

Promoting higher quality development of network freight platforms: a blockchain-based financial service model for upstream and downstream integration

Haidong Huang^{1,*} and Wenrui Wang²

¹Anhui University, School of Business, Hefei, 230601, China,

²Tianjin University of Technology, College of Management, Tianjin, 300382, China

Abstract. As an innovative platform for a new mechanism in the logistics industry, the emergence of network freight transport is a key point in the development of the logistics industry. The network freight platform has entered the golden period of its development since its legal status was clarified in 2019. Still, in developing the network freight platform, its upstream shippers and downstream actual carriers both need help with long account periods and difficulties in financing. To promote the higher quality development of the network freight platform higher quality development and solve the financing difficulties of small and medium-sized logistics enterprises and related production enterprises, we propose a financial service model of upstream and downstream network freight platforms using accounts receivable pledges based on blockchain technology. In this model, the network freight platform uses the credit advantage of its core enterprises to solve the financing problem for upstream and downstream suppliers under the premise of pledging accounts receivable, thereby accelerating the development of the network freight platform.

1 Introduction

The network freight platform uses the platform function to aggregate the supply and demand sides of the transport chain, providing shippers with information on actual carriers, and providing logistics companies, social transport capacity and other carriers with demand-side platforms [1, 2]. Since 2019, it has entered a period of rapid development. The supply chain of the network freight platform has also been gradually improved since this time. It includes three roles: the seller shipper, the network freight platform (carrier in charge), and the actual carrier. Both the upstream shipper and the downstream actual carrier suffer from long account periods and difficulties in financing [3, 4]. However, the advantages of blockchain technology, such as decentralisation, traceability and tamper-proofing, offer a completely new solution.

Review of the existing literature shows that in the traditional supply chain finance model on online freight platforms, the creditworthiness of the borrower and lender often requires a game of chance. In contrast, the innovative financial services model based on supply chain technology only mentions financing services for small and medium-sized enterprises, without exploring the financing of the shipper of goods, i.e. the upstream supplier of the supply chain and the social transport capacity [5, 6]. It proposes a more comprehensive supply chain financial services model that provides access to finance for all participants in the supply chain, and uses

blockchain technology to significantly enhance the security of the entire financial process. Therefore, it proposes a supply chain financial model based on actual orders and relying on blockchain technology to serve the upstream and downstream of the supply chain: that is, for the seller-shipper, through the use of IoT technology and blockchain technology to obtain the transaction price of the shipment and provide the shipper with partial financing of the payment by pledging part or all of the ownership of the goods, to help upstream enterprises to better capitalise the flow of funds. For downstream actual carriers, through the pledge of accounts receivable and other means, to provide financial support to actual carriers to help them develop better.

2. Blockchain-based supply chain finance model

By using the tamper-evident, decentralized, and traceable nature of blockchain technology, the authenticity of information can be guaranteed to reduce the risk of supply chain finance and the information inequality between borrowers and lenders can be eliminated [7]. Checking the literature, it can be seen that the pledges of supply chain finance using blockchain technology for network freight platforms can be used in two major modes: financing of cargo rights and transfer of accounts receivable, of which, due to the network In this proposal, the pledge method of accounts receivable transfer is proposed as the financing mode of supply

* Corresponding author: m02014105@stu.ahu.edu.cn

chain finance with the network freight platform as the core enterprise due to the lack of supervisory capacity of the freight platform for the right of goods.

Researchers described in detail how the general supply chain finance should be developed based on blockchain technology [8]. It demonstrates the feasibility of this model by analyzing the complementary nature of blockchain technology and accounts receivable pledges. This feature is still present in supply chains with online freight platforms as the core business, so the model is still viable in this article. And researchers also analysed the specific operational logic of the model at seven levels: data layer coupling, network layer coupling, consensus layer coupling, incentive layer coupling, contract layer coupling, access layer coupling, and application layer coupling [8]. In the data layer, the model's data structure is analyzed to collect multi-dimensional and discrete data to serve the upper layer. The network layer specifies the network protocols and technologies to be used in the model, guaranteeing the data's authenticity, legitimacy, rationality and logical validation. The third consensus layer identifies various consensus mechanism algorithms to determine the boundary values for supplier and core enterprise granting. The fourth incentive layer proposes an incentive-based approach to address the need for more motivation of core enterprises and how to maintain the proper functioning of the financial chain. The fifth layer encapsulates various pre-defined program codes, algorithms and smart contracts that underpin the programmability of the blockchain. The sixth layer, the access layer, specifies the various user entities and their responsibilities in the process. The seventh layer is the application layer, which describes the concrete implementation steps of blockchain + accounts receivable pledge. It is easy to see

that this model successfully solves the situation of information inequality between borrowers and lenders in lending relationships and successfully reduces financial risks.

