

# *Progress in research on supply chain finance based on blockchain technology*

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**Keywords:** Blockchain technology; Supply chain finance

**Abstract:** Since the 2020, the financing environment for small and medium-sized enterprises (SMEs) has become even more severe, and the lack of financial support has made it difficult for them to make progress in future development. In such a macro environment, it is particularly urgent to help small and micro enterprises get out of financing difficulties. However, due to many drawbacks in the traditional supply chain financing model, such as information sharing, high financing costs for end enterprises, frequent default events, and low payment efficiency, it is no longer sufficient to meet the strong financing needs of numerous small and micro enterprises in the supply chain. The emergence of blockchain technology has provided a new approach to traditional supply chain finance. The automated processing mechanism brought by its smart contract, the consistency mechanism provided by the distributed bookkeeping, as well as the characteristics of non-tampering and traceability can well solve the traditional supply chain finance problems. In this case, through blockchain technology, efficient financing services can be provided to SMEs, and the financing cost of SMEs can also be reduced.

## **1. Introduction**

According to Sixlens, as of the end of August 2021, the number of operating SMEs has exceeded 46 million, accounting for 85.2% of the total number of all operating enterprises in China (more than 54 million), and contributing 50% of China's tax revenues, 60% of its GDP, 70% of its technological innovations, and 80% of its population's employment. However, it is difficult for Chinese SMEs to obtain funds from external financing due to their lack of collateral in the financing process, often in a situation where they have insufficient information and small assets leading to their low creditworthiness. Data from the official website of the Central Bank of China shows that by the end of 2021, the balance of inclusive microfinance was only 19 trillion yuan, only 10% of the size of all financial institutions, in sharp contrast to the problem of "financing is difficult and expensive".<sup>20</sup> Since 2020, with the spread of the new coronavirus, the contradiction between the small and medium-sized enterprises and microenterprises has become even more prominent, and the financial sector has become increasingly vulnerable. Since 2020, with the spread of the new coronavirus epidemic, the contradiction between small and medium-sized enterprises and microenterprises has become more prominent, and the financial environment has become tighter.

Since supply chain finance can, in a sense, solve the financing problems of SMEs in the chain, it

has attracted great attention from governments and introduced a series of dividend policies since its theory and mode of operation were introduced into China. Under the impact of the new coronavirus, supply chain finance can provide strong financial support for SMEs, which plays an important role in the resumption of production and labor of SMEs under the epidemic.

However, the current supply chain finance is still facing problems such as falsified information, small service scope and inefficient financing. These deficiencies have become important factors restricting the normal operation of traditional supply chain finance business, which greatly undermines the cooperation among enterprises in the supply chain. In recent years, with the gradual application of many technologies in the financial field, the process and technical level of financial services have been improving, especially blockchain technology, which has led to a great change in China's supply chain finance business in practice, and has provided effective solutions to many problems faced by the traditional supply chain finance, including: establishing "technological trust in the supply chain. It has provided effective solutions to many problems faced by traditional supply chain finance, including: establishing "technological trust" in the supply chain; promoting the circulation of credit through the supply chain; ensuring that the data and information in the supply chain are real and reliable; and improving the overall work efficiency. It can be said that the emergence and rapid development of blockchain technology has enabled China's supply chain finance to smoothly break the bottleneck in its development and facilitate the financing of small and medium-sized enterprises.

Under the current impact of the new coronary pneumonia epidemic, the traditional supply chain financing model is difficult to adapt to the financing needs of SMEs. "Blockchain+Supply Chain Finance" is a new model, which can effectively solve the traditional supply chain finance problems and alleviate the financing difficulties of SMEs to a certain extent.

Although the emergence and development of blockchain technology has only just begun, its features such as non-tampering, traceability, distributed bookkeeping, and smart contracts have shown a good fit in many aspects, including supply chain finance. Currently, the academic application of blockchain technology in the field of supply chain finance mainly focuses on the matching of the two, but there is little research on the practical application and risk control. The article combs and evaluates the relevant literature at home and abroad from four perspectives, including supply chain finance, internet supply chain finance, blockchain technology, and the combination of blockchain technology and supply chain finance.

