Block Chain Based Supply Chain Financial Risk Management Research

Fengge Yao$^{1, *}$ and Zenan Qin$^1$

$^1$School of Finance, Harbin University of Commerce, China, 150000

*Corresponding author e-mail: qznan@hrbcu.edu.cn

Abstract. The current supply chain finance risk management has problems such as asymmetric operation information and difficult risk control, for this reason, this paper proposes a research on supply chain finance risk management based on block chain technology. Combining the technical characteristics of block chain and the business model of supply chain finance, we analyze the causes of its operational risk, trade authenticity risk, payback risk and contingency risk, and use the physical sensors to react and track data in real time to improve the efficiency of supply chain risk control; replace the signing of legal documents in various disciplines with electronic signatures to solve the problem of trade authenticity risk; program the transaction contract and contract-related clauses to provide trust for both sides of the transaction and improve transaction efficiency. Implement a comprehensive risk management strategy, design early warning and emergency management processes, and realize supply chain financial risk management based on block chain technology.

Keywords: Block Chain, Supply Chain, Finance, Risk Management

1. Introductory remarks

At present, the real economy is facing the double pressure of the domestic economic downturn and the shrinking of foreign trade. President Xi Jinping repeatedly proposed to strengthen efforts to support the high-quality development of the real economy. In this context, the creation of the supply chain finance model provides a new way of solving the financing problems of enterprises. However, while using the supply chain finance model to solve the financing problems of the real economy, we should also study in depth what risks exist in the supply chain finance model, and how to control these risks.

The current supply chain finance risk management faces the challenges of inadequate control of core enterprises and false trade orders. With the flourishing development of the Internet, big data, and block chain technology, it provides new solution paths for the risk management of block chain finance. Based on this, the purpose of this paper is to analyze the characteristics related to supply chain finance based on block chain technology, explore the risks that exist in supply chain finance, and how to use block chain technology for supply chain finance risk management.

2. Bottlenecks of risk management in supply chain finance

Supply chain finance is a financial service carried out by relying on the core enterprise credit and the
relationship between supply chain participants, and financial institutions take the core enterprise as an endorsement to provide financing services to the enterprises in the chain. The current supply chain finance model mainly faces the following challenges: firstly, because the core enterprise is the core of the supply chain, the current supply chain finance risk management model mainly relies on the management and monitoring of the core enterprise. However, this model has two drawbacks: first, the core enterprises may blindly provide credit guarantee for upstream and downstream enterprises based on various social networks, lacking meticulous pre-loan investigation, loan supervision and post-loan management; second, there are fraudulent cases of collusion between loan enterprises and core enterprises to forge procurement contracts. However, the current risk management mode of supply chain finance lacks effective means to deal with the asymmetric information of chain enterprises and the collusion and fraud of chain enterprises, which greatly increases the risk of supply chain finance. Secondly, the current risk management mechanism for supply chain finance is still incomplete and the governance capacity is yet to be perfected, and the large flow of commodities and goods between supply chain participants leads to frequent disputes over ownership of goods. Thirdly, the operation of supply chain finance is mainly dependent on the supply chain, except for the core enterprises, the enterprises in the chain are mostly small-sized and medium-sized enterprises, they have problems such as inadequate corporate governance mechanism, weak technical force of enterprises, frequent staff changes, etc. In particular, the credibility of financial statements is low in terms of business processing, and large-scale and irregular business activities increase the risk of enterprises. Fourthly, trade authenticity is the basis of supply chain finance model operation, and how to prevent participants from forging trade contracts, fraudulent loans and other improper behavior in supply chain finance has become a challenge to deal with. Therefore, the ability to implement effective risk management for supply chain finance is the key to the development of the supply chain finance model.

