

Research on the Information Tracing Model for Cross-border E-commerce Products based on Blockchain

Zheng Hua¹, Keran Be¹, Qinwen Shi¹

¹ Business School of Hohai University, Hohai University, HHU, Nanjing, China

Abstract. Information asymmetry, information island, high regulatory cost, etc., emerge from the fast development of cross-border e-commerce in China, for which the blockchain, with its capabilities in information sharing, information traceability, smart contract, and so on, can play an effective role in product information tracing. Based on blockchain, this paper builds the product information tracing model using information chains of two different degrees of openness. The model includes the three major bodies of cross-border e-commerce—the supply chain alliance, the consumers and the regulatory departments, so as to produce information tracing, ensure information authenticity and integrity, and be applicable to all kinds of e-commerce platforms.

1 Introduction

The volume of Chinese cross-border e-commerce transactions is increasing so fast that the development of relevant regulatory system, technologies and policies of China can no longer catch it up. This can be observed as effective solutions for regulation, logistics, transaction, etc., for cross-border e-commerce remain absent. Fortunately, as a typical Distributed Ledger Technology, the blockchain supports verification, sharing, calculation and storage of data, which will significantly contribute to the improvement of cross-border e-commerce. And in turn the reasonable application of blockchain in cross-border e-commerce will also greatly contribute to its own better standardization and systematization.

2 Challenges Brought by Cross-border E-commerce

The cross-border e-commerce refers to the business activity in which transactions are done among parties from different countries or regions through the same Internet e-commerce platform where payments and settlements are cleared and the cross-border logistics to complete commodity delivery. The cross-border e-commerce, despite that it is young, has changed people's way of daily purchasing and become part of their lives, and it is taking more and more share in national trade volume. However, challenges exist with such fast exploratory development.

2.1 The product information is fragmented and without sufficient accuracy and completeness

The supply chain elongates with the expanding cross-

border transactions, which make it difficult to use unified information control system on all supply chain alliance enterprises, resulting in fragmented product information between upstream and downstream enterprises, or the serious problem of “information island”. In addition, there is no common-coding platform to store, process, screen and analyze data of manufacturing for consumers. Usually the data is inaccessible, nor can it be verified, which produces extra cost due to the consumers' lack of trust.

2.2 The high cost in cross-border commodity regulation

It is very easy to become a cross-border seller, a simple registration would make it happen. That brings more counterfeit, defective and smuggled goods to the market and degrades its order. To solve such problems, the government's strict regulation must take effect. However, by now no clear standards of the goods' quality has been defined by the government's regulatory department for the emerging cross-border e-commerce. Moreover, the high frequency and small orders of cross-border transaction make it harder and more expensive for regulation.

2.3 The cross-border e-payment takes long time and low efficiency

Cross-border payments increase with the increasing cross-border transactions. During the whole trading the information needs to be checked and cleared constantly, which produces higher error rate, lower efficiency and long trading time. Besides, the participation of financial institutions also leads to higher payment costs and longer time of transaction, which bring more risk for consumers.

3 The Blockchain

The blockchain is a chain data structure composed of chronological data blocks, and it uses cryptography means to ensure that the distributed ledger cannot be modified or forged [2]. It originated from bitcoin and serves as its core technology. At the very beginning the bitcoin needed a solution to the problem that the reliable third party was absent for e-transactions, then the blockchain was born. It can establish a trustworthy relationship for both sides of the transaction without any central authority.

3.1 Development of the blockchain

The blockchain is originally designed for bitcoin, and then, depending on reorganization of mature technologies and combination of cryptography technologies such as public key encryption, digital signature and zero-knowledge proof, it became a new type of distributed infrastructure and computing paradigm [3]. As its advantages are gradually observed, application of the technology has been extended from the original use in digital currency to the Internet of Things, intelligent manufacturing, finance, and other fields. Blockchain alliances such as R3CEV, Hyperledger and China Ledger have been established inside and outside China to accelerate the development of blockchain. People from different countries are also pushing their governments to develop blockchain.

3.2 Features and advantages of the blockchain

- Information sharing

The data of each node of blockchain system is open. Anyone can access the internal data of the node at any time as long as he holds the key [6].

- Information authenticity

Records and storage of the blockchain system's internal data are carried out in strict accordance with the preset machine language, which means the data cannot be changed or interfered with by anyone. Therefore, the authenticity of blockchain information and data can be guaranteed. Meanwhile, since all blockchain nodes use the same identification mechanism, they own the same rights and obligations, so the blockchain technology can play a role of decentralization.

- information traceability

Since the data inside the blockchain is produced in chronological order and connected end to end, and each of it is encoded independently, the traceability of the data can be guaranteed.

4 The information tracing model for cross-border e-commerce products based on blockchain

4.1 Major bodies of the product information tracing model based on blockchain

Three major bodies are included in the information

tracing model for cross-border e-commerce products of this paper.

