

Research of Agricultural Supply Chain Finance Based on Blockchain Technology: Findings from Chinese Industry

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Abstract. Supply chain finance has brought new choices to agricultural enterprises facing funding shortages. However, due to the different credit ratings and frequent default events of participating enterprises in the chain, the promotion of agricultural supply chain finance business is hindered. This can be solved by the technical characteristics of blockchain. This study discusses the rationality and feasibility of applying blockchain technology to agricultural supply chain finance through literature review and mechanism analysis, using data from Chinese industries. The application of blockchain technology helps to build a good supply chain financial ecosystem, helping Chinese agricultural enterprises explore new financing channels and overcome financial difficulties.

Keywords. Agricultural enterprise, supply chain finance, blockchain.

1. Introduction

The world economy after the COVID-19 epidemic deviated from the traditional development track. Coupled with global climate degradation and ongoing regional conflicts, this uncertainty in development has led to financial difficulties for agricultural enterprises around the world, especially small and medium-sized enterprises in developing countries [1]. These enterprises are unable to obtain ideal loan limits due to qualifications, credit certificates, property certificates, and other reasons. This has generated a significant amount of credit risk and social issues. At this time, the rise of agricultural supply chain finance (ASCF) in recent years has provided a highly cost-effective financing model. In this model, core enterprises on one or more chains provide qualification guarantees for their partners with their good credit, enabling small and medium-sized enterprises, even micro startups, to smoothly obtain loans from financial institutions or fintech companies.

However, in the operation process of ASCF, even with core enterprise guarantees, various new problems continue to arise, including poor data transmission, complex intermediate processes, low efficiency, and high risk of loan fraud. Due to the lack of real-time transparency of information, the credit of small and medium-sized enterprises

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cannot be truly guaranteed, and core enterprises may also falsify transaction information to obtain loans. To solve this problem, applying blockchain technology is a highly feasible option.

Blockchain is a distributed ledger technology. It has the characteristics of decentralization, information transparency, and tamper resistance. Using blockchain technology to transform ASCF business can increase the credit of small and medium-sized enterprises in the long tail field, avoid loan fraud, reduce operating costs, and improve performance efficiency. For financial institutions, this digital technology helps to provide authentic and reliable transaction information, achieve automatic fulfillment of online smart contracts, reduce regulatory difficulties after loans, and improve the financial risk management system of the entire agricultural supply chain. This study elaborates on the current development status of blockchain in China and provides a typical ASCF case of blockchain application. This is an effective proof that blockchain solves the financial challenges of agricultural supply chain.

2. Literature review

This study provides an overview of the current situation of agricultural supply chain finance, the development trend of blockchain, and innovation in financing models.

2.1. Agricultural supply chain finance

The key to supply-chain finance lies in the enterprise ecosystem driven by core businesses. The process optimization of this system can have a significant effect on the availability and cost of funds [2]. Popa (2013) elaborated on the concept of information technology in supply-chain finance, the functional requirements for technology, and implementation planning [3]. A supply-chain finance ecosystem can monitor and optimize cash flows in real time and achieve capital transparency across the supply chain [4]. The information gap between suppliers, the demand side, and financial institutions will be gradually leveled, and the overall financial cost will be significantly reduced. Supply-chain finance can be expected to develop better against the background of e-commerce [5].

Due to the popularity of e-commerce, the opportunities for agricultural enterprises to use supply chain finance for capital replenishment have greatly increased. The decrease in financing interest rates and the increase in capital opportunities will positively affect farmers' optimal production decisions and increase their expected returns [6]. In the financing process, leveraging the coordinating role of intermediary platforms can significantly improve the welfare of farmers and the total profit of the supply chain, while also fulfilling the increasing attention to social responsibility, bringing win-win results to farmers, platforms, and the entire supply chain [7].

2.2. Development of blockchain

Blockchain's cryptographic-based decentralized algorithm allows for the establishment of social trust relationships that do not require third-party intermediaries, and improves supply chain transparency [8]. Further, the technology, free from the shackles of third-party trust, reinforces the advantages of trust itself. It validates information throughout all aspects of the business through effective process design and the traceable division of

authority and responsibility. Complemented by other related technologies, such as big data and cloud computing, blockchain can provide a highly trusted data flow environment for business scenarios, including finance and logistics [9-10].

