Research on the Application of Blockchain Technology in the Field of Cross-border Logistics for Small and Medium-sized Enterprises

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Abstract：With the continuous development of the current economic globalization, coupled with the continuous maturity of Internet technology, e-commerce, as a new industry, has been developing rapidly. Cross-border e-commerce has become the mainstream of development in the current economic era. In the process of cross-border e-commerce development, logistics plays an important role. The success or failure of small and medium-sized enterprises also depends on the efficiency and quality of logistics to a great extent. If some cross-border e-commerce enterprises want to get a place in the current fierce market competition, they must choose appropriate logistics channels to effectively promote their own development. This study explores the typical application mode of Blockchain technology in the field of cross-border logistics, and proposes specific implementation path to improve the performance of cross-border logistics management. This study combines the selection of cross-border logistics drive of small and medium-sized enterprises, analyzes the structural framework, core technology and main advantages of Blockchain, and then analyzes the combination of Blockchain technology advantages and cross-border logistics management needs. On this basis, the application mode of Blockchain technology in cross-border supply chain logistics is proposed; the application mode of Blockchain technology in cross-border trade logistics is proposed with information, documents and containers as typical objects; the application mode of Blockchain technology in cross-border customs clearance is proposed with customs declaration as typical carrier. Finally, the paper puts forward the specific implementation path, main success factors and implementation steps of the application of Blockchain technology in cross-border logistics.

Keywords: Small and Medium-sized Enterprises, Blockchain Technology, Cross-border Logistics, Application Mode

1. SELECTION OF CROSS-BORDER LOGISTICS CHANNELS FOR SMES

1.1 Postal parcels and international express

Postal parcels and international express delivery are a kind of logistics mode with high proportion of cross-border e-commerce logistics channel selection for some small and medium-sized enterprises. Goods transacted online are sent to the postal delivery platform by personal mail to complete the delivery of goods. Due to the long history of the development of postal parcels in China, the logistics channels of postal parcels are particularly mature, and the logistics of postal parcels are widely distributed in some countries and regions, which to a certain extent brings a lot of convenience to the recipients. In addition, the way of sending postal parcels is relatively simple. The cross-border e-commerce only needs to post the number of the bill number on the express mail in the process of mailing, so that the goods can be mailed to the buyer. For a series of procedures required after the delivery of the goods, the postal company will handle the cross-border e-commerce of small and medium-sized enterprises, which saves the work pressure and reduction of the cross-border e-commerce of small and medium-sized enterprises to a certain extent. Due to the convenience of postal parcels, most of the current cross-border e-commerce of small and medium-sized enterprises in China will use postal parcels to complete delivery when choosing logistics. However, the logistics mode of postal

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parcels is not perfect. Due to the large number of items delivered, the delivery time of postal parcels is longer than that of other express delivery. If they are delivered to western countries, it usually takes about 25 days. The express delivery mode of postal parcels only uses some electronic accessories, clothes and hats and other light industrial logistics distribution. In addition, if the managers of cross-border e-commerce of small enterprises deliver the goods, they do not register the goods. As long as the goods leave the country, they will lose contact and cannot get the buyer's receiving status, which brings many problems to the follow-up after-sale of cross-border e-commerce of small and medium enterprises. Therefore, when choosing logistics channels, small and medium-sized cross-border e-commerce must choose logistics channels reasonably according to the type of products they are engaged in.

1.2 Special line logistics

With the continuous development of cross-border e-commerce, special line logistics is a new type of logistics mode. It mainly transports logistics through a third party. Compared with postal parcels, special line logistics is not only fast, but also has a relatively favorable delivery price. With the help of professional third-party cross-border logistics services, the service level of cross-border logistics can be improved and the initial investment cost of enterprises' cross-border logistics can be rapidly reduced[1].

In addition, special line logistics also has a higher advantage in customs clearance. The special line logistics is mainly to effectively decompose the goods in the warehouse of the export city, then organize the goods through strict packaging, and adopt a unified logistics transportation mode to carry out the export operation of logistics for the goods. Because of the advantages of special line logistics, some small and medium-sized cross-border e-commerce enterprises in China begin to try special line logistics one after another, and special line logistics is highly praised by most small and medium-sized cross-border e-commerce enterprises because of its high professionalism. However, special line logistics also has its limitations, the region where special line logistics is located has a certain restriction on the delivery scope.