The first is the Supply Chain Alliance including the manufacturers, the e-commerce platforms and the enterprises of the supply chain. It is the main provider and user of product information. During manufacturing, the enterprises can store and transfer information on product quality of their steps timely and accurately through the blockchain, and gather it into the blockchain system. At the same time, the enterprises of the supply chain alliance can monitor their product quality using the semi-open information chain authority, and obtain the product quality information of the upstream enterprises in time. This can ensure that the products' high-quality will be maintained to the downstream of the supply chain.

The second one is the consumers. Through the blockchain the consumers have access to the open product information chain and have the authority to get sufficient information on product quality, which is important to protect their rights and interests. When the consumers—who play the role of buyers in the markets—participate in information tracing of the supply chain, they help improving the transparency of product quality information and because of which, all enterprises in the supply chain would have to do something to improve their product quality.

The third one is the regulatory departments, mainly the ones of the market and the law-enforcing department. The departments are given the authorities to access the semi-open information chain, by this way they can directly work on information tracing of supply chains. That would obviously simplify the supervision, improve the efficiency of quality control and make law enforcement more standardized.

4.2 The overall structure of the product information tracing model based on blockchain

The information tracing model for cross-border e-commerce products based on blockchain is basically structured from the bottom to the top as—the layer of infrastructure, the layer of data, the layer of technology, the layer of regulation and the layer of application. Among them the layers of infrastructure and data serve together as the foundation of the model; The layer of technology, including smart contract, consensus mechanism, etc., is responsible for data processing and transmission, which is the core of information tracing; The layer of regulation is the guarantee of data security during information tracing. The layer of application is the entrance of information inquiry and tracing by consumers. The details are shown in the figure 1 as follow:

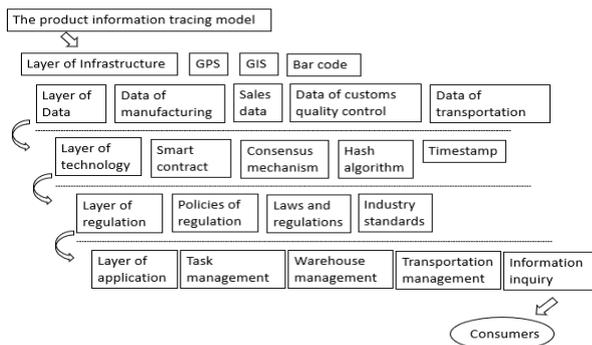


Fig1. The overall structure of the product information tracing model based on blockchain.

4.3 How product information tracing model works

This paper tries to use semi-open and open product information chains on the information tracing model, and integrate the three major bodies—the supply chain alliance, the consumers and the regulatory departments—into a unified model. The details are shown in the figure 2:

Compared with the open product information chain, the Semi-open one has stricter access control and less participants. The supply chain alliance blockchain connects with and provides unified interface programs to the manufacturers, the e-commerce platforms, the customs quality control sections, and the transportation agencies to unify data formats of all enterprises and exchange data with accurate information definition and unified processing interfaces. With blockchain CA technology, the node management module sets authorities for different levels of production data, e-commerce platform transaction data, customs quality control data and transportation data, and stores them on the blockchain. Meanwhile, it provides smart contract management, account management, data recording, access, etc., for each blockchain node. This part makes product information of the supply chain alliance transparent and open. It facilitates the upstream and downstream enterprises to plan for production and improve product quality, avoids unnecessary cost due to distrust and resource waste, and enhances information exchange and communication between supply chain alliance enterprises. In addition, because the layer of regulation composed of market regulatory departments and law enforcing departments has the authority to access the semi-open product information chain, it can carry out real-time monitoring on the data of product quality provided by relevant enterprises, and timely control the enterprises' product quality and operation status.

Compared with the semi-open one, the open product information chain has less strict access control and more participants, including the supply chain alliance, the consumer, and the regulatory departments. The data processing module of blockchain is mainly responsible for transforming the product quality data, while the data screening module is responsible for screening such data of different supply chain nodes. The latter chooses the valid product quality data related to the current transaction and transfers it to the open quality information chain.

Consumers are given access to the open quality information chain by logging into their consumer accounts on the e-commerce platform, by which way they can look for the information of their purchased products, clarify the responsibilities of relevant supply chain alliance enterprises, and timely protect their rights.