## **2. Current status of research on supply chain finance**

### **2.1 Research on supply chain finance financing methods and efficiency**

Foreign research on supply chain finance is relatively mature and has unique insights in many areas, mainly focusing on financing methods, financing efficiency and other aspects. First of all, supply chain finance is a kind of optimization of supply chain through collaboration with third party financial institutions, and in the process of synergy, it is also necessary to integrate capital, logistics and other related businesses (Timme, 2000)<sup>[1]</sup>. Secondly, according to the different research directions can be divided into the following directions. First, through the research of supply chain operation and management, a new type of supply chain financing model has been produced in the world, which provides a theoretical basis for the theory of supply chain finance (Berger AN, 2003)<sup>[2]</sup>. Secondly, through the research on the interest objectives of the members of the supply chain in another direction, we should combine various technical means to realize the comprehensive management of the capital flow and cash flow in the supply chain, and provide all-round service and guidance to the upstream and downstream enterprises, so as to enrich the supply chain financing model. Thirdly, the research of supply chain finance is conducted from the perspective of core

enterprises in the supply chain, which as the core enterprises have the advantages of accelerating the flow of funds, optimizing the operation process and controlling the cost.

When discussing how to improve the efficiency of supply chain financing, supply chain finance should apply innovative technology as a "fresh factor" to the business activities of enterprises, so as to increase the transparency of the whole chain and increase the security of funds (Atkinson, 2008)<sup>[3]</sup>. Analyzing the cost of capital from the perspective of capital flow, when the return on investment reaches a certain requirement, all parties in supply chain finance can get the corresponding benefits.

From the perspective of the prospect and development history of supply chain finance, for a long time, the financial system has been highly dependent on the government, banks and other large financial intermediaries to maintain the credit system of the entire economy, however, under this model, small and medium-sized enterprises are suddenly faced with more prominent financing problems, and there are major obstacles to the development of supply chain finance. Based on this prospect and development history from the analysis of the development history and prospect of supply chain finance, a financial flow management model based on supply chain has emerged, (Federico Caniato et al., 2019)<sup>[4]</sup>.

## **2.2 Research on the Innovation of Supply Chain Finance Financing Methods**

Foreign scholars have explored the innovation of financing methods, and in the comparative study of accounts receivable financing and inventory financing, warehouse receipt pledge financing, factoring financing, and trust pledge financing are compared, and it is believed that the risk in financing transactions can be reduced through the construction of credit system (Burman, 1948)<sup>[5]</sup>. In terms of accounts receivable financing in supply chain finance, factoring accounts receivable as a financial tool can not only solve the financing problems of SMEs, but also provide more credit information for SMEs, so as to provide credit services for customers with different credit levels. And while the accounts receivable financing business is developing, the inventory financing business with logistics companies as the main body is also expanding, so in the supply chain, in addition to providing basic commodity transportation and warehousing services, the logistics service provider can also use the logistics, inventory information, commodity monitoring and other means at its disposal to provide inventory financing for the logistics enterprises, which can not only improve the profitability of the logistics companies, but also provide customers with differentiated services, thus improving the competitiveness of logistics services.

Against the backdrop of industry scale and capital market development, inventory-based prepayment methods have gradually become a focus of attention. By building a stochastic kinetic model and analyzing a large number of future cash flows, it is concluded that prepayment financing is an effective solution to the logistics lag problem (Basu & Nair, 2012)<sup>[6]</sup>.

## **2.3 Research on domestic supply chain finance**

Compared with foreign countries, domestic supply chain finance started late, but with the rapid development of China's economy and national support for supply chain finance, as well as the trend of convergence with the real economy, domestic scholars are more and more biased towards the study of its innovative model.

In China, supply chain finance has been defined from the perspective of banks as it was first proposed and implemented by the banking industry. Although the development of supply chain finance is relatively lagging behind in China, in recent years, supply chain finance is gradually becoming an important means of combining production and financing and promoting industrial upgrading, both from the perspective of national policy to industry and from the perspective of industry. At present, China's supply chain finance is moving towards "supply chain finance 4.0"

centered on technological innovation with the massive application of blockchain, Internet of Things and other technologies.

By exploring the model of the "Rongtong Warehouse", it can be found that the storage, monitoring, and value assessment of the pledge are all done by the warehousing and logistics company, which will also provide credit guarantee for SMEs. Financing also provides new ideas for the business model of financial institutions, and in supply chain finance, the way of operation of commercial banks will have a certain impact on their financing methods. Later scholars optimized the prepayment financing strategy in supply chain finance by empirically analyzing it (Xiao Di, Tian Jun and Li Qi, 2014)<sup>[7]</sup>.