1.3 Overseas warehouse

Some small and medium-sized cross-border e-commerce enterprises choose logistics channels in order to save logistics costs. Some buyers choose to transport products to the warehouse in the sales place first, and then in the e-commerce platform, as long as customers place an order, they immediately carry out the packaging and delivery of goods. In terms of logistics mode, the logistics mode of overseas warehouse is a more efficient logistics distribution mode. For some small and medium-sized enterprises with high strength, cross-border e-commerce can establish a separate warehouse overseas to transport products. Of course, for some small and medium-sized enterprises in the development process of cross-border e-commerce, only by cooperating with some logistics enterprises can independent warehouses be established overseas. Hybrid cross-border logistics is suitable for complex and changeable cross-border markets, which has the advantages of flexibility, such as special logistics line (International Express) + overseas warehouse, special logistics line + overseas warehouse + border warehouse, etc. [2].With the development of small and medium-sized enterprises' cross-border e-commerce, building overseas warehouse is an advanced way of logistics and transportation, and its management system still has many shortcomings.

2.   WHY DO SMES CHOOSE BLOCKCHAIN FOR CROSS-BORDER LOGISTICS?

The concept of Blockchain is believed to originate from the digital currency, which is a kind of combination of block and a data structure composed of chains. At present, the generally accepted definition of Blockchain has not been formed. The narrow sense of Blockchain refers to the decentralized sharing general ledger that combines data blocks into specific data structures in the form of chain and in order of time, and prevents forgery and tampering guaranteed by cryptography; the broad sense of Blockchain refers to the

generation and update of data with the distributed node consensus algorithm, and the encryption chain block structure a distributed computing paradigm and decentralized framework for data verification and storage, data operation and programming using automated script code (smart contract).

The technological revolution and the multitude of data collection components have highlighted the issue of the level of data security, and the reliability of communications. Blockchain's ability, reliability, traceability, and authenticity of information, as well as intelligent contractual relationships for a trustless environment, foreshadow a major overhaul of supply chains and chain management.[3]

The core technologies and main advantages of Blockchain are as follows[4].

2.1 Distributed ledger technology - decentralized, permanent data storage

Based on the distributed structure and ledger technology, the process of data accounting, verification, storage, maintenance and transmission is completed. Instead of relying on the central organization, the mathematical method is adopted to establish the trust relationship between distributed nodes and form a trusted decentralized distributed system. Transaction bookkeeping is completed by multiple nodes distributed in different places. Unlike traditional database technology, which records and stores data by central administrators, many nodes in a peer-to-peer network can copy each other's copies of real ledgers. Data is backed up by each other among nodes. Each node maintains the system functions in an equal position. Therefore, the damage or abnormality of the point affects the operation of the system and the recording of information, so as to realize the permanent storage of transaction records and data.

2.2 Consensus mechanism: security, authenticity and credibility

In order to effectively verify the effectiveness of transaction information and ensure the authenticity and reliability of data, the Blockchain does not rely on the central organization of traditional database technology, but relies on all nodes in the network to form a consensus on the authentication principle, and ensures the participation of many nodes in the distributed system with a special economic incentive mechanism. In the verification process of data blocks (bitcoin's "mining" is a typical example), only when the number of agreed node members exceeds 51%, can the transaction data be recognized as true and effective.

2.3 Asymmetric encryption algorithm security and tamper proof

The asymmetric cryptography principle is applied to encrypt the data, and the powerful computing power formed by consensus algorithm is used to resist external attacks, so as to ensure that the Blockchain data cannot be forged and tampered; the public key, private key and digital signature are used to ensure the security and accuracy of the stored information and control the access right of the account book, so as to ensure the security of transaction records and information data rely on. For example, IoT devices safety and pricing is an area of concern for IoT industry. Blockchain can help in improving the privacy and safety of IoT devices[5].