3. Characteristics of supply chain finance based on block chain technology
The block chain-based supply chain finance system uses the coalition approach in all scenarios of supply chain finance. Investment institutions, such as financing institution, core businesses and third-party logistics companies join the alliance chain as network nodes, and supply chain participants (upstream and downstream businesses) join as users. The existence of alliance chains between public and private chains has the characteristics of six levels of block chain technology, which is more secure, efficient, and business practice. In the alliance chain of supply chain finance, the participating organizations and institutions build trust and consensus mechanisms through contracts and other means to form a block chain.

Block chain technology is tamper-proof and easy to verify, each data block contains the previous block data, thus forming a new block, and all bookkeeping verification can be done by verifying the last block function value. The principle structure of supply chain finance built on block chain technology is shown in Figure 1.
From Figure 1, it can be seen that the block chain-based supply chain financial architecture includes data, network, consensus, incentive, contract and application layers. The database encapsulates various underlying core technologies of block chain, including block structure, asymmetric encryption technology, time stamps, and data blocks that write and record supply chain financial transaction data in hashed form; the network layer includes P2P (point-to-point) data transmission technology, transmission mechanism and verification mechanism based on block chain technology; the consensus layer encapsulates the consensus algorithm between network nodes, while the supply chain financial alliance chain mainly uses POA approach. The incentive layer mainly considers the incentive mechanism of entrusted agent and trading income distribution mechanism. The supply chain financial technology system built by block chain, the supply chain finance alliance chain issuance incentive mechanism and the impact of economic factors such as profit distribution and value creation in the alliance chain system on supply chain finance; the contract layer mainly considers the programmability of the block chain supply chain financial system, including script code, intelligent contract, various computer algorithm language as well as the EVM virtual machine. In supply chain finance platform based on block chain technology, all actual transaction contracts will be written as smart contracts.

4. Risk management for supply chain finance based on block chain

4.1. Operational risk management

In the supply chain finance business, operational risk is one of the most important risks. The core enterprises and downstream distributors are independent economic entities, and some core enterprises lack a strict management system for downstream distributors. Therefore, once a commercial dispute occurs, core enterprises are reluctant to take the initiative to assume obligations such as guarantee compensation and buyback, as well as economic losses arising from any improper operations and business violations.

The use of block chain technology can effectively reduce the operational risks in supply chain
finance. Based on block chain technology, the documentary information between enterprises is transformed into block chain records, which has a high credit value. Each transaction of each trading entity is sent to all subjects of the system and the information is continuous and complete, the core firm is composed of n suppliers and then continues to expand the distributor. Each transaction has a real-time transaction entity with an associated transaction record that includes information about the transactions during the period, all members of the complete record\cite{6}. With the development of the Internet technology, the integration of technology and supply chain systems can be realized. The information of goods in the logistics warehouse is reflected online in real time through physical sensors, and financial institutions can capture all the information of suppliers on the block chain in real time, easily accessing the historical transaction information of each entity in the supply chain at once, such as transaction frequency, delivery date, inventory, payment cycle, and historical default. In a block chain of continuous records, the data source can be reused without the process of double-check and double-validate. These data are reusable, traceable and fully transparent, which helps to improve the efficiency of supply chain risk control.

4.2. Trade authenticity risk management

The essence of the financing model of supply chain finance is that financial institutions provide loan services for chain participants based on real transactions such as bills, advances, inventories, and accounts receivable. Among them, based on the "real transaction" is the premise of the operation of the model. In order to obtain bank loans, many enterprises take fictitious transactions, fictitious accounts receivable, repeated pledges of accounts receivable and fictitious inventories. Such phenomena greatly increase the difficulty of supply chain risk control.

As block chain technology can carry out distributed bookkeeping for related transactions, it can ensure that transaction information cannot be tampered with. Therefore, block chain technology is used to replace the signing of legal documents in various disciplines with electronic signatures. Specifically, at the technical level, the relevant transaction corresponds to a public key encryption and key, and after encryption, the information can be signed and stamped to obtain the same legal validity, thus ensuring the authenticity of the subject.

