of all, blockchain can keep the information in the supply chain interconnected, and each member node can grasp the relevant situation in the first time, thus greatly improving the efficiency of supply chain management.

Secondly, each node of the blockchain can obtain accurate transaction information. All member nodes are the owners of all information in the supply chain. On this basis, production activities can reduce the risk faced by suppliers and raise the stability of the supply chain.

Thirdly, the traceability and non tamperability of blockchain can not only ensure the accuracy of data, but also ensure the traceability of transactions. At the same time, blockchain can resolve the trouble of information asymmetry and improve the credit evaluation system [8].

5. APPLICATION PROSPECT OF BLOCKCHAIN IN THE FIELD OF LOGISTICS SUPPLY CHAIN

5.1. Solve the Financing Problem of Small and Medium-Sized Logistics Enterprises

Many logistics enterprises are difficult to handle financing and loan business because their credit is not rated. Blockchain technology can solve this problem with its unchangeable characteristics. Blockchain technology can make information-based goods valuable and capitalized, thus also fixing the sole ownership of goods, making all goods in the logistics chain traceable and unchangeable, and realizing the capitalization of logistics goods. At the same time, the blockchain platform can quickly access the funds to the logistics industry, so that the business environment of enterprises can be improved.

5.2. Avoid Package Loss and Ensure the Safety of Goods

As far as the logistics industry is concerned, the well-known problem is often the phenomenon of package loss, wrong picking, information leakage and so on. However, blockchain technology can truly record and transfer logistics, cash flow and information flow. The transportation process of goods can also be clearly recorded on the blockchain. It can avoid packet loss and wrong claim. As for the sign in of express delivery, only the block chain needs to be checked, which eliminates the problem of false picking of packages. This will help to crack down on counterfeit goods, and ensure the interests of offline distributors at all levels.

5.3. Application of Blockchain Technology in EDI Business

There are many participants in the import and export trade, which produce a series of related business documents and need a lot of information exchange. Therefore, there are special EDI service providers at all ports in the world to provide paperless data exchange services for enterprises, governments and other relevant units in the logistics supply chain. However, in the process of using EDI, the service provider does not provide a unified electronic data exchange format standard, which leads to the complexity of the current data format and the problems of information security and confidentiality. It can be seen that the application of blockchain technology in the international logistics supply chain can play an active role in economic development.

5.4. Improve Logistics Credit Evaluation System

Blockchain technology is also used in the most basic express delivery field. It is mainly to record the whole process from the delivery of goods to the signing in, so as to achieve the traceability of goods, and merchants and customers can master the logistics information dynamics. The application of blockchain can save the credit information of related transaction entities on it, and any transaction participant can query the credit information of all transaction parties. This kind of credit information recorded on the blockchain is true and reliable, which cannot be tampered with, and provides a reliable basis for the parties to the transaction. During the peak period, problems such as wrong picking, false picking and package loss are effectively avoided, the real name system of logistics is implemented, and the interests of both merchants and customers are safeguarded [9].

6. CONCLUSION

With the deepening of "Internet plus", intelligent logistics demand is constantly expanding. Meanwhile, one belt, one road and other major initiatives will continue to be implemented. Logistics will increase rapidly between the two countries, and the demand for regional logistics efficiency will also be enhanced. As a new thing, blockchain has strong vitality. It will find a series of balance points in the industry and application market segments, such as freedom and supervision, anonymity and openness, privacy and security. Although the research of blockchain technology still tends to theory, the development of blockchain technology is widely favored by the industry, and this more and more popular trend will continue. To make good use of this new technology, we need rigorous research and demonstration as well as policy support. The application of blockchain technology is expected to solve the existing problems in the logistics supply chain and achieve industrial transformation. It is believed that the mature blockchain technology in the future will reshape the future economy.

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