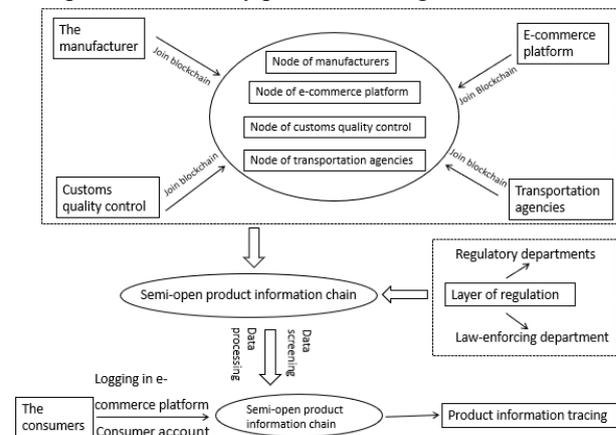


Fig2. How product information tracing model works.

4.4 Advantages of the model

First, the information tracing model based on blockchain is known for decentralization, which means each participant—as an independent node without reliance on the central system—of the blockchain follows the same rules and mechanism. That would obviously save the cost of data storage and improve efficiency.

Second, the blockchain can ensure the accuracy and completeness of product information. All product information in the blockchain is transparent and open. By logging into consumer accounts on the e-commerce platform, consumers are allowed to inquire about the information of their purchased or interested products. They can also clearly define the responsibilities of each supply chain alliance enterprise, which can basically solve disputes due to distrust during cross-border e-transactions. Blind spots are erased throughout the information chain, and the product information can be monitored real-time to timely discover vulnerabilities and add information missing.

Three, the information tracing based on blockchain can reduce cost and improve efficiency for market regulation. Through the information chain, the supply chain alliance enterprises can learn the data of manufacturing of upstream enterprises; With the access into the open product information chain, the consumers can acquire information of their purchased or interested products, which would push the enterprises to improve their product quality; And the direct participation of regulatory departments in the semi-open product information chain simplifies the regulation and generally realizes low-cost regulation.

Finally, depending on the authenticity of the data stored in the blockchain, the small and medium-sized cross-border e-commerce enterprises can improve their credibility. And the financial institutions can also use the data for credit risk rating on the enterprises and develop corresponding financial products, which would reduce

financing costs and expand financing channels for the supply chain alliance enterprises.

5 Conclusion

This paper focuses on the analysis of product information asymmetry and consumer trust crisis, etc., in the cross-border e-commerce market which accounts for an increasing proportion in the international competition. To solve these problems, based on the fast developing blockchain, this paper tries to build the product information tracing model using product information chains of two different degrees of openness, with which the market's three major bodies—the supply chain alliance, the consumers and the regulators—are included into one unified model. By this way, information traceability is realized, the information's authenticity and completeness are guaranteed, and the model is applicable to all kinds of e-commerce platforms.

However, blockchain has not yet been mature, thus bugs are unavoidable when the information tracing model is put into actual use. What scholars can do is to keep repairing and improving the information tracing method based on blockchain for cross-border e-commerce platform products, so as to keep away bugs as much as possible and finally, to protect the consumers' privacy and optimize their shopping experience.

REFERENCES

1. Cuiping M. (2019). Analysis of Confusion and Countermeasures of Cross-border E-commerce Logistics in the New Era. *Shandong Industrial Technology*, 2019 (2), 245+234.
2. Information Center of Ministry of Industry and Information Technology. A White Paper on China's Blockchain Industry in 2018. <http://www.miit.gov.cn/n1146290/n1146402/n1146445/c6180238/part/6180297.pdf>
3. Yong Y., Feiyue W. (2016). Current Status and Prospect of Blockchain Technology. *Acta Automatica Sinica*, 2016,42(04), 481-494.
4. Takemoto Y, Knight S. Mt.Gox Files for Bankruptcy, Hit with Lawsuit. Oct. 5, 2018. <http://www.reuters.com/article/us-bitcoin-mtgox-bankruptcy-idUSBREA1R0FX20140228>.
5. Iansiti M., Lakhani K. R. (2017). The Truth About Blockchain. *Harvard Business Review*, 2017, 1(95), 118-127.
6. Wei Zhao (2019). Research on Traceability System of Agricultural-Food Safety based on Blockchain Technology. *Journal of Technical Economics & Management*, 2019(1), 16-20.
7. Xiaoping L., Yayun W. (2019). Construction of Logistics Service Supply Chain Information Platform Based on Blockchain Technology. *Supply chain management*, 2019, 5(21), 101-106.
8. Feng C., Chong Y. (2018). Establishing an Interactive Supply Chain Quality based on Blockchain: Exploration of Product Quality Traceability Scheme. *Shanghai Management Science*, 2018, 40(6), 83-87.
9. Boxiang W. (2019). Discussion on the Traceable Model of Cross-border E-commerce Product Information under Blockchain Technology. *Value Engineering*, 2019, (18), 92-94.
10. Qingyang D., Jianming Zhu (2017). The Information Tracing and Anti-fake Model for B2C E-commerce Platform Products based on Blockchain. *China Business and Market*, 2017 (12) , 41-49.