Introducing blockchain into the supply-chain finance industry could increase industry transparency and break through the established benefit distribution pattern [11]. The cumbersome transaction process and high cost of manual processing can restrict the development of supply-chain finance [12-13]. Introducing blockchain into supply-chain finance can therefore reduce business costs and risks and improve the transparency of the process. Arguing for the use of blockchain and internet of things in supply-chain finance simultaneously, the tamper-proof nature of blockchain will match the characteristics of Internet of things, real-time input of goods information, which can reduce risks and optimize Internet financial services [14].

2.3. Impact of blockchain on financial models

The traditional ASCF model is increasingly challenged and threatened by financing risks, counterparty risks, and a lack of consumer trust. There are enormous opportunities to transform and enhance agricultural enterprises and supply chains through blockchain technology. A set of issues that blockchain can address include food traceability, new business and direct sales models, and rebalancing power in the food chain [15-17]. The adoption of blockchain technology affects not only farmers, but also all parties in the supply chain, including banks, insurance, and other financial institutions. In addition, the distributed data exchange business model using blockchain technology is a new business model in the agricultural industry. Participation based on blockchain platforms can also increase production volume and total supply chain surplus. This can also stimulate more sustainability/green investment to produce more environmentally friendly products [18-20].

3. Case study from China

3.1. Development trends of blockchain in China

Currently, the development of blockchain technology is rapid, and the industrial ecosystem is steadily being constructed. Due to the gradual return of the cryptocurrency craze from initial wild speculation to rational development, the popularity of using blockchain for speculative trading has decreased, and the entire industry is returning to the normal logic of technology to improve productivity. According to Forbes statistics, dozens of companies around the world continue to invest in blockchain, as this distributed database technology supports the entire industry. Most of these listed companies are large enterprises with good reputation, and they believe that blockchain can help their businesses operate better, faster, or more cost-effectively. Figure 1 shows the country and regional distribution details of these companies.

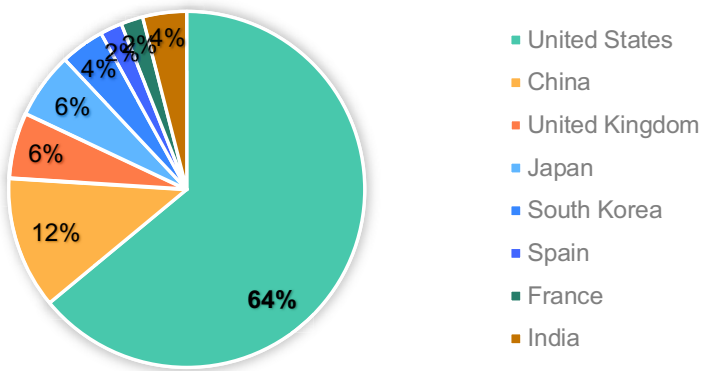


Figure 1. Distribution proportion of blockchain enterprises from different countries and regions entering the top 50 globally (Source: www.forbes.com, 2023 [21]).

China has a good development momentum in this technology field. With the joint promotion of the government and the industry, the policy environment encouraging blockchain development is gradually improving, with an increase in the number of enterprises at the forefront, a stronger willingness to expand business in multiple fields, and a continuous emergence of iconic application scenarios. Thanks to the support of macro policies, the business environment of blockchain enterprises has been continuously optimized. The blockchain information service filing list released by China's Internet Information Office in 2022 shows that enterprises engaged in blockchain business in China are not uniformly concentrated in the cryptocurrency field. The technological characteristics of blockchain are very suitable for applications in three aspects: electronic evidence, automated collaboration, and value transfer. More enterprises are starting to apply this technology in the real economy, government affairs, people's livelihood, and other fields. Figure 2 shows the business distribution of blockchain enterprises registered in China as of 2022.

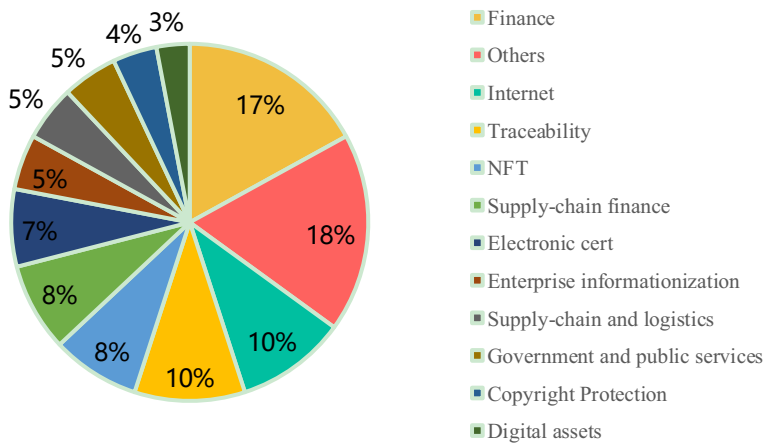


Figure 2. Business Distribution of Blockchain Filing Enterprises.