China's current supply chain finance business operation mode is mainly divided into six categories: B2C type e-commerce mode, industry information portal mode, software company mode, logistics company mode, traditional leading enterprise mode, and commercial bank mode. Among these models supply chain finance has certain technical advantages, but there are still some shortcomings, supply chain finance technology can effectively alleviate the financing difficulties of small and medium-sized enterprises, but its development is still subject to certain constraints due to the fact that its own business can't cover the whole industrial chain, which leads to the information islands in the supply chain. Although there are some problems in supply chain finance, supply chain finance through the network has greater superiority, which can effectively reduce the financing cost and improve the financing efficiency.

### 3. Research on Internet supply chain finance

As the development of network information technology continues to be closely linked with people's economic lives, the advancement of the "Internet +" initiative will also lead to a qualitative change in the needs for supply chain financing. This change will come about through the application of network technology and the adoption of innovative models that bring about improvements in efficiency and risk control. Network technology has laid a solid foundation for financial institutions to realize the informationization and automation of financial services. The key to the financial service providers in the supply chain, the supply chain lies in the integrated management of transaction system, financing cost and transaction risk through network technology. In the network supply chain, led by core enterprises, it can effectively reduce the financing cost of enterprises. With the integration of network and supply chain finance, a new technological element is introduced into the concept of supply chain finance, and a method that can visualize logistics is proposed (Li Ji-an, 2014)<sup>[8]</sup>. The network will make the breadth and depth of supply chain finance extend to all the upstream and downstream of the supply chain, and even the financial services between the supply chain, it is because of the wide extension, with the network supply chain finance combined with big data technology can reduce the cost and improve the efficiency, the Internet supply chain finance model is characterized by the integration of business data through the digital platform and the financial services, this model is the development direction of supply chain.

Risk management is the lifeline of the financial industry, so many scholars have explored the risk control of network supply chain finance. In terms of risk control, a network supply chain financing model with a third-party logistics company as the main body is proposed, and through the application of IoT technology, it can monitor each member in the supply chain finance, such as financial institutions, in real time and carry out risk monitoring. By using network technology, it is possible to understand the dynamics of the enterprises in the supply chain and determine their risks, which is a breakthrough in risk identification of financial data (Wang Baoshen and Wang Di, 2017)<sup>[9]</sup>. And through the use of big data technology for risk identification, it can effectively reduce the cost of risk control, for example, the combination of P2P and supply chain finance can reduce the intermediate transaction links and reduce the transaction costs, but the risk due to the lack of supervision, can be

increased through the integration of the Internet and supply chain finance to increase the supervision of its transactions, so as to achieve the reduction of the the purpose of risk. It can be said that Internet supply chain finance is a kind of financial system based on the network, using big data technology for effective management of risk control, thus reducing the risk of supply.

Most of the foreign studies on network supply chain finance regard it as the support of technological means, while the domestic studies mainly focus on business model innovation, risk identification and evaluation, risk control innovation and industry financial ecological construction. The development and application of more information technology around the supply chain for financial services remains a direction for future practical exploration.

#### **4. Research on blockchain technology**

In recent years, the heat of Bitcoin is increasing day by day, and the technology, blockchain, has become the focus of attention of scholars and scientific and technological circles at home and abroad. At present, academics have conducted in-depth research and discussion on the characteristics, functional design, application value and other issues of blockchain technology.

##### **4.1 The main feature of blockchain is decentralization**

Blockchain originated from research into Bitcoin technology, which was first utilized in 2008 when Satoshi Nakamoto proposed a way to exchange money without having to go through a third-party financial institution, known as Bitcoin, the blockchain technology. Blockchain technology is a technology that allows trust to be agreed upon without relying on an intermediary.