2.4 Time series data: traceable and verifiable

The Blockchain stores data through the chain block structure with time stamp inside to generate time sequence for data, and any two blocks are associated with each other through cryptography method, which can trace the data information of any block, so it has strong traceability and verifiability.

2.5 Smart contract: automatic and efficient transaction completion.

The Blockchain provides a flexible script code system for users to build advanced smart contracts, which is equivalent to the digital contracts of business rules, and automatically execute pre-defined rules and procedures when the transaction is in progress; the transparent script code of smart contracts is automatically executed under the supervision of each node and when the conditions are met, the performance process of the transaction cannot be interfered, manipulated or tampered with, ensure the reliability of the results in automatic predefined programs operation.

3.   APPLICATION MODE OF BLOCKCHAIN TECHNOLOGY IN CROSS-BORDER LOGISTICS

3.1 For cross-border supply chain logistics

The cross-border supply chain logistics information platform based on the Blockchain can collect the important information of the supply chain logistics process such as the source of goods, manufacturing, distribution and retail completely and accurately, and store it permanently in the Blockchain information platform for sharing and not tampering, which can significantly enhance the convenience of each member (including the end user) in the supply chain to query and track products, and improve traceable function and information transparency. For example, the platform information can be used to prove the legitimacy of the drugs transported, and high-value commodity manufacturers can provide authentic proof, which is also conducive to the effective identification of consumers whether the goods are authentic.

3.2 Application mode of Blockchain technology in cross-border trade logistics

3.2.1 Simplify and accelerate trade order fulfillment

Cross border logistics is considered as the core support of cross-border trade, while orders for large quantities of goods under business models such as B2B and B2C mainly rely on international shipping or air logistics to fulfill the contract. However, the process of cross-border logistics is more complex, involving a large number of stakeholders. There are often conflicts in the priority of interests. The information management systems for tracking and querying goods are different, resulting in many logistics obstacles, low efficiency of logistics, and even fraud. The management of cross-border logistics based on Blockchain can help ease the friction in the purchase, transportation management, customs cooperation, information tracking query and trade financing of goods, optimize the cross-border logistics documents and information processing, save operating costs and processing time, so as to simplify and speed up the order fulfillment process.

3.2.2 Improve the efficiency of cross-border trade logistics

Trade participants can transfer and exchange electronic data point-to-point, efficiently and safely in the decentralized Blockchain information system. The business records of all Blockchain information systems are authentic, permanent and tamper proof. The operation information of all parties can be traced and verified to prevent fraud to the greatest extent. Participating members can query the logistics progress at any time, track the location of goods in real time, master the continuously updated data in time, understand the customs clearance dynamics in detail, take remedial measures for unexpected events in time, greatly reduce the delivery delay, so as to improve the efficiency of cross-border trade logistics. In addition, they will improve business processes by simplifying the process of acquiring products and services by exceeding currency constraints and transfer charges. As well as encouraging customers and improving their demands[6].

3.2.3 Minimize document costs and errors

In the process of cross-border trade of bulk commodity orders, documents such as Bill of lading and waybill are the core logistics documents, which can effectively promote the digitalization of bill of lading and waybill by using Blockchain technology. Ocean bill of lading is one of the most important documents. As the real right certificate, transportation contract and receipt of trade goods, the information stored in the bill of lading is very important. Like the bill of lading, air bill of lading contains all important details such as the consignee and consignor, loading and unloading place, specific name and quantity of goods, goods handling and expense settlement. In the cross-border logistics management based on the Blockchain, the decentralized Blockchain information system enables the relevant parties of bill of lading and waybill to directly communicate with each other and eliminate the dependence on the central entity or intermediary organization. The core organizations (such as small and medium-sized cross-border logistics enterprises) and participants send, transmit and receive digital documents point-to-point, efficiently and safely through the decentralized network, realize the safe and efficient transmission of documents, minimize the cost of documents and document errors, and

provide a strong guarantee for the accurate delivery of goods to the consignee.