(Source: China Academy of Information and Communications Technology, 2022 [22])

From Figure 2, it can be seen that finance, especially supply chain finance, is the most explored field for the application of this technology, and iconic projects have been put into operation in relevant sub industries. Therefore, this article studies the mechanism of blockchain optimization in China's agricultural supply chain finance industry, which has strong reference significance for the promotion of this technology in other fields.

3.2. A typical case in China

Before 2020, the pig loans of the banks in China were mainly mortgaged with housing, land or pig house equipment. This type of loan had high requirements for real estate collateral, making it difficult to meet the needs of enterprises and farmers. The most valuable pig assets of such enterprises were not easy to register, value evaluate, and monitor, making it difficult to obtain bank credit support.

Guangdong Rural Credit Union launched a blockchain based ASCF product in 2020, named Real Pig Loan. Under the government support and the bank credit, this product had given the digital identities to the live pigs. In 2021, it provided credit support of 10 billion yuan to the pig breeding industry. This is a beneficial attempt of blockchain technology in the field of rural financial services, and also marks the true realization of financial productization of biological assets.

In this case, Guangdong Rural Credit Union introduced blockchain traceability technology to identify pig individuals, so that each pig would wear a digital identity tag, forming a big closed-loop in the whole process of pig birth, transaction, epidemic prevention, insurance, evaluation, right confirmation, mortgage, loan, sales and repayment, ensuring pig traceability, and solving the problems of asymmetric information and insufficient financial credit.

Through the Real Pig Loan financial product, pig breeding enterprises can apply for financing from Guangdong Rural Credit Union at a maximum of 50% of the current pig market value, and a pig can apply for a loan of about 2000 yuan. The traditional model can only grant an average loan amount of 200 yuan per pig. The former has increased by about 10 times compared to the latter, greatly meeting the financing needs of enterprises. Taking a branch of Guangdong Rural Credit Union as an example, in just over two months starting from 2021, this product supported enterprise loans of 300 million yuan and supported 150000 pig breedings, accounting for 10% of the city's pig inventory.

4. Analysis

4.1. Mechanism of utilizing blockchain to improve ASCF

Blockchain technology has enhanced ASCF products. The reasons for its success are as follows.

- Decentralization

The decentralized nature of blockchain technology has led to the recording, storage, and updating of distributed data, which does not rely on the management of central nodes. This structure is manifested in a multi node system or multiple individual networks, where nodes directly interact and form a trusted network system.

- De-trust

The de-trust of blockchain comes from the technical characteristics of decentralization, thereby eliminating reliance on any third-party notarization. When users use a de-trust system for trading behavior, they are incentivized to abide by the agreement and prevent default and fraud. This technical feature ensures the safety and smoothness of the trading process.

- Data security

By matching all raw data, whether it's photos or music, to specific values, the hash algorithm of this technology can achieve this transformation that ensures data security. If the node is maliciously tampered with, there will be indelible traces left on the blockchain, and its tampering cost is much higher than the benefit of overturning the confirmed results.

- Anonymity

Blockchain networks transmit data based on network addresses, without the need to identify specific individuals during this process. In addition, data transmission between nodes is supported by fixed mechanisms and algorithms, which can break away from specific third-party trust, thus enabling anonymous operation.

- Verifiability

Under this feature, nodes with account accounting permissions can record information and store it in existing chain blocks, while tracing the history of the previous chain block information to ensure the verifiability of platform information and achieve accurate data positioning. This indicates that blockchain data storage and transmission have timestamp characteristics.

4.2. Routes of utilizing blockchain to improve ASCF

Blockchain highlights its role as a necessary infrastructure for a "trust economy". Designing appropriate business processes based on their characteristics, assigning appropriate permissions to each participant, and conducting multiple verifications of the same information throughout the entire agricultural supply chain financial process can solve the key issues of their business. The solution is as follows.

- To solving the problem of data sharing, the distributed ledger networks could transfer real information.