However, when applied to a supply chain with a web-based freight platform as the core business, we find areas for improvement in some of the elements. The fourth incentive layer has a very significant point of difference here. Because the profitability of the network freight platform itself comes from the volume of the platform itself, and the successful application of the model will spontaneously attract more upstream suppliers, which means that the platform itself will have more orders, which coincides with the purpose of the platform, we should not focus the incentives on the core business side of the supply chain finance with the network freight platform as the core, but rather the incentives should be role should be considered more in terms of allocating it to financial institutions, which are meant to stimulate them to provide higher pledge rates, and upstream shippers, which are meant to stimulate them to generate more orders on the platform. Therefore, at this level, we propose to use a set of incentives: the upstream shippers' order turnover and order generation stickiness on the platform will be taken into account in the pledge rate, and shippers with high turnover and high user stickiness will be offered a higher pledge rate to help their capital flow and promote more orders; for financial institutions, the platform will charge a lower fee for the financial business while promoting it. For financial institutions, the platform facilitates the conclusion of financial business while charging a lower fee for that business as a way to promote the willingness of financial institutions to provide more capital flow. As shown in Figure 1.

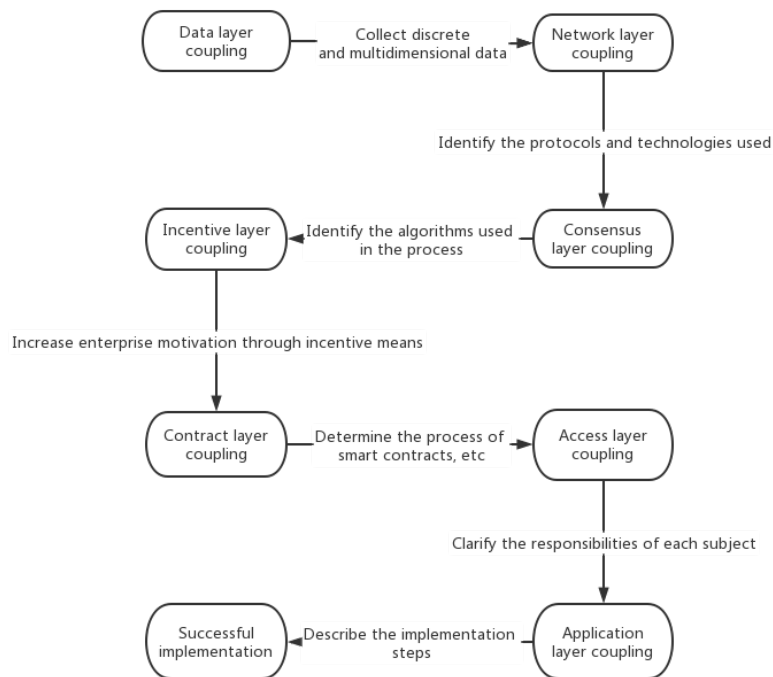


Fig. 1. The application of “blockchain + accounts receivable pledge” model diagram in supply chain finance.(Photo/Picture credit : Original)

The main difference between the supply chain finance with the network freight platform as the core and the ordinary supply chain is that the core enterprise does not receive raw materials or services from upstream and does not need to export products or services downstream, which causes the core enterprise and the upstream and downstream do not have a debt relationship between them, so there are some differences in the specific realization process [9]. This is reflected in the handling of the pledge rate. When the financial institution to the shipper and carrier credit, it considers the credit rating of the shipper and carrier and the credit rating of the network freight platform, so the network freight platform needs to provide credit guarantees to promote the financial pledge business more smoothly.

3. Financial pledge service process for upstream shippers

The upstream shippers of the network freight platform are often suppliers of large equipment or certain raw materials, etc. They generally have relatively fixed transport needs, and at the same time, there is often a long accounting period, and they can not pay back promptly, resulting in the production cycle being affected by the problem. Therefore, it is necessary to provide financial pledge services for upstream shippers. At the same time, the bad debt rate of such financial pledge services, which are based on real contracts payable for loading, can be well controlled, and the introduction of blockchain can solve the problems of repeated pledges and repeated financing and ensure that pledge information is open and transparent. The following describes the specific process of providing financial pledging services to upstream suppliers (as shown in Figure 2).

Apply for the pledge. When the shipper has a capital demand problem, first of all, it should be clear that all supply chain financial services with the network freight platform as the core business are based on the real orders that occur on the network freight platform, so the shipper must first provide a real consignment order that has occurred on the platform, while providing relevant contract documents about the goods of the order, and apply for a financial pledge to the platform at this time services.