3.2.4 Achieve automatic performance

B2B or B2C is the main mode of cross-border trade of large quantities of products. In the process of cross-border logistics in which the seller enterprise delivers large quantities of products to the buyer enterprise (non-individual), the container is the key logistics equipment. Container delivery involves multiple participants, which is a typical scenario applicable to Blockchain. The Blockchain smart contract technology can be applied to develop smart containers to improve the performance efficiency of cross-border trade orders. The container based on the Blockchain smart contract technology can realize many important functions: first, confirm the authenticity and effectiveness of the smart contract execution through the visual process tracking of the physical chain of the smart container; second, automatically confirm the fulfillment of the smart contract through the visual result tracking of the physical chain of the smart container, so that the contract can be automatically closed; third, through the visual process tracking of the physical chain of the smart container ,and verify the goods documents and complete the automatic settlement of the smart contract. A smart contract is therefore like a bunch of codes and commands to make a transaction (or an action), so long as the permissions or the rules written in the associated codes dictates how that's going to happen. A smart contract once created can be imagined as an object with a code instructing it how to behave in an object-oriented environment[7].

3.2.5 Application in cross-border customs clearance

Customs clearance is one of the core links of cross-border logistics. In the process of customs clearance, we should not only strictly manage the customs, but also improve the speed of customs clearance to promote trade facilitation. These two aspects have always been the dilemma for customs agencies. Among them, the key and difficult point is to ensure the reliability of information data of inbound and outbound goods. Generally, enterprises need to provide complete documents and materials to verify whether the information is accurate, including on-site inspection of goods, which makes it difficult to improve the speed and experience of customs clearance. The blockchain technology and cross-border customs clearance field are integrated to achieve the effect.
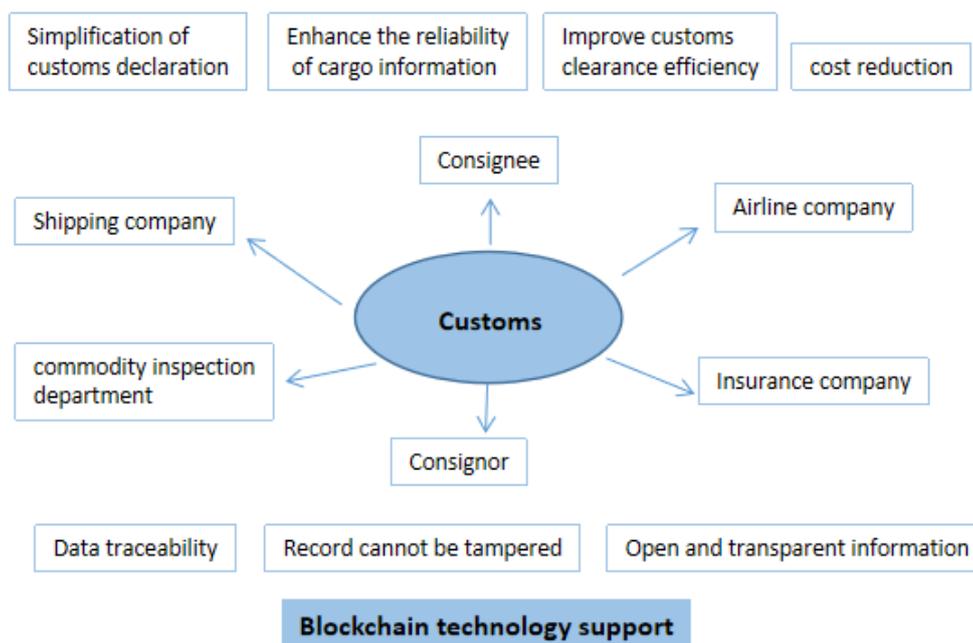

Figure1.   Blockchain support in cross-border customs clearance.

4. HOW CAN BLOCKCHAIN TECHNOLOGY BE IMPEMENTED IN CROSS-BORDER LOGISTICS?

4.1 Create a cooperative relationship and win-win vision

It is very important to construct the path of cross-border e-commerce and cross-border logistics collaborative development for the integration and symbiosis of the two systems. The collaborative path of the two systems can be founded through strategic, functional and business level[8].

