

Research on Agricultural Supply Chain Finance Innovation Strategies Based on Blockchain

Yanyan Huang, Yanyu Chen*

College of Economics and Management, Minjiang University, Fuzhou, Fujian, China

**Corresponding Author.*

Abstract: Comprehensively promoting rural revitalization and accelerating the construction of an agricultural power are important measures for the comprehensive construction of a modern national strategy. Under this strategic guidance, agricultural supply chain finance is particularly crucial as it is vital for the development of small and medium-sized enterprises and farmers. However, ordinary farmers, small and medium-sized agricultural enterprises, and core enterprises all face financing and credit risks throughout the supply chain. These challenges constrain their development and growth. This thesis first analyzes the current development status of agricultural supply chain finance, then identifies the risk issues affecting the development of agricultural supply chain finance through analysis of the relevant entities involved in the practice of agricultural supply chain. Finally, it proposes a solution approach through the innovative strategy of "dual-chain" combining blockchain with agricultural supply chain finance to address these problems. This thesis provides theoretical support for the development of agricultural supply chain finance and offers practical significance for the innovation research of agricultural supply chain finance under blockchain technology.

Keywords: Rural Revitalization; Agricultural Supply Chain Finance; Blockchain; Internet Financial Platform; Financing Risk

1. Introduction

1.1 Research Background

At present, the digital economy, as an important part of the modern economic system, has brought great opportunities for rural

revitalization and agricultural modernization through information and communication technology (ICT), the Internet and other digital tools. Specifically, the digital economy has played an important role in the following two aspects: first, it provides a wide range of information acquisition channels and sharing platforms, making it easier for farmers to obtain agricultural science and technology, market conditions, policy information, etc., so as to help them make more accurate agricultural production decisions; Secondly, it has promoted the development of rural e-commerce. Farmers can use the e-commerce platform with good development momentum in recent years to directly sell agricultural products to consumers, eliminating the need for middlemen to earn price differences, breaking the geographical constraints, and improving the sales scope. Therefore, in order to achieve the goal of rural revitalization, we must make full use of the digital economy to promote agricultural development.

In recent years, the digitalization of rural industries has been hampered by financing bottlenecks. First of all, rural infrastructure lags behind, the development of rural e-commerce requires huge investment to improve the logistics, payment system to improve the quality of service; secondly, rural consumers have limited understanding of e-commerce, advertising and promotion to enhance brand awareness, increase sales conversion rate; furthermore, rural e-commerce platforms need to continue upgrading the information technology system in order to enhance the user experience, service efficiency. However, at present, rural e-commerce financing is difficult to obtain financial support due to the influence of regional resources, policies and systems. Agricultural supply chain finance is mainly for the real economy, can mobilize financial resources to invest in infrastructure

construction, integration of resources to attract enterprises to invest in rural e-commerce, and then based on the initial investment, share the investment returns[1]. In recent years, the level of information technology in China has been improving, and digital finance has gradually matured. In recent years, China's information technology level continues to improve, the gradual maturity of digital finance, agricultural supply chain finance can use big data to accurately match e-commerce resources for different rural areas, help rural e-commerce development, form an e-commerce network to meet the needs of the people, and promote rural revitalization.

Agricultural supply chain finance faces multiple risks, such as credit, financing and traceability, which have wide-ranging impacts, leading to credit deficits, capital chain breaks and product safety issues. To solve these challenges, the introduction of blockchain technology is an innovative move. The decentralization, anti-tampering and easy traceability of blockchain can effectively deal with the above problems, provide solutions for rural e-commerce financing, and promote the realization of the goal of rural revitalization and the construction of a strong agricultural country.

1.2 Research Meaning

Responding to the development strategy of rural revitalization and injecting new sources of rural financing. Through literature collation, it can be learned that in recent years, the research objects of blockchain-based supply chain finance practice are mostly banks and financial enterprises, while the research on blockchain-based agricultural supply chain finance practice is still relatively small. In order to respond to the government's call for rural revitalization and to solve the management, business and loan problems faced by agricultural supply chain finance, and through the case analysis of the predecessor to explore its innovation point for In order to respond to the government's call for rural revitalization and to solve the problems of management, business and loan faced by agricultural supply chain finance, and to explore its innovative points through previous case studies, agricultural finance can be injected as a source of power to better serve the rural socio-economic development.

Utilize blockchain technology to promote the economic and social development of agriculture. The implementation of rural revitalization strategy needs the help of rural e-commerce, and the financing of rural e-commerce needs the help of supply chain finance, and the supply chain finance problems such as lack of credit, supply chain capital chain breakage, production efficiency decline and product safety need the addition of blockchain, so the blockchain technology provides strong financial support to solve the problems of agricultural supply chain finance, and greatly promotes the development of rural economic and social development.

Explore the "dual-chain" innovation model of agriculture, help solve the pain points of the industry. Combining supply chain finance and blockchain to form a "dual-chain" model, and exploring their strategies for solving problems in agricultural production, circulation and sales is a direction worthy of innovation and research.