Credit assessment. The network freight platform first makes a preliminary assessment based on the shipper's current order situation and historical order transactions, and after completing the preliminary assessment, sends the application orders of applicants with better credit ratings to the financial institutions, and in this step, the blockchain's tamper-evident line and uniqueness provides a good reference basis for credit rating, while the pledge information is directly connected to the People's Bank of China through the blockchain pledge system The People's Bank of China's unified registration platform for movable property financing is used to avoid duplicate pledges, and the financial institution receives the order to further review the applicant's information, at which point the financial institution considers the influencing factors that should be influenced by the credit rating of the online freight platform in addition to the credit of that applicant, which is the most important role played by the online freight platform in facilitating the smooth financial process.

Contract signing. The applicant and the pledgee sign an online contract, which is confirmed and effective after registration of the public node and is digitally encrypted by blockchain.

Division of responsibility. The applicant, the financial institution and the network freight platform, through the established contract, complete the division of responsibility for abnormalities in advance of the division of responsibility; However, the applicant and the network freight platform do not exist debt relationship; this does not mean that the network freight platform in the financial services does not bear responsibility, the financial institution in the credit process concerning the credit rating of the network freight platform before the subsequent credit Services. Hence, this part needs to network freight platforms as the core business and financial institutions to reach a consensus.

Actual performance. Financial institutions in completing the credit grant to carry out the fund's payment hit service. At the same time, when the shipper successfully obtains the accounts payable, pay the relevant accounts and interest to complete the entire service process.

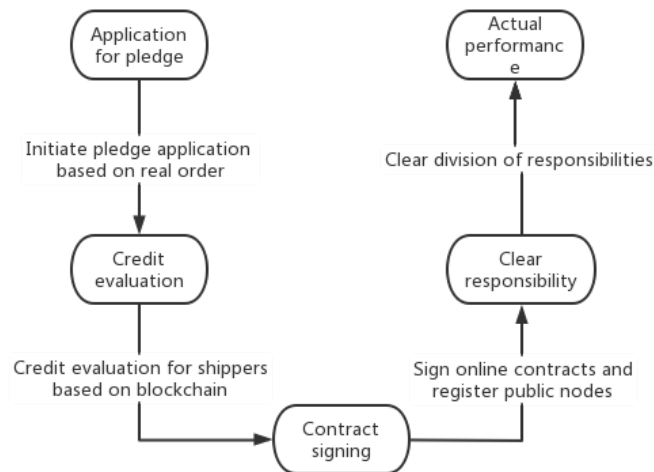


Fig. 2. Financial pledge business process for upstream suppliers of network freight platform.(Photo/Picture credit : Original)

In the whole process, the network freight platform, first of all, completes the task of information matching through their link up the supply and demand sides, followed by the network freight platform as the core business, the use of their credit advantages to help shippers better financial financing, which is also helping the platform itself to generate more orders.

4. Financial pledge service process for downstream carriers

There are two main sources of actual downstream carriers of the network freight platform. The first is the Third-party logistics company; the actual carrier is a company with drivers and transport vehicles to complete the transportation task. For this type of carrier, the pledge process is mostly the same as that of upstream shippers; Another type is social transportation capacity, which means that the driver owns the vehicle personally. For this type of carrier, we need to consider some special circumstances when granting credit and pledging. The specific process is as follows.

Registration and identity verification. Downstream carriers must register on the online freight platform and complete the identity verification process, including submitting necessary identity documents, transportation permits, and other relevant supporting documents. The registration procedure divides the carrier into two types: Third-party logistics company and social transport capacity.

Pledge application. When the carrier needs pledge service, it initiates a pledge application based on a total order on the online freight platform, and the platform will provide additional credit and pledge financing services according to different types of applicants. ③ **Credit evaluation:** when the Third-party logistics company initiates an application, the platform can get more relevant information for reference, including the company's operation, existing assets, historical orders,

etc., and conduct an authenticity investigation on the applicant's information based on the tamper-proof and uniqueness of the blockchain. At this time, the aspects considered in the credit process are comprehensive and reasonable, and it is easy to complete the credit; When the social transport capacity driver initiates the application, the information obtained by the platform is less due to the instability of the social transport capacity. Therefore, the platform can consider reducing the risk by reducing the pledge rate or retaining part of the pledged deposit as a credit guarantee. This step will be more detailed than what Third-party logistics companies must consider [10]. Regardless of the applicant type, after granting credit, the pledge information needs to be directly connected to the unified registration platform for movable property financing in the People's Bank of China through the blockchain pledge system to avoid the occurrence of duplicate pledges.

Contract signing. The applicant signs an online contract with the pledgee, confirms and takes effect after registering the public announcement node, and undergoes blockchain digital encryption.

