Research on Supply Chain Logistics Information Ecosystem Model based on Block Chain

Chengdong Li¹,*

¹Chongqing Chemical Industry Vocational College, China, 400020

*Corresponding author e-mail: chengdongli@cqhgyz.edu.com

Abstract. With the rapid development of science and technology, people have higher and higher requirements for supply chain (hereinafter referred to as SC) management, including SC logistics management. With the rapid development of block chain (hereinafter referred to as BC) technology, the traditional capital flow, information flow and people flow have been unable to meet the requirements of logistics information. Therefore, BC technology has become the main development direction in the future, which will improve the application of logistics information. Firstly, this paper analyzes the technical principle and framework of BC. Finally, this paper constructs a supply chain logistics information ecosystem model (hereinafter referred to as SCLIEM) based on BC. This can further develop the role of information flow.

Keywords: Block Chain, Supply Chain, Logistics Information, Ecosystem Model

1. Introduction

At present, the competition between upstream enterprises and downstream enterprises of SC presents a new trend. Therefore, suppliers have gradually changed from focusing on internal capabilities to external information linkage. Through interaction and communication with external environment, SC can reduce market uncertainty [1]. Therefore, we must build a SCLIEM based on BC, which can further refine the information management of block SC logistics. With the advent of the era of big data, SC logistics management has attracted much attention, which is inseparable from capital flow, information flow, people flow and so on. In 2008, the concept of "bitcoin" began to enter the financial field through the digital cryptocurrency system, which led to the emergence of BC [2]. At present, BC technology has been applied to the Internet of things, intelligent manufacturing, SC management and other fields. Through BC technology, we can better build an information bridge, which will promote the transformation of social organizations from providing services to leading services. At present, BC is maintained, managed and supervised by all nodes of the network, which has the characteristics of decentralized and trustless. Based on the BC, we can analyze the coupling between the BC and the SC logistics information resource management, which can build the SC logistics information ecological model [3].

2. Technical principle and framework of BC

2.1. Working chain block principle

In the BC, all the authentication subjects can participate in the verification of each business activity data, which can obtain the authenticity verification results of a block's accounting right. After the authentication
subject is confirmed, we can record all business activities in this period in our own block, which will form a block body with Merkel tree hash value structure[6]. By aggregating the block header hash value, Merkel tree root value, timestamp information and block version number of the previous block, we can form the data block header of the block. In the BC structure, a BC is formed by connecting the block head with the previous block[7]. The working principle of BC is shown in Figure 1.

$$\text{S1 block data}$$

| Block header data | Block volume data |
|-------------------|-------------------|
| Block header hash value of previous block |
| Root value of Merkel tree structure in this block |
| Block version number |
| Hash value of all business related data in this block |

$$\text{S2 block generation process}$$

In S1, all signed business-related data and authentication information are broadcast throughout the blockchain network.

In S2, all the authentication subjects authenticate the authenticity of block data, and obtain the accounting rights of the authentication subjects broadcast all over the network.

All authentication subjects confirm the authenticity of business data and reconstruct blocks respectively.

$$\text{S3 block}$$

$$\text{S4 block header data hash value}$$

$$\text{S5 block}$$

**Figure 1.** The working principle of BC.

2.2. **BC structure**

Each block in the BC is composed of block head and block body. The block body is composed of business data and Merkel binomial tree structure of business data. The BC structure of blocks and BCs is shown in Figure 2.

3. **Overall framework of SC logistics information resource management**

3.1. **Object dimension**

Through BC technology, we can minimize the system cost under a certain service level, which is the fundamental purpose of SC management. However, there are some shortcomings in traditional SC management, which only links node enterprises into a whole. By joining the BC, we can provide more effective technical support for the SC management, which will develop from the original point to the chain, and then to the network. For node enterprises, we can embed BC technology into the enterprise Internet of things, which can meet the technical mechanism and operational requirements of BC under various technologies, including intelligent perception technology, identification technology, etc. Through the exchange of information and real-time communication, the BC network will be further extended. Therefore, the distributed network nodes of BC system have coupling relationship with the Internet of things, which can support the decentralization of BC system.