1.3 Relevant Basic Theories

1.3.1 Agricultural supply chain finance

Agricultural supply chain finance is the use of supply chain finance in the field of agriculture, agriculture and supply chain finance is closely integrated, financial institutions for agricultural procurement, equipment leasing, agricultural production, processing, sales, storage, logistics and other aspects of the main body of financing to provide financial support[2].The agricultural supply chain finance model consists of three components.

The first is the traditional agricultural supply chain finance model led by commercial banks, in which the entire chain is centered on commercial banks, thus helping to provide financing to farmers and enterprises of different sizes that rely on the supply chain for production and marketing operations.

The second one is the agricultural supply chain finance model based on the Internet financial platform. The traditional model relies on the continuous operation of all kinds of resources of the financing core enterprises or individuals, but with the rapid growth of all kinds of emerging technologies in recent years, it further promotes the integration of all kinds of resource flows of the financing main body in the agricultural supply chain finance and thus gives birth to the agricultural supply chain

finance model centered on the Internet financial platform. Under this model, the core subjects can choose to cooperate with experienced leading enterprises to carry out agricultural supply chain finance by utilizing various types of platform funds and the platform's own big data resources.

The third is based on the e-commerce platform as the core of the agricultural supply chain financial model, the emerging e-commerce platform instead of the traditional financial platform, became a new management center in the agricultural supply chain finance, and then penetrate into the agricultural supply chain upstream and downstream of all kinds of enterprises in all kinds of economic activities, so that upstream and downstream of the supply chain of all kinds of enterprises to become a major force in the use of the e-commerce platform loan financial products

1.3.2 Blockchain technology

The public's understanding of blockchain technology firstly comes from electronic money, and in recent years, due to the continuous explosion of electronic money in the capital market, the underlying logic of its technology supports the blockchain to step into the public's line of sight, and in recent years, the blockchain technology has been widely concerned and studied by various sessions.

In order to have a clearer understanding of blockchain technology, it can be divided into data layer, network layer, consensus layer, incentive layer, contract layer and application layer[3]. The data layer is responsible for storing blockchain transaction records, and uses hash function encryption algorithm, timestamp and Merkle tree to ensure the data can not be tampered with; The network layer manages the communication and connection of nodes to achieve decentralization and ensure the stability and security of the network; The consensus layer ensures the consistency and credibility of data from nodes, and maintains the tamper resistance of the blockchain. The incentive layer designs a reward mechanism to encourage participants to contribute to network security and stability; The contract layer realizes smart contract technology, automatically executes transactions with preset rules, and improves transaction efficiency and security; the application layer builds specific applications and services, solves business problems in the fields of digital currency,

supply chain management, etc., and provides users with more secure, transparent and reliable services.

Blockchain is a continuous data chain, which packs transaction information into indivisible data blocks in chronological order, and uses advanced cryptography methods such as hash function encryption algorithm, timestamp and Merkle tree to closely connect each block. Under this structure, once the data is recorded in the blockchain, it is difficult to be tampered or forged, so as to ensure the authenticity and security of the data.

There are two main types of key blockchain technologies. The first one is distributed ledger. Distributed ledger can be understood as a shared database, which can make the data chain not rely on the management and control of the central node, and realize the decentralization of information transmission, so that each node has equal status and function, and the members of the blockchain can view and access the data on the chain at their own nodes, which ensures the transparency and reliability of the data[4].

In this type of storage, data on all operations and transactions are recorded. Whenever there is a change in the data, it is instantly recorded by each participant with a time stamp that cannot be tampered with. These records are stored on multiple block nodes, enabling data sharing and verification. Blockchain distributed storage can be categorized into two modes: cloud storage system and local server[5]. In the cloud storage system model, data is encapsulated into files and stored in the cloud. In the cloud storage system model, data is encapsulated into files and stored in the cloud, while in the local server storage model, data is first cached to a network node and then stored in a backend server or database.

The second one is smart contract. In 1994, Nick Szabo (a computer scientist) firstly openly put forward the concept of smart contract, pointing out that the essence of smart contract is a kind of computer program which can automatically execute the relevant codes and contract terms[6]. These terms are defined in various codes, which are run and verified on multiple nodes on the blockchain network. The core concept of smart contracts is to standardize the terms of the contract into executable code, thus enabling automated contract execution. Compared with traditional

contracts, smart contracts are designed to eliminate intermediaries and human interference, making contract execution more efficient and reliable.