Division of responsibilities. Applicants, financial institutions, and online freight platforms complete the division of responsibilities through established contracts to avoid the occurrence of bad debts. In the case of an application by a Third-party logistics company, the platform does not need to have a debt relationship with the applicant and financial institutions. At this time, the online freight platform plays a more important role in communicating supply and demand; However, if providing financial services for social transportation, to minimize the occurrence of bad debts, the platform should enter into a contract with financial institutions as a debtor, and then accept the applicant's accounts receivable pledge as a creditor. Through this process, the platform can better control the pledge rate and retain a portion of the pledged deposit as a credit guarantee to avoid bad debts as much as possible.

Actual performance. All parties shall complete the

pledge process by the established contract and contract.

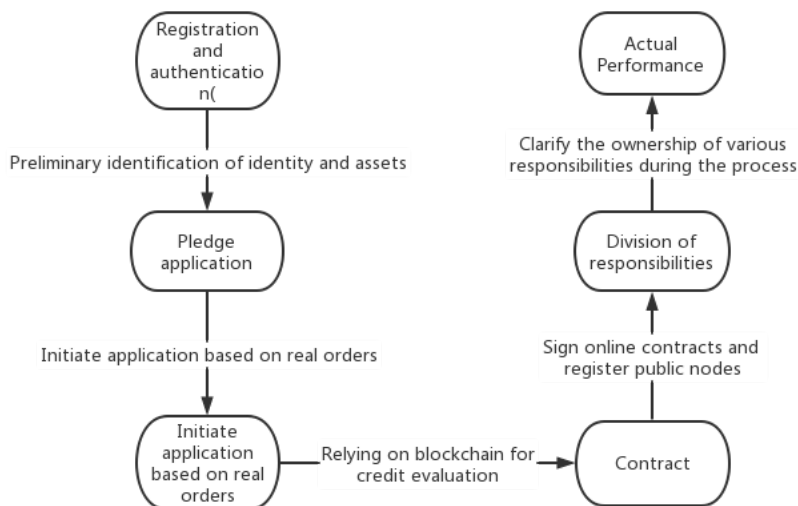


Fig. 3. Financial Pledge Business Process for Downstream Suppliers of Online Freight Platforms.(Photo/Picture credit : Original)

Given the difficulty and instability of credit for individual drivers, the platform may consider minimising the implementation of this service as much as possible. However, in China's current road transport situation, social transport capacity is still an indispensable part of road transport. Therefore, the platform needs to combine the specific transport capacity on the platform to form a reasonable financial pledge service. The financial pledge business process for downstream suppliers of online freight platforms as shown in Figure 3.

5. Conclusion

As an information matching platform, the online freight platform is responsible for communicating supply and demand and plays a role similar to that of an intermediary rather than an actual production enterprise. Therefore, supply chain financing with the online freight platform as the core enterprise will have many differences, such as the difficulty of pledging actual assets due to the lack of actual production and the lack of direct debt relationships with upstream and downstream suppliers. This also makes financial institutions question the credit process when financing their upstream and downstream. By implementing blockchain, the credit rating of the entire financial service process can be significantly improved and financial risks can be reduced. For core enterprise network freight platforms, attracting investment from small and medium-sized logistics companies and shippers is also attracting investment. The two goals are aligned. Based on the above, an upstream and downstream financial pledge service based on blockchain technology is proposed, which has the following advantages: (1) All financial pledges are based

on real orders, and by using blockchain technology, their creditworthiness is greatly enhanced and financial risks are reduced. (2) By attracting investment from shippers and carriers, it solves the problem of long accounting periods, which restricts the development of both the supply and demand sides of online freight platforms, and promotes the joint development of multiple parties. (3) Fully utilise the information data of online freight platforms and successfully monetise a large amount of useful information through intermediary service fees and other methods.

Authors contribution

All the authors contributed equally, and their names were listed alphabetically.

References

1. P. Bai, Q. Wu, Q. Li, *Wireless Commun. Mobile Comput.* **1**, 1 (2021)
2. Y. Gui, C. Jing, *J. Syst. Sci. Math. Sci.* **10**, 2892 (2021)
3. L. Xiao, T. Ke, F. Yu, P. Guo, *J. Enterprise Inf. Mgt.* **2**, 583 (2023)
4. C. Jiang, L. Xu, S. Li, *Int. J. Environ. Res. Public Health* **22**, 15031 (2022)
5. P. Xie, Q. Chen, P. Qu, *Smart Resilient Transp.* **2**, 69 (2022)
6. J. Huang, Z. Hou, L. Zhang, *Finance Accounting Newsl.* **24**, 127 (2021)

7. B. Debajyoti, J. Hamed, A. Amir, D. Pietro, Eur. J. Oper. Res. **1**, (2023)
8. Y. Fu, Account. Newsl. **14**, 145 (2021)
9. B. Li, Earth Environ. Sci. **1**, (2021)
10. Y. Zhao, European J. Wirel. Commun. Netw. **1**, (2023)