Application of Blockchain Technology in the Field of International Logistics

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Abstract: *Blockchain technology is now a new type of science and technology with high application value in many fields. Exploring its application in the field of international logistics will help solve the problems in international logistics, further accelerate the intelligent process of logistics, reduce costs, and improve the efficiency of international logistics. This paper analyzes the characteristics of blockchain and the problems in international logistics, and finds that there is a close coupling between blockchain technology and international logistics, and then proposes the application models and practical cases.of blockchain technology in international supply chain logistics, international trade logistics and customs clearance.*

Keywords: *Blockchain Technology, International Logistics, Application Mode*

1. Introduction

As one of the more cutting-edge modern information technologies, blockchain technology has gradually become known, and people have begun to try to use it in various fields. Although Bitcoin is the most famous and earliest application of blockchain, its application field is far more than cryptocurrency. At present, the application areas of blockchain technology include: finance, Internet of Things, public and social services, security and privacy, etc. As an important part of international trade, the application of blockchain technology in the field of international logistics cannot be ignored. This will help improve the efficiency of international logistics, including helping to track vehicles, increasing transparency in the transportation chain.

The marginal contribution of this article lies in the fact that this article focuses the application of blockchain technology in the field of international logistics. In addition to exploring the theoretical level of application mode, it also combines specific practical applications.

The remaining content of this article is organized as follows: The second part is a literature review; the third part is an overview of the blockchain; the fourth part is the problems of international logistics; the fifth part is the research on the coupling between blockchain technology and international logistics; the sixth part is the research on the coupling between blockchain technology and international logistics; The part is the application mode and practice of blockchain technology in international logistics; the seventh part is the conclusions and prospects.

2. Literature Review

In recent years, the literature related to the application research of blockchain technology in the logistics field has gradually increased. Francisconi M. (2017) empirically studied the application of blockchain technology in port logistics, corresponding the functions provided by the information system to various uses of the blockchain, analyzed the practical application cases of blockchain technology, and evaluated Benefits from the application of blockchain technology. Hao Yukun et al. (2017) designed a blockchain-based smart container information platform to leverage the technical advantages of blockchain to efficiently and securely share information, reduce logistics costs and simplify processes. Cai Jinhua et al. (2017) analyzed the application of blockchain technology in the construction of a cigarette supply chain logistics information system, and believed that technical advantages such as decentralization, traceability verification, and smart contracts can help solve problems such as high cost, low efficiency, and high risk. Wang Chuanlei et al. (2017) studied the

coupling relationship between blockchain and supply chain logistics information resources, analyzed blockchain supply chain logistics information resource management from the object, attribute, and function dimensions, and constructed a blockchain-based supply chain logistics information ecosystem model. Wang Juanjuan et al. (2018) conducted a research on the applicability of blockchain technology in logistics in the "Belt and Road" region. The results showed that blockchain technology can help the "Belt and Road" region to improve the transparency of logistics information and build an efficient logistics mechanism. It also proposed that the government should lead the construction of logistics safety mechanism. Li Xudong et al. (2019) analyzed the typical application models of blockchain technology in cross-border supply chain logistics, cross-border trade logistics, and cross-border customs clearance, and proposed implementation paths to improve cross-border logistics management performance.

To sum up, there have been many studies on the application of blockchain technology in the logistics field. Scholars have proposed some design-level application models and operational-level programs and methods, but there are few documents aiming at the internationalization of blockchain technology. The application in the field of logistics is mostly theoretical exploration, and less attention is paid to practical cases that have been used.

3. Blockchain Overview

3.1. Concept

In 2008, a scholar named "Satoshi Nakamoto" published a seminal paper "Bitcoin: A Peer-to-Peer Electronic Cash System". Bitcoin is a cryptocurrency, and blockchain is the underlying technology of Bitcoin and the virtual infrastructure of Bitcoin. Bitcoin was the first application of blockchain. It was not until 2013 that blockchain technology began to be applied to other cryptocurrencies, such as Ethereum.