2 Analysis of the Current Status of Agricultural Supply Chain Finance

2.1 Analyzing the Current Status of Agricultural Supply Chain Finance Development

2.1.1 The agricultural supply chain finance

Table 1. Financing of Selected Rural Financial Service Providers

Platform	Location	Financing time	Financing rounds	Amount of financing
Baoxiang Finance	Shanghai	2016-01-26	Wheel A	50 million RMB
		2016-12-06	strategic financing	Hundreds of millions of yuan
Shima Finance		2017-01-16	B+wheel	Hundreds of millions of yuan
2018-05-07		C wheel	RMB 300 million	
Lingxian Finance	Beijing	2017-07-20	A+wheel	1100 RMB
		2018-02-27	Wheel B	Tens of millions of RMB
Traceable Finance	Hangzhou	2016-06-29	Wheel A	RMB 150 million
Sannong Financial Services	Shenzhen	2017-03-14	Wheel A	Undisclosed
		2018-04-03	Wheel B	Undisclosed

Data source: Toubao entry report series https://pan.baidu.com/s/1KjjEBRGMtJF0PiT_dJgFWg#list/path

2.1.2 Supply chain finance is infiltrating rural areas

The Internet penetration rate in rural areas has increased, and the number of Internet users has steadily expanded. With the popularization of smart phones and the basic full coverage of mobile 5G networks, the number of rural Internet users in China has continued to grow. By December 2022, the number of Internet users in rural areas in China has reached as many as 380 million, and the Internet penetration rate has increased by 4.6% year-on-year. The increase in the penetration rate makes it easier for farmers and rural enterprises to obtain market information, policy information and financial service information. This information fluency shows that agricultural supply chain finance is infiltrating rural areas, making it easier for various rural entities to understand market demand and supply, so as to more effectively adjust production plans and business strategies to obtain more reasonable financing.

2.1.3 Supply chain finance empowers the flourishing development of rural e-commerce

By collating and analyzing the relevant data from the National Bureau of Statistics, we can see that as various types of villages have been

market is favored by capital

In recent years, the Internet financial platform for rural finance has been favored by capital, and financing in the "three rural" Internet financial field has continued to increase. From the perspective of financing amount, as shown in Table 1, platforms such as Baoxiang Finance, Shima Finance, and Traceable Finance have all obtained large-scale financing of over 100 million yuan.

strongly supported and highly valued by the national policy, the growth rate of demand for consumer goods in rural areas is consistently higher than that in urban areas, and the consumer market in rural areas occupies a pivotal position in China. According to the big data statistics of relevant platforms, the online retail sales in rural areas will be 2.8 percentage points higher than the total online retail sales in 2023 during the "618 Activity" period, and the online retail sales in rural areas will be 2.8 percentage points higher than the total online retail sales in 2023[7]. In addition, the Ministry of Commerce's relevant public data show that in the first and second quarter of 2023, the national online retail sales reached 7.16 trillion yuan, of which the national rural e-tailing reached 1.12 trillion yuan. In addition, the Ministry of Commerce's relevant public data show that in 2023, the first and second quarter of the national online retail sales reached 7.16 trillion yuan, of which the national rural online retail sales amounted to 1.12 trillion yuan, a year-on-year growth of 12.5% [8]. At the same time, if rural e-commerce wants to grow and strengthen on this basis, it not only requires distributors and retailers to have more complete rural infrastructure construction and technical support, but also requires production ends to have more sufficient raw material reserves, which requires more financial

support. Supply chain finance, as a new form of financial support, can provide strong financial support for rural e-commerce from the production end to the retail end.

At present, most of the rural e-commerce supply chain finance is from the local characteristics of the product, such as Dangshan County agricultural products, Dangshan County is located in the northernmost part of Anhui Province, known as the "world pear capital, the hometown of fruits", which skillfully used the supply chain finance for the development of characteristics of the agricultural products to provide financial support, which led to the rapid development of rural e-commerce, as shown in Table 2 which shows that the supply chain finance for the development of rural e-commerce is not only the supply chain finance but also the supply chain finance for the development of rural e-commerce. as shown in Table 2. In recent years, Dangshan County has 22 e-commerce platforms, 2,022 e-commerce enterprises, more than 1,500 e-commerce brands, more than 60,000 online stores and micro-businesses, and annual sales of agricultural products exceeded 5 billion yuan[9]. It has driven more than 150,000 people to start their own businesses, driven the synergistic development of fresh food logistics, advertising design, agricultural product processing and other industries, become a nationally important logistics and express delivery center, and has been recognized as the province's rural e-commerce consolidation and upgrading of the work of the demonstration counties.

Table 2. Development of Dangshan County in Recent Years

e-commerce platforms	22
E-commerce companies	2022 Home
e-commerce brands	1500+
online stores and microbusinesses	60,000+
Network sales of agricultural products	5 billion +
employment-led	150,000+

2.2 Analyzing the Existing Application Models of Agricultural Supply Chain Finance

2.2.1 A commercial bank-led model for the orderly functioning of the supply chain

At present, there are mainly the following modes of agricultural supply chain finance, namely, the traditional agricultural supply chain finance mode centered on commercial banks, the agricultural supply chain finance mode centered on Internet financial platforms, and the agricultural supply chain finance mode centered on e-commerce platforms.

The traditional agricultural supply chain finance model with commercial banks as the core, where leading enterprises (wholesalers) will send purchase demands to farmers to purchase agricultural products, this process makes farmers get purchase orders, farmers can get orders as a credit certificate to the commercial bank to apply for appropriate loans to buy raw materials; at the same time, the leading enterprises have to guarantee the process of farmers applying for loans with orders to the bank, and also provide accounts payable for the farmers, so that farmers can get income to repay the bank loans. At the same time, the dragon-head enterprises guarantee the process of applying for loans from the banks with orders, and also provide accounts payable for the farmers, so that the farmers can earn revenues to repay the bank loans.