Decentralization is the biggest feature of blockchain, and the advantages of this technology are increasingly recognized in the exploration of blockchain technology. In Africa, where there is a lack of effective payment systems and opaque market information, blockchain technology can be utilized to create a system similar to Bitcoin without the intervention of any financial intermediaries. IoT technology platforms have certain shortcomings in terms of reliability and scalability, which will be helped if they are combined with blockchain technology. Public chain is the earliest idea of blockchain technology, which allows all people to participate, compared with traditional transactions, the use of public chain can not only save transaction costs, but also allow users to play a greater role in data sharing. And the smart contract based on blockchain technology has the function of enforcement, and in the process of execution, the hash value of the password is copied into the smart contract along with the digital signature, which improves the accuracy of the contract execution.

##### **4.2 Advantages and Prospects of Blockchain**

The use of blockchain technology in the financial field has important advantages and can solve many pain point problems in the traditional financial industry. If the blockchain is combined with the stock trading platform and smart contracts and consensus mechanisms are used, the rights and interests of investors can be better protected, and the blockchain technology can also effectively protect the user's identity information.

But the use of blockchain's decentralization, anti-tampering, consensus mechanism, smart contracts and other technologies may seem perfect, but it is not. For example, the POW algorithm has deficiencies and may have uncertain security boundaries (Xu Zhong and Zou Chuanwei, 2018)<sup>[10]</sup>.

At present, the research on the application value of blockchain technology in practice is still in the stage of theoretical research, and lacks the research of quantitative and empirical research on it, but it also has a certain reference role in the future research, including computers, the economy, the society and other fields, which need to make breakthroughs in blockchain technology.



## 5. Domestic and international research on the integration of blockchain technology with supply chain finance

### 5.1 Improvement of Supply Chain Finance Financing Efficiency by Blockchain Technology

In the field of "blockchain + supply chain finance", foreign scholars mainly focus on how to improve the financing efficiency.

Blockchain technology can make the financing process of the supply chain more transparent, simpler, more efficient and more secure, so as to reach a win-win situation for all the subjects in the supply chain, and to realize the organic combination of improving efficiency and ensuring security (Omran, 2016)<sup>[11]</sup>. Based on empirical analysis, combining blockchain technology with supply chain finance can greatly improve the efficiency of capital flow, thus reducing financing costs and improving financing efficiency. Smart contracts based on blockchain technology can effectively control the flow of funds in the supply chain and also promote cooperation in the supply chain. If the traditional supply chain finance and the supply chain finance combined with blockchain technology have been compared and analyzed, it will be found that the supply chain finance using blockchain technology has a smaller financing risk and higher data information security. By using blockchain technology, the operational efficiency of logistics and capital flow of supply chain finance can be increased by about 70%, making it more secure and reliable in operation (Marjaneh Jahangiri Lakhani et al., 2020)<sup>[12]</sup>.

### 5.2 Blockchain Technology Can Optimize Problems in Supply Chain Finance

In the research of "blockchain + supply chain finance", domestic scholars focus more on the role of blockchain in solving the pain points of previous supply chain finance to carry out research.

In view of the technical superiority of blockchain, scholars in China believe that the use of blockchain technology can break through the traditional restrictions and improve the operational efficiency of the entire supply chain, thus promoting the development of supply chain finance. Relying on many technical features of blockchain, an alliance chain platform that complies with regulations can be established, on which the data and information of enterprises can achieve a high degree of transparency, can be shared in real time in all aspects of the supply chain, and all data can be recorded, which ensures the security of supply chain information and avoids asymmetric information, as well as the falsification of information.

An in-depth discussion on how to introduce blockchain technology in supply chain finance is carried out, and on this basis, combined with some successful cases in foreign countries, an in-depth discussion on its application in China is carried out (Xu Didi, 2019)<sup>[13]</sup>. By comparing the characteristics of traditional supply chain finance and blockchain+supply chain finance, blockchain's smart contract, distributed bookkeeping and other features are of great significance in solving the credit and operational risks in traditional supply chain finance. "Blockchain+Supply Chain Finance" has great application value for core enterprises, suppliers and other financial institutions.

## 6. Conclusions

Throughout the relevant research of domestic and foreign scholars mentioned above, blockchain has high value in solving the past pain points of supply chain finance by virtue of its many characteristics, and it can effectively control the supply chain financial risks. At present, most of the domestic scholars' research on the application of blockchain in supply chain finance still remains in the basic theoretical analysis, and there are fewer specific practical case studies, and with the continuous development of technology and deepening of application scenarios, the service scope of

"blockchain+supply chain finance" business is also being extended continuously.

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