Generally speaking, the blockchain can be defined as a decentralized and distributed digital account, in which all information sequences are recorded in chronological order, with the purpose of creating permanent and tamper-proof account records. These records are combined in "blocks" and then "linked" to each other using encryption technology, so they are called "blockchains". The blockchain can be regarded as a ledger. Everyone can participate in bookkeeping. A person's bookkeeping will be sent to everyone in the system for backup. Therefore, everyone in the system has a complete ledger. When the accounting behavior occurs, all the ledgers are updated through the peer-to-peer network, and the accuracy and non-tampering of the information of the ledgers are ensured based on the consensus mechanism and time stamp technology. The workflow of blockchain transactions is shown in Figure 1.
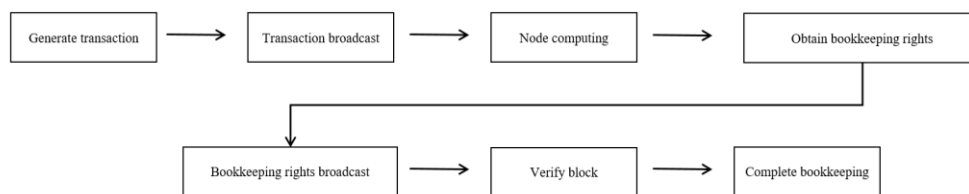

Fig 1. Blockchain transaction workflow

3.2 Features

3.2.1. Decentralization

There is a central institution in the traditional transaction system, and every transaction must be verified by this institution. For all participants, the information added to the blockchain is immediately visible and distributed. Distributed accounting replaces the original central organization. Each node can access the data on the system, thereby achieving peer-to-peer Direct transactions do not require a single central third party to authenticate. Decentralization can reduce server development and operation costs, and make transactions autonomous and simple. The comparison between traditional centralized ledger and distributed ledger is shown in Figure 2.
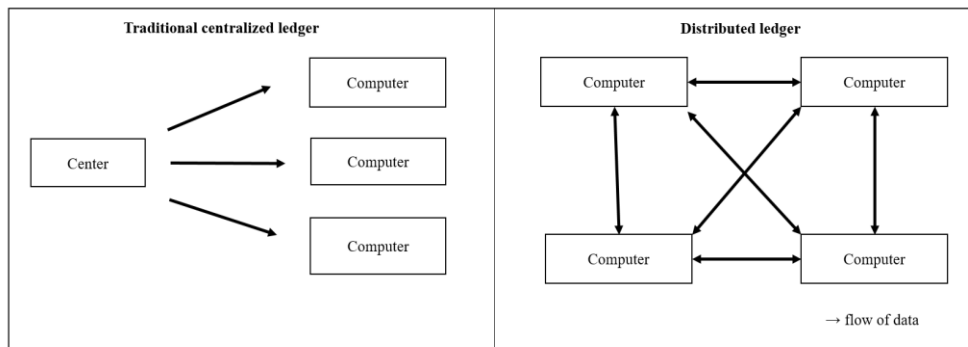
Fig 2. Traditional centralized ledger versus distributed ledger

3.2.2. Traceable

The timestamp is to give the blockchain system a time dimension, and connect the nodes in the order of time according to the time sequence and cover the system time proof, which is used to provide accurate time for the data transaction information within the blockchain system. Any transaction on the blockchain is time-stamped and cannot be easily modified. Users can verify and track previous records by visiting any node in the distributed network, and each transaction can be traced back to the previous transaction, so the blockchain has strong traceability and verifiability.

3.2.3. Automation

Blockchain provides a flexible script code system for users to build advanced smart contracts, which can automatically execute pre-set rules and procedures in transactions. The use of smart contracts automates transactions, payments, etc., thereby improving efficiency.