The dragon-head enterprises will purchase agricultural products and then process and manufacture them, and then give them to agriculture-related SMEs for retail sale, at which time the agriculture-related SMEs will also obtain purchase orders, and they can also apply for corresponding loans from commercial banks to operate their companies on the basis of the orders they have obtained as credit certificates, and the dragon-head enterprises will have to provide guarantees for the agriculture-related SMEs, and the funds obtained by the agriculture-related SMEs from the sale of agricultural products will have to be repaid to the banks. The funds obtained from the sales of the small and medium-sized agricultural enterprises have to repay the bank loans. The flow of agricultural products starts from production by farmers to processing by dragon-head enterprises and finally to retailing by agriculture-related SMEs, which completes the closed loop of the supply chain.

Such a structure makes the supply chain relationship between commercial banks and leading enterprises, agriculture-related SMEs and farmers interdependent, together constituting a complete agricultural supply

chain. This model realizes the orderly operation of the supply chain, thereby facilitating efficient financing for all parties.

2.2.2 The Internet-based financial platform-led model improves the efficiency of financing

The integration of Internet financial platforms with core leading enterprises is the optimal path for integrating Internet financial platforms into agricultural supply chain finance. Large enterprises with strong capital and technical strength are often chosen by financial platforms. First of all, such leading enterprises tend to have rich industry experience and prestige, enough to effectively manage the supply chain. Secondly, leading enterprises have years of experience in the industry and have established a wide network of suppliers and farmers. These enterprises are connected to many small and medium-sized agribusinesses and farmers, and know their credit status well. Therefore, these enterprises can assist financial platforms in screening farmers and have accumulated a large amount of agricultural transaction data.

Nongjin Circle is a large-scale agricultural financial group in China, mainly providing lending, wealth management, insurance and other services. Through intervening in various consumption scenarios of farmers, its Nongfa Loan has provided loans to more than 3,500 dealers, 13,000 farmers and 13,000 farmers nationwide. It has provided more than 7 billion yuan of financial services to a number of large-scale farms. Focusing on the agricultural planting vertical, Nongfa provides a wide range of agricultural supply chain financial products such as planting, agricultural machinery and dealer loans.

Agricultural development loan platform to production materials as the entry point of farmers' financing needs, agricultural development loan platform based on the cooperation with the relevant enterprises, agricultural materials dealers, farmers and buyers of agricultural products to provide loan services, and by the agricultural manufacturers, dealers, farmers and buyers of agricultural products entrusted to provide them with payment of the loan, the completion of the whole process to achieve the mutual benefit of the main body of the situation of win-win situation, get the loan support for farmers to buy agricultural materials into production, get the loan support other subjects also realize the

orderly operation of the business. This whole process realizes the win-win situation among all the subjects, the farmers who get the loan support start to buy agricultural materials and put them into production, and the other subjects who get the loan support also realize the orderly operation of the business. Over the years of operation, Nongfa loan has accumulated a large amount of transaction data and established a huge data network, which has fully solved the problems in the field of agricultural supply chain finance caused by the lack of farmers' credit data and information, such as the difficulty of financial institutions to provide loans and the difficulty of farmers in the financing of enterprises in need.

2.2.3 The e-commerce platform-driven model enhances the credit line

Representatives of the agricultural supply chain finance model centered on e-commerce platforms include Ant Financial and Jingdong Financial. Here we mainly introduce the product of Ant Gold Service under Alibaba Group - Wangnong Loan. "Wangnong Loan" is an online credit loan product for rural small and medium-sized enterprises and farmers engaged in related production activities to meet the needs of small and medium-sized enterprises and farmers for turnaround financing and development financing. Through cooperation with core enterprises in the agricultural supply chain, it provides financing services to customers with large gaps in their needs, and relies on e-commerce platforms to provide sales channels for MSMEs and farmers in the agricultural supply chain.

When agricultural small and medium-sized enterprises and farmers encounter funding gaps in the production and operation process and have financing needs, they apply for loans from Ant Financial Service; Ant Financial Services conducts credit review, mainly by reviewing the historical transaction information and past credit situation of lenders and related core agricultural enterprises, and then combining the borrower's background consumption transaction data in Tmall, Alipay and other Alibaba groups, and then gives the lender the required credit line; When the lender purchases the required agricultural inputs from Tmall or Taobao within the credit limit, they provide certain production technical guidance to the successful loan farmers to improve their production efficiency and

quality, ensure their repayment of loans, and to some extent enhance the credit limit.

3 Risks of Agricultural Supply Chain Finance in Practice

By analyzing the application of the three modes of agricultural supply chain finance in practice, it can be seen that, although their existing mode of rural finance to provide a certain degree of convenience, but due to the variety of subjects involved, and the platform involved in the technical requirements of the higher, it is often easier to appear a lot of potential financing risks and credit risk problems, specifically in the following aspects.

