Research on Supply Chain Management Based on Block Chain Technology

Weiting Li\textsuperscript{1,a} and Zhiping Lu\textsuperscript{1,b}

\textsuperscript{1}School of Economics and Management, Guangxi University of Science and Technology, Liuzhou, China

\textsuperscript{a}837531121@qq.com, \textsuperscript{b}404840561@qq.com

**Key words:** block chain; supply chain management; decentralization

**Abstract.** Under the new wave of technological innovation, more and more attention has been paid to the application of block chain technology in supply chain management. As a distributed digital ledger technology, it guarantees transparency, traceability and security, and is expected to drive the rapid development of modern supply chain. This paper focuses on the shortcomings of current supply chain management and combines the characteristics of block chain technology to build a framework of supply chain management based on block chain technology, which is expected to solve the deficiencies in supply chain management.

1 Introduction

With the development of economy and society, the competition between enterprises under the traditional mode has extended to the competition of supply chain. The supply chain integrates and optimizes the upstream and downstream partners and related resources efficiently, realizing the organization form of the whole process coordination of product purchase, production, sales and service\cite{1}. However, under the background of globalization, the volume of supply chain increases, and the production and sales of products tend to be regional and decentralized. Supply chain management relies heavily on the internal centralized information system of enterprises. There are information barriers among some enterprises and lack of trust in the transaction process, there are unevaluable information and management risks in supply chain management\cite{2}.

As a disruptive technology in the new era, block chain has the characteristics of decentralization, security and information tamperability, which can make up for the problems in supply chain management.

2 Block chain

Block chain technology is a distributed database that records or shares a public or private ledger of all digital events that have been executed and Shared among block chain participants. Unlike most existing information system designs, block chain technology includes four key features\cite{3-4}: decentralization, security, transparency, and smart contracts.

In the block chain, participants create a new transaction that is first broadcast to the network for verification and auditing. Once a majority of the nodes in the chain have approved the transaction according to pre-determined rules, the new transaction is added to the end of the chain as a new block, and the record of the transaction is kept in multiple distributed nodes for greater security. At the same time, smart contracts allow trusted transactions to be executed without the participation of third parties.

Decentralization is an important feature of the block chain technology, which can check whether the information is adulterated, so as to improve the effectiveness of the information. It is not possible to delete collectively maintained records in a blockchain. Li Dong et al.\cite{5} (2016) pointed out that participants on the block chain can access the verification records of each transaction through distributed public or private ledons. In contrast, Tian\cite{6} (2016) verified that centralized databases are more vulnerable to hacker attacks or crashes. Decentralization solves the trust
problem because there is no need to assess the credibility of intermediaries or other actors in the network, and the information is easily queried and verified. Participants are able to view ledgers and analyze transactions, a feature that ensures transparency while keeping records encrypted with keys to ensure anonymity.

3 Supply chain Management Issues

Due to the independence of nodal enterprises in most supply chains, the problem of supply chain management becomes more and more prominent with the increasing number of enterprises in the supply chain. Enterprises in the supply chain provide opaque data to each other, resulting in production data fraud. Different systems among enterprises lead to silos of equipment data. Due to the lack of standardization in management, the efficiency of the supply chain is low, and the authenticity of data in the supply chain is difficult to guarantee, and the traceability is not reliable.

The integration of logistics, information flow and capital flow is a difficult problem to solve, which leads to high collaborative interaction costs and difficult realization of multi-party collaboration.

3.1 Insufficient control

A complete supply chain at least includes core enterprises, suppliers, logistics enterprises, multi-level dealers and other roles. Relationship maintenance among roles and overall control of supply chain are the main responsibilities of core enterprises. In the process of supply chain implementation, due to the variety of circulation links, information cannot be timely shared, and data connection between core enterprises and upstream and downstream enterprises is not smooth, which greatly reduces the control power of supply chain.

3.2 Low trading security

Problems such as order data fraud, empty container delivery, brand fraud and enterprise road running keep emerging in the supply chain. All kinds of dishonest behaviors greatly increase the value loss of the supply chain, and the cost of the supply chain reaches 45% due to credit problems. Credit problem not only increases the logistics cost of enterprises, but also damages the brand reputation of enterprises, seriously restricting the development of supply chain.

3.3 Non-transparency of system information

The degree of information sharing has a direct impact on the transaction of the upper and lower
belt enterprises. The asymmetry of information leads to serious information barriers between the upper and lower reaches of enterprises, and the security inventory of enterprises cannot be reached. The information between the upper and lower reaches of the supply chain is not fully shared, and the supply chain data is not transparent, which cannot form a harmonious service chain.