4.3. Risk management of repayment

In supply chain finance, financial institutions, as the lender of funds, are unable to effectively monitor the collection of accounts receivable of lending enterprises and obtain information about the buyer's accounts receivable, resulting in commercial banks being unable to take effective measures to investigate and verify in a timely manner. This problem increasing the cost of financial institutions to recover funds and the risk of non-performing loans, as well as reducing the efficiency of the utilization of funds in the entire supply chain finance chain.

The use of block chain time stamp attributes and smart contract attributes can achieve effective control of such risks. First of all, the impact of block chain on the authenticity of transactions mainly depends on the time property of block chain. When records are recorded, they have a reliable time stamp. With the time stamp, block data can fully record transactions from the beginning, generating all historical transaction states of subsequent transactions, thus avoiding the possibility of human tampering in the supply chain. Each transaction changes the block data and adds the current transaction data to the previous block. The modified block of data is sent to all participating entities in the system. After receiving the data update, all entities validate the status of the relevant transaction based on the public algorithm in case the node tries to create a fake transaction against the business logic, the block of data obtained based on the public encryption algorithm will not agree with the validation results of other entities. When other nodes are not involved in the fraud, the fake transaction will not be validated as having been written to the general ledger. By combining it with the electronic signature of the transaction entity, the receivable can be confirmed with the witnessing of all members of the network\cite{7-8}.

Secondly, using block chain technology it is possible to program the transaction contract and the
terms related to the contract. In the form of smart contracts, when the execution conditions are met, the system can automate the core functions of asset transactions and financing transfers, and the execution conditions on the block chain are not subjective to human will, avoiding the moral hazard of human manipulation. Once the contract conditions are met, they will be performed as agreed, and the related receivable funds will be automatically transferred to the bank's supervisory account in real time. Ensure that the transaction is in line with the contract requirements and reach agreement, provide trust for both parties to the transaction, improve transaction efficiency, reduce transaction costs, and thus achieve effective control of supply chain financial risks.

4.4. Emergency Risk Management
Since supply chain finance is a chain composed of multiple enterprises led by core enterprises, emergencies or contingency risks of a single enterprise in the chain may increase the risk of the entire supply chain finance. Therefore, the emergency risk management system of supply chain finance should be established to strengthen the risk early warning mechanism. Especially for the downstream enterprises after default, the emergency control system should be further strengthened and the emergency risk management process should be improved.

Figure 2. Early warning and emergency management process.

Firstly, using block chain technology to establish an emergency risk management process can reduce the probability of risk occurrence. As shown in Figure 2, based on the early warning and emergency management process, the enterprise data in the supply chain finance chain can be monitored in real time, and once there is a large fluctuation in the data, the early warning information can be triggered to provide timely feedback to the emergency function, and the relevant information in the case database can be compared by technical means, so as to formulate the corresponding emergency plan. This process also requires the enterprises in supply chain finance to continuously sort and screen the relevant valuable data in the process of business operation, to form a characteristic case database, to make timely risk management measures, and to control the risk before and during the event.

Secondly, using block chain technology for emergency risk management in supply chain finance can significantly improve the efficiency of risk management and control. First, all the data stored in the block chain has a time stamp, so that all the trading activities can be tracked, which is conducive to ex ante risk control. Secondly, with the help of block chain technology, no specific manual or system duplication is required, which can realize "unmediated" value transfer, reduce manual operations, lower the error rate, and provide effective channels for financial risk control.
5. Conclusion
This paper builds a model of supply chain financial system based on the characteristics of block chain technology, and systematically explains its technical principles and process architecture. Through the analysis of the supply chain financial system built by block chain, it is proposed that there are four types of risks in supply chain finance: operation risk, trade authenticity risk, payback risk and contingency risk. According to the characteristics of these four types of risks, it is proposed how to use block chain technology for risk management, so as to improve the risk governance ability and risk management efficiency.

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