3.1 Financing Risk Analysis

3.1.1 Dispersed and numerous subject information is susceptible to tampering

When carrying out supply chain finance for rural areas, multiple entities in the industrial

chain are involved, including financial institutions, core enterprises, and upstream and downstream agricultural small and medium-sized enterprises, as shown in Figure 1. The information associated with them is not only uneven, but also thousands, all of which are retained in their respective management information systems. Information transmission is very difficult, and the possibility of information tampering is high. If there is a conflict between two entities at this time, it is highly likely to lead to mutual shirking of responsibility and even the result of unauthorized tampering with information. Due to the interdependence and win-win relationship of each entity in the industrial chain, once one party tampers with information, all entities in the industrial chain will be affected, which may lead to the collapse of the entire information and capital chains, with unimaginable consequences.

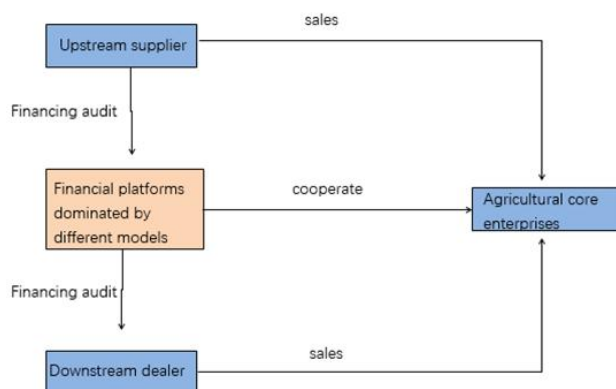


Figure 1. Relationships between the Various Players in Agricultural Supply Chain Finance

Photo source: Network data sorting <https://news.qq.com/?no-redirect=1>

3.1.2 Insufficient technical support and information identification for agricultural supply chain finance

Currently, many agricultural supply chain finance sectors usually rely on Internet data platforms to operate. When smart contracts are triggered for execution, high quality code is required to ensure smooth operation. However, given the current state of the art and related programming limitations, completely eliminating technical security risks is a daunting task. If a smart contract is vulnerable and is enforced, the potential risks are often unpredictable[10]. In addition, the agricultural supply chain financial platform is quite imperfect in recognizing and screening information, which may lead to errors or false data input, which will cause greater losses to the whole platform. In addition, the

agricultural supply chain financial platform is quite imperfect for the identification and screening of information, which may lead to the existence of errors or false data input, and then it will cause greater losses to the whole platform. At the same time, these problematic data will cause all kinds of false and malicious information to flow in the platform and supply chain, and there will be asymmetry between the platform information and the real information, which will cause certain risks.

3.2 Credit Risk Analysis

3.2.1 Credit risk arising from core business

In the field of agricultural supply chain finance, the role of core enterprises is crucial, as they play a crucial role in the supply chain. As the primary holder of data, the core enterprise plays a decisive role in the visibility of

transactions. In addition, they provide credit guarantees for small and medium-sized enterprises involved in agriculture, providing solid support for the normal operation of agricultural supply chain finance platforms [11]. However, in order to maintain their own interests, core enterprises may choose to conceal bad information and even use their ability to provide financing guarantees to exert pressure on upstream and downstream enterprises, resulting in significant credit risks for upstream and downstream enterprises.

In addition, due to reasons such as debt and operational pressure, the supply chain may face a redemption crisis, usually referring to a situation where an entity (such as a company, government, or financial institution) is unable to fulfill its debts, commitments, or obligations on time or in full. When the relevant assets cannot continue to maintain the entire chain, the core enterprises may face significant financial shortages due to the repayment crisis and inability to repay accounts payable or collect accounts receivable on time, thereby affecting the market circulation of funds and materials, and even causing the core enterprise's capital chain to break. This result is highly likely to lead to significant credit risks for the core enterprises that provide guarantees for small and micro enterprises, and even affect the overall credit of the agricultural supply chain finance platform.

3.2.2 Risks arising from credit problems of agriculture-related SMEs

The participation of agribusiness SMEs has increased the richness of the variety and quantity of transactions in the supply chain, but the credit problems of agribusiness SMEs have also constrained the development of the supply chain to a certain extent. First of all, SMEs often do not have strict rules and regulations and reasonable division of parts because they are husband-and-wife, brother-and-brother, family-and-friend enterprises. Due to the irregularity and instability of their financial personnel, it is difficult to provide standardized financial data, which makes it difficult for financial institutions to make an objective and true evaluation of the credit level of SMEs, and it will increase the credit risk of the agricultural supply chain financial platform if these credit-uncertain enterprises are financed.

Moreover, many agriculture-related SMEs still

provide collateral as security in the traditional way, and financial institutions often do not have specialized local supervisory departments, so they can only entrust third-party enterprises to supervise the collateral. However, due to the strong mobility of the collateral itself, if the financial institutions and the commissioned third-party enterprises and agriculture-related SMEs conceal some of the real situation of the collateral, resulting in the financial institutions will not be able to accurately obtain the information, and thus unknowingly release the loan leading to an increase in credit risk.