For core enterprises and upstream and downstream enterprises in the agricultural supply chain, they form an alliance chain based on a distributed ledger network. By joining the chain, the original "one to one" business model can be transformed into a "one to many, many to one" business model. Under the premise of transparent supply chain operation, share relevant transaction data to confirm the rights belonging to all parties involved.

- To solve the problem of data evidence, the blockchain technology could provide reliable data for real transactions.

In the modern information era, authentic documentary information can ensure the healthy operation of ASCF. Blockchain technology can generate non tampering business documents, and the fraudulent behavior of participants is clearly restrained by this technology's de-trust mode. The multi angle mutual verification of data further improves its authenticity. Enterprises that provide real data can also increase their credit rating based on this behavior.

- To solve the problem of value transfer, the core enterprises could transfer credit.

Using blockchain can more effectively confirm suppliers' accounts receivable. After the rights are confirmed, the corresponding payment vouchers can be split and converted into tokens. In other words, this securitization behavior transfers the credit of core enterprises to enterprises in different levels of the chain. Whether it is a medium-sized enterprise or a small and micro enterprise, as long as they are in this supply chain, they can obtain core enterprise credit authorization. This reduces the financing threshold and improves the financing efficiency of small and medium-sized enterprises.

- To solve the problem of default, the smart contracts could reduce the occurrence of risks.

Blockchain based smart contracts can record the pre-agreed creditor's rights relationships of each participant. When the agreed conditions are met, the relevant terms are automatically enforced. If this model is successfully promoted, funds can be quickly settled between multiple suppliers. This replaces the extensive manual audit work that originally existed in the supply chain business, reduces the probability of errors, and improves work efficiency.

4.3. Value of blockchain-driven ASCF

Based on the above analysis, the application of blockchain in ASCF can bring the following value to core enterprises, small and micro agricultural enterprises, and financial institutions involved.

- Value for the core enterprises

In traditional supply chain finance, core enterprises play a crucial business role. However, in blockchain based ASCF, core enterprises are only a node that forms a distributed network, while the overall ecosystem of ASCF has developed more healthily. Core enterprises ensure access to more reliable supplier and logistics enterprise information. This is more conducive to the refined management of all participating enterprises on the blockchain platform, and improves the comprehensive return rate.

- Value for the small and medium-sized enterprises

Blockchain brings true inclusive finance. With the coverage of high-quality credit of core enterprises in the entire supply chain, real-time transactions with small and medium-sized enterprises have been confirmed on the chain, which significantly reduces the financing threshold and risk of the latter. Due to the connection between the blockchain platform and financial institutions, the latter provides financing services through the credit of core enterprises, which can achieve lower financing interest rates. Enterprises raise funds online on demand, enhancing the timeliness of fund acquisition and eliminating the need for additional guarantees and collateral, thereby saving financing costs.

- Value for the financial institutions

Firstly, it reduces the cost of customer acquisition. ASCF operates on the basis of core enterprises with more credible qualifications, providing high-quality financing resources for small and medium-sized enterprises based on trust in core enterprises. This also means that financial platforms can quickly expand similar customer groups; Secondly, it reduces regulatory costs and optimizes loan risks. On the blockchain, there is a complex amount of transaction data that interacts and exchanges, and it is difficult

for general enterprises to have sufficient ability to forge these data, which provides financial institutions with real and reliable risk control evidence. In addition, the smart contract that automatically executes transactions reduces the difficulty of post loan supervision and subsequent management costs.

In summary, the integration of blockchain and ASCF can bring additional value to participants and has significant application prospects.

5. Conclusion

This study strongly proves the rationality and feasibility of applying blockchain technology to ASCF from both literature review and mechanism analysis. After the application of blockchain technology to ASCF, a good supply chain finance ecosystem can gradually be established.

5.1. Limitation

Due to misunderstandings about speculation, ASCF products that have applied blockchain have not yet been fully accepted by customers. This makes this study limited to Case study and difficult to obtain more business data, which affects the acquisition of global data in this field and the refinement of macro scientific issues.

5.2. Future scope

In the future, research on the application of blockchain in ASCF should focus on more simulation and quantitative analysis. Through in-depth analysis in this field, the feature indices of ASCF before and after the application of blockchain can be compared. By proving the credibility and practicality of blockchain through data, ASCF can benefit more small and medium-sized farmers in the supply chain, reduce their financing difficulties, and assist in the sustainable and high-quality development of agriculture.

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