4. Problems in International Logistics

4.1. Information Distortion

In the current cross-border logistics business, the information exchange between different logistics relationship parties is a series linear single-chain business. Once the data in a link of the information chain is lost, tampered with or deleted, the upstream and downstream logistics relationship parties cannot retrieve the real data in the early stage. Due to frequent transactions and the inability to share information between transaction subjects, it is easy to cause information distortion, and information distortion will inevitably cause transaction security risks, such as fraudulent origin of goods, fraudulent express document information, and increased frequency of return and exchange of goods.

4.2. Difficulty in Tracing Responsibility for International Logistics Accidents

The difficulty in traceability of cross-border logistics accident liability mainly stems from the isolation of logistics information. Carriers, customs, storage enterprises, distribution centers and other related parties control the information platforms of different business links. These platforms are not connected to each other. The logistics information required by the logistics relator of a certain business link is provided by the consignor or its agent, and then the logistics relator inputs the information into the information platform of the business link. But the logistics relation party of other business link cannot share and supervise the data on the logistics link information platform. In the international logistics business, common accidents include transportation document fraud, cargo damage, poor cargo, loss, delayed delivery, etc. Because cross-border logistics takes a long time, and there are many procedures and steps, the responsibility for accidents is due to the existing cross-border logistics business system. The relevant records of is unknown or untrue and cannot be accurately defined.

4.3. The High Cost of International Logistics

Since international logistics needs to go through such links as outbound customs clearance, international logistics, commodity inspection and tax declaration, and entry customs clearance, each link involves multiple activities, such as customs clearance, warehousing, packaging, distribution, commodity inspection and other steps, which leads to higher international logistics costs.

5. Research on the Coupling between Blockchain Technology and International Logistics

5.1. The Coupling between the "Decentralization" Characteristics of the Blockchain and the Need to Solve the Problem of Information Distortion in International Logistics

The distributed accounting feature of blockchain technology can ensure that the entire supply chain is completely in a reliable and transparent visual state in terms of institutional mechanisms. The logistics parties on each distributed node in the blockchain logistics service system jointly supervise and maintain the data. The "centralized" data distribution model ensures the authenticity of the data and eliminating information islands.

5.2. The Coupling of the "Traceability" Feature of the Blockchain and the demand to solve the difficult problem of responsibility traceability in international logistics

The time stamp function and traceability technology of blockchain technology can trace the entire process of product production and effectively solve the problem of product traceability and anti-counterfeiting. The most important thing is that if there is a problem during the transportation of the product, any party in the logistics system can trace back to reliable electronic evidence through blockchain technology, which can clearly define the responsibilities of each party.

5.3. The Coupling of the "Automation" Feature of the Blockchain and the Demand for Solving High-cost Problems in International Logistics

Blockchain technology programmable smart contract can automatically fill in the contract according to preset rules without intervening between the two parties in the transaction, and realize automatic execution under the premise of meeting the preset conditions, so as to prevent customers from delaying payment due to various reasons. Smart contracts can be used in a series of links in supply chain logistics that require contract protection. At the same time that the final customer's receiving behavior occurs, both suppliers and intermediaries can simultaneously obtain transaction information.

6. Application Mode and Practice of Blockchain Technology in International Logistics

6.1. Application of Blockchain Technology in International Supply Chain Logistics

6.1.1. Application Mode

In the field of importing pharmaceutical international supply chain logistics, using blockchain technology to improve the logistics management of the international pharmaceutical supply chain will help to deal with the problems caused by drug fraud. The blockchain logistics information platform records in detail the drug information of each step in the supply chain logistics, efficiently processes massive drug serial numbers and transaction orders, and closely monitors the drug supply chain logistics activities to make the information non-tamperable, safe, reliable, transparent and real-time.

In the field of importing food international supply chain logistic, on the one hand, the core organization of the food international supply chain and various partners jointly build a blockchain information management platform to effectively trace the exact source of food and monitor the entire process of food processing. The production and delivery information of each specific food is recorded in detail. If the food is contaminated, it can be quickly dealt with and dealt with. On the other hand, establish an information feedback mechanism to promptly identify and correct improper operations in the process of imported food from farm to store.