3.2.3 Information asymmetry increases the probability of credit risk

Since, in a market economy, financial institutions and agribusiness SMEs and farmers have different levels of access to information, agribusiness SMEs and farmers will not be able to cooperate with financial institutions if they are scrutinized strictly in accordance with their regulations. This may stimulate some low-ethical agribusiness SMEs and farmers to use false information to mislead financial institutions so as to comply with the standards. This will lead to the flow of limited funds to high-risk credit recipients, resulting in agricultural supply chain financial risks arising from credit risk.

4. Blockchain and Agricultural Supply Chain Finance: A "Dual Chain" Innovation Strategy

4.1 Financing Risk Optimization Strategies

4.1.1 Using the blockchain distributed ledger to solve the problem of information tampering
In view of the financing problems caused by the difficulty of free transmission of information of dispersed and numerous subjects, a fair and open management system is needed to make the supply chain financing operation carry out smoothly, and at the same time, it is also necessary to guarantee the openness and transparency of information and tamper-proof information. The cryptography-based blockchain distributed ledger has the advantages of information transparency, visualization and anti-tampering, which can well promote the enterprises of each subject in the industrial chain to realize the sharing of transaction information, the query of transaction records and the prevention of tampering of transaction information.

The cryptology based distributed ledger is the core component of the blockchain, which contains all transaction data in the entire network. The blockchain distributed ledger consists of main block headers and blocks. The block header generally contains the timestamp, hash value, Merkle number root and other information of the previous block; The block body contains Merkle trees and transaction data generated based on transactions. Merkle tree is generated based on the transaction data after multiple hash operations. Its purpose is to quickly summarize and verify the authenticity and integrity of the transaction data of the block body.

When a new block is created, it will contain the hash value of the previous block, which means that the new block forms a chain connection with the previous block. This chain connection helps to ensure the sequence and integrity of blocks. Meanwhile, the hash value of the new block is calculated by combining the hash value of the previous block with the data of the new block (such as transaction information) and applying a specific hash function. This calculation method ensures that the hash value of the new block is not only related to its own data, but also influenced by the previous block, thereby ensuring the security and consistency of the blockchain. In this way, each block is closely related to the previous block, forming an immutable chain structure. In summary, the current hash value will affect all subsequent hash values. If the information of a block changes, it will cause all subsequent blocks of that block to change. This mechanism prevents arbitrary tampering of information between different entities, thereby improving the security of the agricultural supply chain finance platform.

In addition, the timestamp function also helps to visualize the financial information of the entire agricultural supply chain. By analyzing the timestamp records on the blockchain, transaction timelines and transaction flow charts can be generated to visualize the transactions and the flow of funds in each segment of the supply chain. This visualization capability provides decision makers with deeper insights, helping them to better manage and optimize supply chain finance activities[12].

4.1.2 Optimize platform technology support using blockchain smart contracts

Smart contract is driven by various external environments, activities and events, it runs on a collection of programs containing a series of set conditions and rules stored on the blockchain. Trigger conditions, response rules and contract values will be packaged into the smart contract, and will be triggered when the agreed conditions are reached, which can realize the control of assets, complete the business logic, and delineate the rights and obligations of participants. This can realize the control of assets, complete the business logic, and delineate the rights and obligations of participants. When the rules in the smart contract are approved by multiple subjects, the contract will be encrypted and signed, and at the same time cross-validated between each subject. When the conditions and rules stipulated in the agreement are met, the contract will be automatically executed according to the rules.

In the agricultural supply chain financial platform mainly composed of blockchain technology, after the enterprises or farmers in need of financing services log in the platform, the platform will send the credit conditions and performance conditions of the enterprises or farmers to the financial institutions for access, which will serve as a basis for the provision of financing services. In addition, the platform will also determine the repayment ability and repayment time of the enterprise or farmer by reviewing their conditions, based on which the application for financing will be automatically approved. If a user fails to make a repayment on time by a specified date or if the repayment date is approaching, the platform contract automatically recognizes the situation and urges the user to do so.

The application of smart contract greatly improves the operation efficiency of the whole chain, and at the same time improves the user's trust in the platform, stabilizes the security and reliability of the platform, thus solving the drawbacks of insufficient technical support and information recognition in agricultural supply chain finance.

4.2 Credit Risk Optimization Strategies

4.2.1 Reducing the credit risk of core enterprises by utilizing the "blockchain + account splitting and transferring" model

The "blockchain + accounts splitting and financing" model uses blockchain technology

