

# ***Problems and Countermeasures of Block Chain Technology in Cross-border Supply Chain Application***

—Take Guangdong free trade area as an example

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**Abstract**—Guangdong free trade area (FTA) is one of the four pilot areas for cross-border e-commerce in China and an important hub of the "21st century maritime silk road". The development of cross-border e-commerce in Guangdong free trade area cannot be separated from the further development and improvement of supply chain. Blockchain is a decentralized and transparent database, Starting from the consensus mechanism, distributed storage, cryptography principle and other technologies of blockchain, this paper studies the application value and advantages of this technology in cross-border supply chain, and points out the existing problems and countermeasures. This paper provides new ideas for solving the problems of supply chain management and optimization in the development of cross-border e-commerce and international trade in guangdong free trade zone under the background of "One Belt And One Road".

**Keywords**—Guangdong free trade area; Block chain; Cross-border e-commerce; Supply chain; Problems and countermeasures

## I. INTRODUCTION

In December 2014, the state council decided to establish the China (Guangdong) pilot free trade area, covering three major areas, namely Nansha new area in Guangzhou, Qianhai shekou area in Shenzhen and Hengqin new area in Zhuhai, with a total area of 116.2 square kilometers. As an important province of cross-border e-commerce in China, Guangdong province takes up more than 1/3 of the share of the national e-commerce, and is one of the most mature regions in the development of e-commerce in China. Meanwhile, Guangdong is also the largest foreign trade province in China, and has a good foundation for the development of cross-border e-commerce. However, after the rapid development in recent years, constraints such as logistics, supply chain, cross-border payment, tax, government regulation and enterprise clearance have become increasingly prominent, especially cross-border logistics supply chain, which is not only the core competitiveness of cross-border e-commerce development in our province, but also an important development bottleneck [1]. At the same time, blockchain technology is rapidly emerging in the world and gradually applied in many fields.

With the application of blockchain technology, cross-border supply chain appears in the public view in a more advanced, more comprehensive and more efficient form of organization. Driven by block chain technology, China's cross-border logistics supply chain will enter a new development period and actively promote the continuous improvement of international trade industry chain.

## II. DEVELOPMENT STATUS OF CROSS-BORDER SUPPLY CHAIN IN GUANGDONG FTA

Guangdong FAT is located in the pearl river delta economic belt, adjacent to Hong Kong and Macao, with highly complementary industries and high economic correlation. With its superior geographical location and economic foundation, Guangdong FAT is always at the top of China's economic aggregate. According to the Guangdong branch of the general administration of customs, the total value of Guangdong's foreign trade in 2018 was 7.16 trillion yuan, accounting for nearly a quarter of the total value of China's foreign trade, ranking first in the country for 33 consecutive years [2]. According to the monitoring data of 100ec.cn e-commerce research center. In 2018, Guangdong's cross-border e-commerce import and export reached 75.976 billion yuan, up 72.0% [3].

In recent years, Guangdong provincial government has successively introduced a series of measures to support the development of cross-border e-commerce. Under the promotion and combination of China's "One Belt And One Road" strategic opportunities, Guangdong's cross-border e-commerce can still maintain an annual growth rate of more than 30% even under the adverse impact of china-us trade war. However, according to the Guangdong foreign trade development research report 2017 released by the Guangdong academy of social sciences [4], after the international financial crisis, the growth rate of FDI in Guangdong has been declining year by year.

With the increasingly mature ecological environment of cross-border e-commerce industry, the "demographic dividend", "land dividend" and other cheap advantages will gradually lose.

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The export trade advantage gained through the combination of cheap input of production factors, economies of scale and foreign market resources will disappear. Obviously, in order to maintain the rapid development momentum, Guangdong FTA must further overcome many problems in its own development, especially cross-border supply chain, which is not only the core competitiveness of cross-border e-commerce development but also an important development bottleneck. Cross-border e-commerce in Guangdong FTA includes goods trade and service trade. Cross-border supply chain is an important branch of service trade and a carrier of goods trade and investment financial services [5]. As a demonstration zone of close cooperation between Guangdong, Hong Kong and Macao, the main functions and positioning of the cross-border supply chain of Guangdong FTA as shown in table I.