6.1.2. Application Practice

In 2018, JD.com introduced the launch of a blockchain anti-counterfeiting traceability platform built by blockchain technology. More than 400 domestic and foreign brands have cooperated to achieve full traceability of more than 11,000 key products and more than 1 billion traceable products.

IBM and Wal-Mart have cooperated in recent years to develop solutions for food safety based on blockchain technology to help Wal-Mart improve its supply chain tracking capabilities in the Chinese market. In 2019, Wal-Mart requires the fresh vegetable suppliers of its Wal-Mart supermarkets and Sam's Club stores to use the blockchain technology developed by IBM to achieve fast food traceability.

Everledger is a blockchain technology development service platform in the United Kingdom. Its business started from tracking diamonds. Currently, more than 2 million diamonds have passed password authentication on the blockchain, and later expanded to industries such as colored gemstones, jewelry, fine wine and art.

The bottom layer of Wine Chain is based on the QTUM platform, which can track and identify the whole process of production location, production time, transportation and distribution terminal of Wine. Consumers can view the information of each bottle on their mobile phone.

6.2. Application mode of Blockchain Technology in International Trade Logistics

6.2.1. Application Mode

The fulfillment of trade orders should be simplified and speeded up. Blockchain-based international logistics management helps to alleviate many frictions in goods procurement, transportation management, customs cooperation, information tracking and inquiry, trade financing, etc., optimize international logistics documents and information processing, and save operating costs and processing time. Simplify and speed up the order fulfillment process.

The efficiency of international trade logistics should be improved. Trade participants can transmit and exchange electronic data point-to-point, efficiently and securely in the decentralized block chain information system. The business records of all block chain information systems are true and credible, permanently stored and cannot be tampered with. The operation information is traceable and verifiable, which can effectively prevent fraud to the greatest extent.

Transmission of trade documents should be safe and efficient to minimize document costs and document errors. In the international trade process of large-volume commodity orders, documents such as bills of lading and waybills are the core logistics documents, and blockchain technology can be used to effectively promote the digitization of bills of lading and waybills. The decentralized blockchain information system enables the direct interconnection of information between the relevant parties of the ocean bill of lading and air waybill, eliminating the dependence on the central entity or intermediary agency.

Smart containers can be developed to achieve automatic performance. Blockchain smart contract technology can be used to develop smart containers to improve the efficiency of international trade order fulfillment. The container based on the blockchain smart contract technology can achieve a number of important functions: one is to track the visual process of the physical chain of the smart container to confirm the authenticity and effectiveness of the execution of the smart contract; the other is to track the visual result of the physical chain of the smart container, automatically confirm the completion of the fulfillment of the smart contract, and stimulate the automatic closing of the contract; the third is to complete the automatic settlement of the smart contract through the verification of the cargo documents of the smart container.

6.2.2. Application Practice

In 2018, shipping giant Maersk and IBM launched the blockchain-based freight platform TradeLens, which will help improve the efficiency of digital management in all links, and greatly reduce paper documents, mismatched or vacant containers, and fraud in intermediate links. problem. By 2020, it has processed 1 billion cargo, 30 million containers and 14 million documents, more than double the previous year. In addition, Maersk is also cooperating with Microsoft to use blockchain technology to handle marine insurance.

Alibaba's Ant Financial has developed more than 50 blockchain applications on its own blockchain platform "AntChain". A well-known example is OpenChain, which was launched in 2020 to enable SMEs to use its blockchain technology and smart contracts to reduce costs. So far, more than 6,000 users have written 100,000 smart contracts and contributed to 400 million transactions.

6.3. Application of Blockchain Technology in Customs Clearance

6.3.1. Application Mode

Customs, commodity inspection departments, consignor companies, consignee companies, cross-border transportation carriers, international freight forwarders, customs brokers, banks, insurance companies, other relevant regulatory agencies and other related organizations should be connected in

series to give full play to the technical advantages of blockchain's information and data such as traceability, non-tampering, openness and transparency.