When cross-border logistics enterprises or trade enterprises decide to apply Blockchain in logistics management, they should first create close cooperative relationship and win-win vision. Because it will involve multilateral trust and in-depth cooperation, including various partners, industry organizations, customs inspection agencies, and cooperation between legal entities and public institutions such as other relevant departments even competitors. Take the financial service industry with fierce competition as an example. Competitors have built a cooperation platform to jointly study the application of Blockchain technology. Although the cooperation between competitors is contrary to common sense, when more cooperative members are willing to use the same Blockchain solution, all parties can obtain higher value and achieve greater goals. Therefore, in the field of cross-border logistics, logistics blocks can also be built in alliance. However, current data privacy is not applied to the transaction data. Partners are permitted to use such information without any specific data protection. Therefore, it is very important to create certain boundaries to potential applications of blockchain technology. Also, certain parts of shipment details may be referred from Blockchain to an external system link[9].

4.2 Improve the application level of Blockchain technology

New technology is the key support for the organization to realize the value of new operation mode. The cross-border logistics departments and participants of cross-border logistics enterprises and trade enterprises must invest enough resources and time, adopt effective personnel training and technical training methods and establish effective incentive mechanism. The member organizations simultaneously improve the application level of Blockchain technology of employees at all levels, ensure that they fully master relevant knowledge and professional ability, and make due contributions to the implementation of each Blockchain application project.

4.3 Scientific decision-making of Blockchain technology application

The application value and potential of Blockchain technology are immeasurable and need to be explored, which has formed a consensus at home and abroad. However, the current Blockchain technology has not been widely used, and it is still in the early stage of the technology life cycle. The goal and value expectation should be realistic, and the application decision of Blockchain technology should follow scientific and reasonable principles and ideas, which can be completed by decision-making[10].

Questions included:

(1) Is a shared public database required?

(2) Is multi-party participation required?

(3) Are there common interests among participants?

(4) Is it necessary to keep authentic and tamper proof business information records?

(5) Is it necessary to change the business transaction rules in the update cycle?

In addition, in the process of decision-making, SMEs should also consider the cost of applying blockchain technology. Currently, each party creates a partial copy of the product data suitable for their own needs. As a consequence, each party is also responsible for its own costs of creating the imperfect copy and for the failures resulting from inaccurate and obsolete product data[11].

5. CONCLUSION

Also, the use of Blockchain technology in the field of smart logistics remains rare, following its new

appearance, its low popularity, and its complexity for the majority of people and organizations. The first real application in the logistics field was announced in April 2015: Everledger startup uses Blockchain to fight fraud in diamond supply chains[12].

At present, the cross-border logistics industry is speeding up transformation and upgrading, and technological innovation and application have become the core support for improving quality and efficiency. There is a close relationship between the main advantages of Blockchain core technology and the cross-border logistics management needs of SMEs. In the field of cross-border supply chain logistics, Blockchain technology is applied to improve the anti-counterfeiting function of commodities, ensure the safety of logistics process and enhance the transparency of information. In the field of cross-border trade logistics, information, documents and containers are taken as typical objects, Blockchain technology is applied to simplify and speed up the order fulfillment, improve the efficiency of cross-border logistics, and realize the automation of performance .In the field of customs clearance, SEMs shall take the customs declaration as a typical carrier, the Blockchain technology is applied to simplify the customs clearance process and improve the speed of customs clearance. To establish the implementation path of applying Blockchain technology in cross-border logistics, we should first analyze the main success factors, follow scientific principles and ideas to make application decisions, and then formulate corresponding implementation steps. Although the specific application mode and implementation path are put forward, this paper still focuses on theoretical exploration. The successful application of Blockchain technology in the field of cross-border logistics practice cases and empirical analysis are the desirable directions for follow-up research; at the same time, the application research scope for other related fields of logistics needs to be further expanded. The technical characteristics and core advantages determine that Blockchain technology has a broad application prospect in the field of logistics. Looking forward to the future, Blockchain technology will be deeply integrated with new technologies such as artificial intelligence, cloud computing, Internet, big data, etc., so as to promote the sustainable development of intelligent logistics.

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