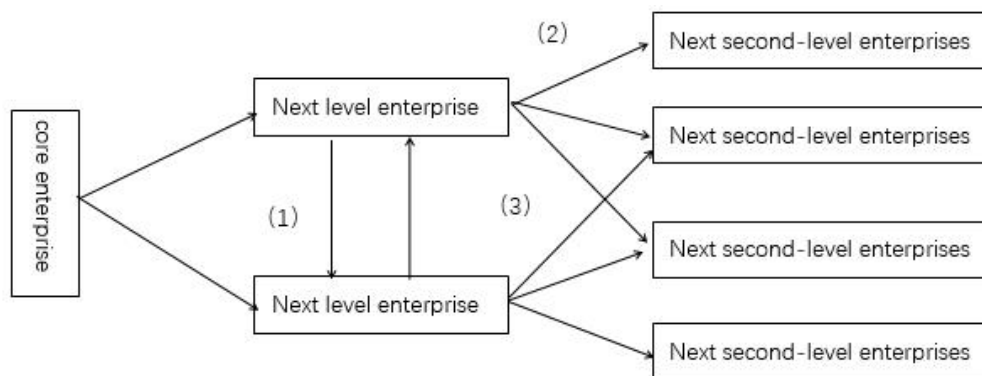
to digitize accounts payable in the supply chain and transform them into digital bonds, a financial instrument, to achieve splitting, circulation and financing. Simply put, core enterprises transform accounts payable into digital assets and issue digital bonds on the blockchain, allowing these bonds to circulate nationwide. Through this project, SMEs can leverage their accounts payable to access capital, while core enterprises can manage and optimize their accounts payable more effectively. The advantage of this model is that physical assets can be converted into digital assets, which can be seen at a glance, and because it is based on the blockchain technology, thanks to its immutable and traceable characteristics, the credit rating of this model has increased, and its business status and asset status have become open and transparent.

The receivables chain platform launched by Zheshang Bank is a platform built based on blockchain to support split and transfer financing. The receivables chain platform based on Zheshang Bank provides credit enhancement and liquidity support for suppliers, core enterprises and distributors in the supply chain, based on which, the suppliers issue and accept accounts receivable for shipment with the core enterprises, and the core enterprises have to issue and accept accounts receivable for shipment with the distributors, and the process can be very good for the splitting, transferring and financing of accounts receivable in the supply chain, and the platform assesses and monitors the digital asset status and credit status of the core customers, and the platform supports splitting, transferring and financing. This process can well split, flow and finance the accounts receivable in the supply chain, and the platform can help the financing-related enterprises to reduce credit risk and guarantee the safety of funds by evaluating and monitoring the digital asset status and credit status of the core customers. At the same time, the platform's data analysis and reporting functions can help enterprises gain an in-depth understanding of their accounts receivable situation and trends. Enterprises can generate financial reports and data analysis through the platform to provide useful information support for decision-making.

In summary, the "blockchain + accounts splitting and financing" model utilizes blockchain technology to transform accounts payable in the supply chain into digital assets, and the core enterprise issues digital bonds, which provides SMEs with a way to effectively improve efficiency, reduce credit risk, and promote the development of agricultural supply chain finance. The accounts receivable chain platform is a blockchain based financial platform of Zhejiang Commercial Bank, which supports such methods as splitting and financing, realizes efficient online processing by transforming accounts receivable into electronic payment and settlement and financing tools. The platform is equipped with powerful risk management tools to help enterprises reduce credit risk and safeguard capital, and provides data analysis and reporting functions to provide in-depth understanding of the situation and trends of accounts receivable and to support decision-making. Together, these initiatives promote the flow of funds among enterprises, improve the efficiency and transparency of financial services, reduce the credit risk of core enterprises, and contribute to the sustainable development of agricultural supply chain finance.

4.2.2 Utilizing the "blockchain + big data analysis" model to solve the credit problems of agriculture-related small and medium-sized enterprises

The financing mode of "blockchain + big data analysis" is to transfer the credit of core enterprises by using blockchain + big data analysis to reduce the credit risk of agriculture-related enterprises and improve the financing efficiency, and its principle is shown in Figure 2. In this case, the higher-level enterprises provide credit guarantee for the lower-level enterprises through relevant data analysis, thus reducing the credit risk of the latter. There is no direct business connection between the participating enterprises, but through the blockchain data analysis and the credit guarantee of the upper-tier enterprises of the financing enterprises, the credit level of the financing enterprises can be improved, thus facilitating the financing activities. Enterprises in the same tier can lend and borrow more easily and with a lower level of risk.



**Figure 2. "Blockchain + Big Data Analytics"
Working Principle**

Alibaba has established a blockchain + big data analysis model agricultural procurement platform based on its "Cainiao Network" and "Dashanqiao" projects. Participants include farmers, planting bases, agricultural product processing enterprises and logistics companies. The platform records transaction data, payment records, cooperation history and other credit-related information among the participants, and ensures the security and non-tampering of the data through blockchain technology. Then, by mining and analyzing the transaction data and behavioral data, the credit characteristics of each enterprise are extracted, including transaction frequency, transaction amount, payment compliance rate, etc. Based on these data, Alibaba has been able to provide the credit information of each enterprise, including transaction frequency, transaction amount and payment compliance rate. Based on these data, Alibaba builds a credit assessment model, and uses machine learning and statistical analysis to continuously optimize and update the model to improve the accuracy and reliability of the assessment. Based on the blockchain platform and big data analysis results, Alibaba can provide more accurate credit assessment services for agriculture-related SMEs and guarantee services for agriculture-related SMEs. Financial institutions provide supply chain financial services to agricultural product processing enterprises based on credit evaluation results, including loans, insurance, financing leases, etc., to help them expand production scale and improve production efficiency; At the same time, Alibaba can provide agricultural inputs and sales channels for agricultural planting bases and farmers, promoting the sales and income growth of its

products.

