Research on the information sharing in the linkage between manufacturing and logistics industry based on blockchain

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Abstract. In order to promote the linkage and integration of manufacturing industry and logistics industry, we should not only pay attention to the convergence of movement time and function among industries, but also consider the orderly combination of industrial subsystems in time, space or function. At present, due to the lack of trust between industries, seeking the maximization of their own interests and other reasons, the information sharing between industries can not be realized. The industrial linkage with many advantages not only fails to operate efficiently, but aggravates the inefficient operation. In this paper, information sharing system in the linkage between manufacturing and logistics industry based on blockchain is proposed, and a detailed sharing model is given on such basis. With the help of blockchain, we hope to break the information flow barrier in the linkage between manufacturing and logistics, realize the efficient coordination and management of the linkage process between manufacturing and logistics, and improve the modernization level of China's industrial chain and supply chain.

1. Introduction
Since the second half of the 20th century, the world industrial pattern is in continuous adjustment. In the new "fourteenth five year plan" outline, China puts forward "upgrading the modernization level of industrial chain and supply chain, and promoting the deep integration of advanced manufacturing industry and modern service industry". It is the important driving force and development path of economic restructuring and industrial transformation and development.

At present, scholars at home and abroad have four views on the relationship between manufacturing and logistics industry: "demand compliance theory", "interaction theory", "supply leading theory" and "integration theory". The general view of China's academic circles is that "demand compliance theory" and "supply leading theory" are too extreme, only see one side of the problem, lack of comprehensive and in-depth analysis of the problem; "interaction theory" is more practical; and "integration theory" reflects the trend of industrial evolution in the future [1].

Both "interaction theory" and "integration theory" point out that with the high development of economy and the widespread use of information technology, the economic dominance of information is increasingly enhanced. From the economic development of various countries, it is obvious that the production, distribution, circulation and consumption of information are becoming the main mode or core content of the economic system. The proportion and contribution of information activities in all
activities are enhanced. The information factors exceed the material factors, or the information content exceeds the non-information content.

The linkage process of manufacturing industry and logistics industry can be regarded as a process of information movement (transmission and sharing). Its essence is the collection, sorting, selection, analysis, judgment and utilization of relevant information resources involved in the process of two industries linkage. So the main enterprise of linkage can make the optimal decision and complete the optimal allocation of resources [3].

As one of the most revolutionary emerging technologies in recent years, blockchain builds trust in a decentralized way [5]. It has the characteristics of openness, consensus, transparency, unforgeability and traceability. By using blockchain technology, we can break the barriers of information flow and realize the efficient coordination and management of the linkage process between manufacturing industry and logistics industry. It will lay a solid foundation for improving the modernization level of China's industrial chain and supply chain and enhancing regional competitiveness.

2. Analysis on the current situation of information sharing in the linkage between manufacturing industry and logistics industry

At present, the following problems exist in information sharing in the process of linkage between manufacturing industry and logistics industry in China.

2.1. The relationship of trust between manufacturing industry and logistics industry is unstable
The trust relationship between manufacturing industry and logistics industry refers to the coordination relationship between two or more members of the linkage. It ensures the realization of the overall specific goals or benefits. It emphasizes that cooperative enterprises should cooperate with each other openly and pertinently on the basis of mutual trust, reduce unnecessary processes. Thus, the long-term cooperative relationship of sharing risks and interests will be formed. The overall competitiveness and economic benefits can be improved.

The establishment of trust relationship is the fundamental factor. It determines the duration, scope and degree of cooperation. In the traditional industrial linkage, enterprises only rely on paper contracts to form contractual relationship. The degree of mutual cooperation is low. In addition, for the sake of self-protection, members of both sides share information selectively, enlarge or even make false information. It reduces the transparency, accuracy, visibility and comprehensiveness of information sharing content. The trust relationship becomes more fragile, and the alliance relationship is more unstable.

2.2. The degree of information sharing in the linkage between manufacturing industry and logistics industry is low and lagging behind
The realization of linkage between manufacturing industry and logistics industry is based on information sharing. To a certain extent, the level of sharing directly determines whether the collaborative effect is good or bad. In the traditional linkage between manufacturing industry and logistics industry, it is difficult to achieve real collaborative information sharing. Because of information centralized management and control, high cost of information sharing, poor system compatibility and other reasons.

2.3. The safety factor of information sharing is low and the risk coefficient is high in the linkage between manufacturing industry and logistics industry
With the arrival of the big data era, both manufacturing and logistics are enclosed by massive data. Once a company tampers with the data, other partners will not be able to detect it in time. This poses a significant risk to the operations of other partners. Therefore, identifying the true and false information accurately, improving data security and reliability, and screening out high-quality and valuable information become the urgent problems to be solved.
3. Information sharing system framework in the linkage between manufacturing industry and logistics industry based on block chain

Based on the blockchain, an information sharing network (Figure 1) is constructed for manufacturing and logistics industry. In the traditional environment, the enterprises are independent of each other in the same industry, and the enterprises are independent of each other among industries. This information sharing network achieves the integrity and agility of the linkage between manufacturing and logistics industry.