TABLE I. POSITIONING AND CROSS-BORDER SUPPLY CHAIN FUNCTION OF EACH ZONE IN GUANGDONG FTA

FTA	Positioning	Cross-border supply chain function
Guangzhou Nansha new area	Comprehensive cooperation platform; Business service center	Supply chain finance; Offshore service outsourcing; Supply chain platform; Supply chain management.....
Hengqin new district, Zhuhai	Entrepreneurship industrial park; High-end business; Modern tourism	
Qianhai snake mouth area, Shenzhen	Shenzhen-Hong Kong modern service industry cooperation zone; Financial innovation zone	

At present, the three zones of Guangdong FTA are quite different in geographical location, resource advantage, policy support and development degree. In the long run, each of the three regions has its own functional orientation, thus forming a relationship of complementary advantages and common competition.

The organic combination of each area and the supply chain can not only make full use of the resource advantages of different areas, promote the benign competition of the three areas, give full play to the effect of industrial aggregation and integration, and further drive the radiating capacity of the expanded FTA. At the same time, it plays an obvious role in upgrading the level of industrial chain construction and promoting the transformation of trade in goods to trade in services.

Although the cross-border supply chain of Guangdong FTA has made great achievements in finance, shipping, logistics and other fields based on its own positioning, many problems are hidden behind it.

- Lack of integrated service platform integrating multiple platforms such as trading, payment, logistics, customs clearance and supervision, etc [6].
- The low degree of information sharing in the cross-border supply chain leads to the poor coordination ability of each participant in the supply chain [7].
- At present, FTA has a large number of logistics enterprises, but it is still not rid of the pattern of large, small and chaotic. Lack of leading enterprises to drive the in-depth development of the logistics industry

[8]. Lack of international logistics service level, no international competitiveness.

- The current infrastructure, service facilities and other hardware of FTA cannot meet the needs of international and even Hong Kong and Macao capital and industries. The comprehensive transportation system of logistics supply chain is not perfect.
- Due to the imperfect logistics system, the logistics costs are high, the speed is slow, the damage rate is high, the return and replacement trouble, the overseas customer experience is poor, etc [9].
- Lack of credit management system, enterprises in cross-border supply chain, especially small, medium and micro enterprises, have difficulty in financing.

### III. APPLICATION VALUE AND ADVANTAGES OF BLOCK CHAIN TECHNOLOGY IN CROSS-BORDER SUPPLY CHAIN

Blockchain is an important concept of bitcoin. It was first proposed by Satoshi Nakamoto in 2008 and has become the core component of bitcoin, the electronic currency, in the following years. Many industry figures believe that blockchain technology will become the important engine of the fourth industrial revolution.

In simple terms, a "block" in a blockchain refers to a block of information that contains a special piece of information called a timestamp. Blocks of information with timestamps interconnect with each other, forming a chain of blocks of information known as a "blockchain." Blockchain is a distributed ledger, a technical solution for collectively maintaining a reliable database in a decentralized manner.

From the perspective of data, blockchain is almost impossible to change the distributed database, where "distributed" is not only reflected in the distributed storage of data, but also in the distributed record of data. From the perspective of technology, blockchain is not a single technology, but the result of integration of multiple technologies. These technologies combine in new structures to form a new way of recording, storing and publishing data. Consensus mechanism, distributed storage, cryptography principles and other core technologies of blockchain have the following application values and advantages in cross-border supply chain.

#### A. Product Traceability and Safety Assurance

The cross-border supply chain system of Guangdong FTA includes 7 subsystems, including warehousing, transportation, distribution, circulation processing, packaging, loading, unloading and handling, and information processing. Due to the long supply chain and many links, illegal merchants, in order to seek higher interests, cut corners, shoddy goods, fake goods, etc. These phenomena occur from time to time and are difficult to eliminate, resulting in the uneven quality of cross-border e-commerce goods, and the quality cannot be guaranteed. Blockchain technology can establish cross-border logistics tracking system to solve the problem of goods traceability [10].

Firstly, digitize the assets of all members of the cross-border logistics system, including production tools, transportation tools, warehouses and products, so as to facilitate the management and tracking of asset information.