4 Supply Chain Management Model Based on Block Chain Technology

The "decentralized" mode of block chain has brought a new dawn to solve the problems of insufficient management capability, imperfect trust mechanism and low transparency of supply chain data in the core enterprise of supply chain. The following figure is the supply chain management framework based on the block chain technology, showing the results of the empowerment of the block chain technology to the traditional supply chain management.

![Supply Chain Management Framework](image)

Figure 2. Supply chain management framework based on block chain technology.

The use of block chain technology has improved the following three aspects of traditional supply chain management:

4.1 Blockchain Technology Improves Supply Chain Responsiveness

With block chain technology, the importance of each enterprise in the supply chain has been attached, weakening the status of "core enterprise". The "decentralized" trading mode of block chain enables enterprises in the supply chain to fully understand and manage the supply chain information. Supply chain information platform based on block chain management, supply chain enterprise independent communication, can be realized through data storing and sharing fair rapid trading, prompting outward from the core enterprise of supply chain and hierarchy transfer pattern of single center to more corporate synergy, to hierarchical multicenter transmission mode, greatly improve the response ability of the supply chain.
4.2 Blockchain Technology Reduces the Cost of Trust

Relying on the block chain platform, enterprises in the supply chain can obtain transaction records immediately and realize information sharing. Block chain technology, due to the time stamp marking, has the characteristics of tamper-proof and data traceability, ensuring the authenticity of historical data. Enterprises in the supply chain can cooperate and trust each other in the case of mutual distrust, reducing the uncertainty and human cost in the process of building trust. In the meantime, once appear dispute, it can be handled accurately.

4.3 Block Chain Improves Transaction Transparency

Whether the supply chain management process is open, transparent and safe will not only affect customer satisfaction, but also affect the trust between enterprises in the supply chain. Blockchain technology can record all the trading activities in the supply chain in a special "distributed ledger", implementing chain ledger management. Special consensus algorithm can prevent data tampering and forgery. All enterprises in the supply chain can share data, which greatly improves the transparency of the supply chain and the credibility of data information.

5. Conclusion

In the global technological and industrial transformation, the decentralization of block chain technology has injected a powerful impetus into the development of supply chain management. With the help of block chain technology, the supply chain management is gradually developed from traditional centralized management to multi-centralized management and to virtual centralized management, so as to ensure the smooth flow of information in the supply chain and improve the value of supply chain management. This paper summarizes the challenges of current supply chain management and USES the new generation of technology innovation product block chain technology to solve the problems related to supply chain management. A supply chain management model based on block chain technology is built, which lays a theoretical foundation for the subsequent system design and implementation.

Acknowledgement

In this paper, the research was sponsored by National Social Science Fund Project of China(18XGL006).

References

[1] Lambert, D.M., & Enz, M.G., Issues in Supply Chain Management: Progress and potential, Industrial Marketing Management (2016), http://dx.doi.org/10.1016/j.indmarman.2016.12.002
[2] Ivanov D. Revealing interfaces of supply chain resilience and sustainability: a simulation study[J]. International Journal of Production Research, 2018 56(10) 3507-3523.
[3] Yuan yong, wang feiyue. Current situation and prospect of block chain technology development [J]. Journal of automation, 2016 42(4) 481-494.
[4] Zhang Ning, Wang Yi, Kang Chongqing, et al. Block chain technology in energy Internet: research framework and typical applications [J]. Chinese journal of electrical engineering, 2016 36(15) 4011-4022.
[5] Li Dong, Wei Jinwu. Block chain technology principle, application field and challenge [J]. Telecom science, 2016 32(12) 20-25.
[6] Tian F. An agri-food supply chain traceability system for China based on RFID & blockchain technology[C]//2016 13th international conference on service systems and service management (ICSSSM).IEEE, 2016.1-6.
[7] Che Z H, Chiang T A, Che Z G. Using analytic network process and turbo particle swarm optimization algorithm for non-balanced supply chain planning considering supplier relationship management[J]. Transactions of the Institute of Measurement and Control, 2012 34(6) 720-735.

[8] Nogueira M L, Greis N P. An Answer Set Programming Solution for Supply Chain Traceability[C]//International Joint Conference on Knowledge Discovery, Knowledge Engineering, and Knowledge Management. Springer, Berlin, Heidelberg, 2012: 211-227.

[9] Tang Xiaobo, Huang Yuanyuan. SCM Collaborative Management Strategy and Model Evaluation [J]. Information Magazine, 2005 24 (1) 88-90.