![Information sharing system framework in the linkage between manufacturing industry and logistics industry based on block chain](image)

This industry-linked information sharing network is manufacturing-centric. Business principals are two-industry enterprise group in corresponding network system. CA stands for Certification Center, it is a credible account center in the information sharing system in the linkage between manufacturing and logistics industry. Nodes in the information sharing system need to be audited. Only business principals of the linked network can join the blockchain system by authorization. In such alliance chain, nodes survive with a certain degree of trust. It can adopt a more efficient, stable and economical consensus mechanism to ensure the operation of the system. It can also avoid the interference of irrelevant users to the system operation and reduce the risk of malicious users jointly forging linkage information. Under the supervision mechanism and competition environment, for their own interests, each business entity tends to provide real information and participate in the supervision of industrial linkage process. They effort to maintain the overall efficiency of industrial linkage. The data in the linkage process is no longer stored separately by its business entities, but distributed in the blockchain operation system. All business entities can access supply chain data through authorization. The risks of information asymmetry and incompleteness are reduced. The information of supply chain is not destroyed and can be traced back. The operation efficiency and information response speed of supply chain are improved.
4. Information Sharing model in the linkage between manufacturing industry and logistics industry based on Block Chain

Based on the analysis of the information sharing framework in the linkage between manufacturing industry and logistics industry based on Block Chain, this part designs a feasible information sharing model for the linkage development of two industries by using the existing blockchain technology. Through the blockchain technology to improve the problems in the link of information resources sharing in the linkage between the two industries. It is possible to share information in the process of linkage between manufacturing industry and logistics industry, and make the trust mechanism of the industry easier and feasible.

4.1. Construction of information sharing model

The operation of blockchain involves different levels of computer network system [6], so the information sharing model in the linkage between manufacturing industry and logistics industry based on blockchain can be divided into four levels (Figure. 2):

- **Data layer.** The data layer is based on RFID, barcode technology, Internet of things and other technologies. It obtain supply and demand information and logistics information from manufacturing enterprises or logistics enterprises. The hash function is used to make blocks as the basic data of the blockchain. The linkage operation of manufacturing industry and logistics industry involves many aspects of data. The characteristics of these data and the security requirements of the system for data are different, so this layer is the necessary definition layer before the sharing data information enters the network dissemination.
4.1.2. **Network layer.** This layer defines the blockchain network that linkage business relies on. In this layer, the P2P transmission of supply chain data is realized, the communication data are authenticated by the authentication subject.

4.1.3. **Collaborative layer.** This layer is responsible for the establishment and maintenance of linkage between manufacturing and logistics. Smart contract is used to establish linkage relationship, and consensus mechanism is used to realize decentralization and linkage maintenance.

4.1.4. **Application layer.** This layer realizes the practical application in the linkage between manufacturing industry and logistics industry. Through cloud platform and mobile APP, we can complete the state information sharing, data sharing and model sharing between manufacturing enterprises and logistics enterprises. It also provides various micro services, carries out linkage optimization, and realizes the connection between information sharing and process.

4.2. **Implementation based on blockchain**

In the information sharing model of manufacturing and logistics industry based on blockchain, the source, structure and use of the data generated in the process of two industries linkage are complex. The relevant data are stored in different modes. In the block body of blockchain data, only the hash value binary tree structure of basic data related to industrial linkage management is stored. The relevant data generated by the industrial linkage process are stored in other storage spaces. The corresponding mapping relationship is established between the generated data and the leaf nodes of binomial tree in the block body.

On the basis of the automatic operation of the blockchain, the industrial linkage smart contract will complete the industrial linkage decision-making activities and conduct Distributed Accounting. These activities ensure traceability of smart contracts and business data through decentralized consensus authentication.

The application of blockchain technology can effectively promote the linkage efficiency of manufacturing and logistics industries. The existing linkage management structure can be further optimized. Information security and information sharing are effectively realized in the process of linkage. Information security and information sharing are effectively realized in the process of linkage.

5. **Conclusions**

In the process of linkage between manufacturing industry and logistics industry some problems exist. The relationship of trust between manufacturing industry and logistics industry is unstable. The degree of information sharing in the linkage between manufacturing industry and logistics industry is low and lagging behind. The safety factor of information sharing is low and the risk coefficient is high in the linkage between manufacturing industry and logistics industry.

Blockchain builds trust in a decentralized way. With the help of blockchain, we can break the information flow barrier in the linkage between manufacturing and logistics, realize the efficient coordination and management of the linkage process between manufacturing and logistics, and improve the modernization level of China's industrial chain and supply chain.

**Acknowledgement**

This work was supported by the Social Science Fund Project of Xuzhou (No. 20XSZ091).

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