3.2. **Attribute dimension**

In terms of information flow, all kinds of information will be generated in the process of SC operation, which will walk in all aspects of the system. At present, the transparency of SC logistics information flow is
extremely lacking. Through the introduction of BC technology, we can further improve the accuracy of data information, which will solve the problems in operation in time. By stamping the data information of BC with time stamp, we can reduce the disputes among the main bodies in the SC system. In terms of logistics, BC will enhance information security by integrating logistics information technology. In terms of capital flow, the application of secure database technology in block SC can ensure the security of transaction data, which does not require mutual trust. For data interaction, because the interaction process can be anonymous, the violation of trust subjects will be greatly reduced.

Figure 2. BC structure.

3.3. Functional dimension
Through a variety of network information storage technology, we can make the warehouse logistics activities more efficient and safe, such as barcode technology, perception technology, including voice and video. Through the network information storage technology, the positioning, identification and sorting of warehousing goods will be more accurate and fast. In addition, in order to ensure that the storage data will not be tampered with, we must play the role of BC distributed "accounting principle". Through distributed ledgers, we can connect to dedicated lockers, which will make the tracking of goods more timely and convenient.

4. SCLIEM based on BC

4.1. SCLIEM based on BC
The SC logistics information ecosystem based on BC has the characteristics of anti attack, data confidentiality, self-healing resilience and ecological operation, which can promote the occurrence, formation and stability of SC information ecosystem. In this way, we can realize the ecological harmony of SC logistics information. The logistics information ecosystem model based on BC is shown in Figure 3.
4.2. Build higher privacy and carefully control network connections
We should attach great importance to the information resources of BC network involving finance, which requires identity verification and multiple authentication when connecting. By preventing unauthorized network node access, we can avoid data leakage. We need to establish an authenticated agency organization, which can act on behalf of users. Protect the BC network transaction from embedding user's personal information and behavior. Second, we should set user data access rights and security private keys, which will prevent data information from spreading across the network. Third, we should adopt the zero knowledge proof algorithm in cryptography, which can verify and protect each node, which can avoid privacy leakage and other issues.

5. Conclusion
Innovation is transforming from "linear paradigm" to "network paradigm", and the competition between upstream and downstream enterprises in SC is also changing from internal capability demand to external information connection. The exchange and interaction of network information resources between the main body of SC and the external environment can reduce the uncertainty of technology and market in innovation activities. By introducing BC into the SC logistics information ecosystem, we can master the flow law of SC logistics information resources. By optimizing the management of SC logistics information resources, we can improve the SC logistics information ecological environment, which can realize the innovative development of industrial clusters.
References
[1] Gao Hang, Yu Xuemai, Yang Huihui. Computing power and BC Technology: the core of future science and technology finance [J]. China economic report, 2016 (7): 106-110.
[2] Gao Heyan. Research on the innovation of enterprise SC logistics financing mode [J]. North economic and trade, 2019 (2): 167-172.
[3] Lian Lin, Zhu Qichao, Zhao Ji. BC technology and its potential military value [J]. National defense science and technology, 2016 (4): 30-34.
[4] Wang chuanlei, Wandi, Qin Qin, Wang Ningning. SCLIEM based on BC [J]. Intelligence theory and practice, 2017, 32 (1): 43-46.
[5] Xu Xian. BC and insurance innovation: mechanism, prospect and challenge [J]. Insurance research, 2017(6):43-52.
[6] Yang Huiqin. Construction of mutual trust and win-win SC information platform based on BC technology [J]. Science and technology progress and countermeasures, 2018, (5): 21-31.
[7] Zheng Rong, Yang ran. Research on the construction of Competitive Intelligence Service Alliance Based on cloud service platform [J]. Intelligence theory and practice, 2016, 39 (8): 54-59.