Secondly, the blockchain will record the production information and transportation records of all members. In terms of production, raw material purchase, product manufacturing, distribution, consumer purchase, after-sales maintenance, product transfer, waste recycling and other information related to the product life cycle will be recorded one by one. In terms of transportation, all links from the shipment, loading and transportation to the receiving of the terminal are clearly recorded in the blockchain and are open to all node members.

Thirdly, add the link of commodity verification and signing and receiving. In the commodity verification link, the production, processing, packaging and other data of commodities will be recorded in the system in the form of photos, video and other forms for members to view at any time, and realize a batch of one yard or even one yard for members to verify. In the signing and receiving process, digital signature technology is used to verify the identities of delivery points and couriers. The signing and receiving or delivery can be verified on the blockchain, so as to ensure that goods cannot be falsely claimed through forged signatures.

With blockchain technology, all members of the cross-border supply chain can check the status and progress of goods in real time. Distributed storage and accounting mechanism realize sharing and security of logistics information system under the function of encryption technology addition. It helps members to know the flow direction of goods, realizes the whole-process monitoring of logistics, and ensures that every goods in transit can be traced to the source, so as to avoid the loss of bags, wrong claim and other events, and put an end to the phenomenon of manufacturing and selling fake goods. It guarantees the benefits of all levels of members and consumers in the supply chain.

#### *B. Improve Logistics Efficiency and Reduce Cost*

In the cross-border e-commerce logistics system, consumers are most dissatisfied with the excessively long logistics cycle. Due to the long supply chain, multiple logistics links, and customs clearance and inspection and quarantine waiting time, the average cycle of cross-border e-commerce logistics is more than five times that of domestic e-commerce. It is estimated that 90% of the world's trade is transported by sea each year. Cross-border logistics participants need a faster, safer and more efficient way to improve workflow and handle the documentation needed to move goods across borders. Block chain technology can play a good role in intelligent transportation of containers.

The scheme USES a distributed accounting system to link dedicated containers and containers, digitizing end-to-end data flow and realizing real-time interaction of original data and documents. The system helps companies manage and track the written records of tens of millions of shipping containers worldwide.

For freight companies, it can not only track moving containers, but also help companies reduce the cost of trade filing and processing, and solve the problem of delay caused by errors in transfer documents.

For customs, real-time tracking can bring more information for risk analysis and target determination, thus enhancing security and improving the efficiency of border clearance procedures.

For members of the supply chain, they can check the status of customs documents, bills of lading or other data at any time. The high transparency of information can help reduce fraud and errors, shorten the time spent in the transportation and shipping of products, improve inventory, and ultimately reduce waste and costs.

The intelligent transportation system of container also can decide the transportation route and schedule of container independently. Through the analysis of previous transport experience, containers have the ability to design, update and optimize their own routes and schedules, so that the efficiency of freight transport continues to improve. According to the analysis, the application of intelligent container technology is expected to save the industry billions of dollars in costs.

#### *C. Improve the Financing Difficulties of Small, Medium and Micro-sized Logistics Enterprises*

In the Guangdong FTA, most members of the cross-border supply chain are small and medium-sized enterprises, which often encounter difficulties in trade financing and export tax rebate financing due to lack of collateral, margin and credit rating. In addition, most smes need to submit information certificates and materials issued by multiple parties when applying for financing. In addition to verifying the authenticity of various trade elements, legal persons and other information, Banks also need to verify the cross-information with the departments of industry and commerce, taxation and inspection. It takes a lot of time to verify the authenticity, and the verification process costs a lot of human resources, materials and money.

Block chain technology has the potential to change the current financial credit infrastructure framework, which enables all kinds of assets of participating members, including manifests, bills, goods, etc. to be integrated into the block chain in the form of digital assets. The reason why assets can be digitized is that blockchain technology can trace and fake all goods and goods in the logistics chain. All assets registered on the blockchain are immutable and cannot be forged, thus securing sole ownership of goods. The technology of sharing accounts of blockchain can optimize the credit granting process of enterprises, effectively shorten the credit granting cycle, accelerate the financing lending of enterprises, and reduce the operating costs and risks of small, medium and micro-sized enterprises due to the lack of timely funds.