Therefore, the "blockchain + big data analysis" financing model reduces the credit risk of agriculture-related enterprises and improves the financing efficiency by transferring the credit of core enterprises using blockchain and big data analysis. Under this model, high-level enterprises provide credit guarantees for low-level enterprises, thus reducing the latter's credit risk and realizing the smooth progress of financing activities. For example, Alibaba has established an agricultural procurement platform with blockchain and big data analysis as its core, recording credit information such as transactions, payment records and cooperation history of all parties, and processing and analyzing it through big data technology to establish an accurate credit assessment model. Based on this model, Alibaba provides accurate credit assessment and guarantee services for agriculture-related SMEs and supply chain financial services for financial institutions to solve the credit problems of agriculture-related SMEs.

4.2.3 Building a Blockchain-based Agricultural Supply Chain Finance Platform to Reduce Asymmetric Credit Risks

Blockchain has a natural advantage in information, financial institutions can well understand the financial status, asset income and expenditure, and operational capacity of core enterprises and agriculture-related SMEs, avoiding the problems caused by information asymmetry. Taking Jiaxing City as an example, it builds Zhejiang Province intelligent three agricultural supply chain finance agricultural supply chain finance platform. The goal of this platform is to become a new tool for the finance and agriculture departments in supporting rural revitalization, assisting

government departments in smoothly implementing key tasks such as rural financial system reform and supporting rural poverty alleviation. In response to and solving various financial problems in the existing agricultural system in Jiaxing City, this platform comprehensively sorts out the characteristics of the operating entities throughout the entire agricultural supply chain, and constructs a database of agricultural entities, an integrity service platform, a supply chain financing platform, a blockchain management platform, etc., so that both lending parties and regulatory authorities can quickly understand the other party's performance and lending ability, improve financing efficiency, and reduce credit risk [13].

5. Conclusions

Based on fully combing and comprehensively analyzing the relevant literature at home and abroad, this paper starts from the basic concepts and relevant theories of agricultural supply chain finance and blockchain technology, takes the development background and development status of agricultural supply chain finance as an entry point, and adopts charts and case studies to expound, so as to conclude that the agricultural supply chain finance, while obtaining vigorous development, is also facing potential financing risks and credit risks, and then introduces blockchain technology to empower the development of agricultural supply chain finance, so as to draw the following conclusions: The following is the conclusion of this paper. It is concluded that agricultural supply chain finance is facing potential financing risk and credit risk at the same time of its vigorous development, and blockchain technology is then introduced to empower the development of agricultural supply chain finance, which leads to the following conclusions.

Blockchain-based agricultural supply chain finance breaks through the problems of the traditional model. Blockchain-based agricultural supply chain finance can break through the difficulties and risks encountered in the traditional mode of capital financing, credit management and information verification by improving information transparency, reducing information asymmetry and lowering financing costs, providing a more efficient, safe and reliable solution for

agricultural supply chain finance. The specific performance is as follows: blockchain technology and smart contract bring new possibilities for financing of agriculture-related enterprises. The automatic execution of smart contracts eliminates the tedious manual intervention, and at the same time, the distributed ledger of blockchain ensures the reliability and transparency of the transaction. This new technology can reduce the financing cost and risk, and make the financing process more efficient and credible. In addition, through the time-stamping mechanism and non-tamperability, blockchain technology improves the creditworthiness of agriculture-related enterprises and makes the transaction information more real and credible. In addition, the decentralized nature of blockchain enhances the voice of agribusinesses, allowing multi-level upstream and downstream enterprises to participate in transactions and record credit information, thus realizing a fairer and safer agricultural supply chain finance model.

Blockchain technology enables the sustainable and smooth development of agricultural supply chain finance. The construction of blockchain-based agricultural supply chain finance platform can help solve the financing and credit risks of each subject in the supply chain, and can also strengthen and maintain the mutually beneficial and win-win relationship between the core agribusiness and other agricultural supply chain enterprises. At the same time, blockchain technology can efficiently and accurately integrate all kinds of information and data for all kinds of subjects, so as to provide them with technical and effective data and information references, which is conducive to empowering all subjects in the chain to realize sustainable development. The main participants in agricultural supply chain finance are core agricultural enterprises, financial institutions, agricultural small and medium-sized enterprises, farmers and other agricultural organizations. The most prominent feature of these organizations is that they have formed a diversified cooperation ecosystem, and the cooperation among different participants can realize risk dispersion and sharing, especially for financial institutions, through cooperation with stable and reliable partners such as core agricultural enterprises, they can reduce loan risks and improve the

security and sustainability of loans.

In the future, agricultural supply chain finance based on blockchain has a strong development prospect. Blockchain technology can effectively reduce the risk of agricultural supply chain finance and provide more convenient and low-cost financing channels for agricultural enterprises. It not only helps to enhance the competitiveness of agricultural enterprises, but also further promotes the implementation of rural revitalization strategy and promotes the benign development of social economy. With the accelerated development of blockchain technology, agricultural supply chain finance will play a more important role and inject new vitality into the sustainable development of the agricultural industry chain.

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