6.3.2. Application Practice

Currently, the full digitization of customs procedures has not yet been achieved. On April 17, 2019, the Tianjin Port Blockchain Verification Pilot Project in China went online for trial operation, achieving for the first time in the country the deep integration of blockchain technology and international trade in transactions, finance, logistics, and supervision.

7. Conclusions and Prospects

In summary, this article combines the theoretical application of blockchain technology in international logistics and practical cases that are being promoted or achieved success. There is a close coupling between blockchain technology and international logistics. The characteristics of "decentralization", "traceability" and "automation" of blockchain technology help to solve the information distortion, difficulty in tracing responsibility and high cost in the field of international logistics. Therefore, the application of blockchain technology in international logistics has extremely strong value. In terms of international supply chain logistics, the application of blockchain technology helps to accurately and completely collect important information about items in the supply chain logistics process, such as detailed records of imported medicine and imported food. At the practical level, many suppliers and e-commerce platforms have applied blockchain technology to trace the source of goods, and there are also many blockchain technology development platforms that provide product traceability services. In terms of international trade logistics, the application of blockchain technology can help simplify and speed up the fulfillment of trade orders, improve the efficiency of international trade logistics, accurately and efficiently transmit trade documents, and realize automatic contract fulfillment through smart containers. At the practical level, the freight platform launched by Maersk Line and IBM has received support and cooperation from multiple parties, and Alibaba uses smart contracts to reduce costs. In terms of customs clearance, the realization of data sharing and cross-validation between all parties can help simplify the customs clearance process and improve efficiency. It has not been fully realized at the practical level, and Tianjin Port has launched a pilot program.

Although the blockchain has great potential at the application level, it still faces many challenges, and issues such as scalability, privacy leakage, and selfish miners' behavior remain to be addressed. At the same time, there are technical development and cost issues at the application level. The regulatory rules for the application of blockchain technology still need to be improved.

References

[1] Badzar A. (2016) Blockchain for securing sustainable transport contracts and supply chain transparency - An explorative study of blockchain technology in logistics.
[2] Cai Jinhua, Hu Jiamu. (2017) Application of Blockchain in the Construction of Cigarette Supply Chain System. Logistics Engineering and Management, 39(06):89-90. (in Chinese).
[3] Francisconi M. (2017) An explorative study on blockchain technology in application to port logistics.
[4] Hao Yukun, Zhang Jiyuan. (2017) Logistics operation management system based on blockchain technology. Information Technology & Standardization, (12):20-24. (in Chinese).
[5] Iansiti M, Lakhani K R. (2017) The Truth About Blockchain. Harvard business review, 95(1):118-127.
[6] Li Xudong,Wang Yaoqiu, Wang Fang. (2020) Research on the application mode and implementation path of blockchain technology in the field of cross-border logistics. Contemporary Economy & Management, 42(07):32-39. (in Chinese).
[7] Mario Dobrovnik, David M. Herold,Elmar Fürst, Sebastian Kummer. (2018) Blockchain for and in Logistics: What to Adopt and Where to Start. Logistics, 2(3) :18.
[8] Qin Ming. (2019). Discussion on the Application of Blockchain Technology in Supply Chain Logistics. Prices Monthly, (12):64-69. (in Chinese).
[9] Wang Mingyan. (2020) Cross-border logistics pain point solution based on blockchain technology and its mechanism analysis. Practice in Foreign Economic Relations and Trade, (12):88-92. (in Chinese).

[10] Wang Juanjuan, Liu Ping. (2018) The application of blockchain technology in the logistics field of the "Belt and Road" region. China Business and Market, 32(02):57-65. (in Chinese).
[11] Wang Chuanlei, Wan Yidi, Wang Ningning. (2017) Supply chain logistics information ecosystem model based on blockchain. Information studies: Theory & Application, 40(07):115-121. (in Chinese).
[12] Zheng Z, Xie S. (2018) Blockchain challenges and opportunities: a survey.