#### IV. THE PROBLEMS AND COUNTERMEASURES OF BLOCKCHAIN TECHNOLOGY IN THE APPLICATION OF CROSS-BORDER SUPPLY CHAIN

##### A. The safety of Assets and Transactions

Encryption algorithm is one of the core technologies of blockchain, which enables the non-forgery, irreversibility and traceability of data information. The specific implementation process is through asymmetric encryption of the public key and private key, using the public key to encrypt the data, using the private key to decrypt the data. Encryption algorithms are used for authentication, credit management, information transmission, proof of ownership of assets, traceability of goods and even every transaction. Although the private key is generated and kept by members and no third party is involved in the whole process, once the private key is lost or the algorithm is cracked, it will lose the ownership of all the assets of the account, which will cause permanent loss to the user. In the future, with the development of quantum computer and other new computing technologies, it is possible to crack asymmetric encryption algorithms. Therefore, while vigorously advocating the development of blockchain, we also need to consider how to integrate blockchain with a variety of new technologies, strengthen research on the security of relevant technologies, improve the overall security level, and strengthen the advantages of blockchain.

##### B. Privacy Issues

Distributed storage is another core of blockchain. Each member of the blockchain has a complete ledger for verifying the validity of transactions and registering transaction data. However, all the transaction data of this book is open to the whole Internet. If you know someone's account, you must know all the personal information, important assets and every transaction record of his account, which makes the personal information and trade secrets of the account have no privacy at all. To solve this problem, it is necessary to establish network connections with higher privacy and settable hierarchical access rights. First, develop authentication agency technology to ensure that block network transactions do not embed personal information, and realize user identity authentication and privacy protection Second, set members' access rights, and stipulate that no other node can view the ledger or transaction information except the node where the transaction is taking place. Third, it attaches great importance to the information resources in the blockchain network. All nodes accessing the network must carry out authentication to prevent unauthorized network node access and information disclosure.

##### C. The Efficiency of Consensus Algorithms

Under the guarantee of the consensus algorithm of blockchain technology, every transaction of each node will be recorded truly and completely. However, the consensus algorithm has the problem of excessively pursuing fairness and transparency and affecting the efficiency of data transmission. Bitcoin, for example, can handle only seven transactions per second on its network and takes 10 minutes to confirm. Such processing efficiency is difficult to meet the requirements of cross-border supply chain characterized by high transaction

frequency, short cycle, large number of members and wide distribution. It can be seen that there is still a lot of room for optimization of the consensus algorithm, which requires constantly strengthening the research and development of core technologies and equipment, improving the consensus algorithm, and establishing a technical system with short update time, large data throughput, efficient and flexible communication mechanism, and high real-time requirements, so as to meet the information management requirements of the cross-border supply chain system.

##### D. Supervision and Management Issues

Adopting blockchain technology to transform cross-border supply chain system is a positive innovation, but only under the effective supervision of the state can such innovation be developed in a healthy and orderly way. At the same time, this innovation has a subversive impact on supply chain infrastructure, credit verification, trade financing, payment and settlement and other aspects. The integration of related technologies and the resulting new transaction mode, transaction scene, transaction behavior and other aspects need to be standardized by a new legal environment. The government should provide adequate policy guidance and support to promote the establishment of technology regulatory environment and the research, development and application of related technologies.

#### V. CONCLUSION

With the implementation of China's "One Belt And One Road" top-level economic strategy, China's cross-border e-commerce industry has obtained unprecedented development opportunities, and has formed a huge market size. Entering 2019, the market is more competitive. The cross-border e-commerce industry in Guangdong province will enter the reshuffle period from the brutal growth period, and the cross-border e-commerce industry will gradually standardize in supply chain, logistics, payment and other aspects. The application of block chain technology in cross-border supply chain opens up a new integration mode and injects a new impetus to the rapid development of cross-border e-commerce in the future. At present, the application of cross-border supply chain based on blockchain technology is still in the proof-of-concept stage. In the future, with the extensive research and in-depth application of block chain technology, cross-border supply chain is bound to make greater breakthroughs in technology, safety, management, efficiency and other aspects, and promote the continuous development of cross-border e-commerce in Guangdong FTA.

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