

The Application of Blockchain Technology in Supply Chain Finance

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Abstract: With the continuous development of Internet technology, applying blockchain technology to supply chain finance will effectively solve the problems of information asymmetry and delayed credit transmission in its development process, ultimately promoting the deepening development of supply chain finance. Based on this, this article will focus on analyzing the application of this technology and its related issues.

Keywords: Blockchain, Supply chain finance, Information silos.

1. Introduction

The most crucial aspect of the entire supply chain financial service system is big data processing, so it is necessary to fully recognize the importance of finance and marketing to ensure the normal operation of the entire service system. However, from the current actual situation, although the overall development level of this service system in our country has been in a stable state, it is still using traditional models, and common problems and information gaps are still one of its biggest problems. And blockchain technology can effectively solve this issue and provide more solutions to address data silos, optimizing the flow and sharing of supply chain data. From this perspective, exploring the application and development of blockchain technology in supply chain finance has great practical significance.

With the rapid development of the global economy, supply chain finance is playing an increasingly important role in promoting enterprise trade, reducing financing costs, and improving the efficiency of fund utilization. However, the traditional supply chain finance model has some problems, such as information asymmetry, lack of trust, and cumbersome operations. These issues have constrained the development of supply chain finance and brought many inconveniences to enterprises.

As an emerging distributed ledger technology, blockchain technology has the characteristics of decentralization, immutability, and transparency, providing new ideas for solving the problems of traditional supply chain finance. Through blockchain technology, digitalization, transparency, and intelligence of supply chain finance can be achieved, improving the efficiency and reliability of the entire supply chain.

This article will explore the application of blockchain technology in supply chain finance, analyze its advantages and challenges, and look forward to future development trends. By gaining a deeper understanding of the application of blockchain technology in supply chain finance, it helps to promote innovation and development in supply chain finance, providing enterprises with more convenient, secure, and efficient financial services.

2. The Concept of Blockchain and Supply Chain Finance

Blockchain is a decentralized shared ledger that combines data blocks in chronological order into a specific data structure in a chain manner, and is guaranteed by cryptography to be tamper proof and unforgeable. It can securely store simple, sequential, and verifiable data within the system. Blockchain can achieve peer-to-peer transactions, coordination, and collaboration based on decentralized credit in a distributed system where nodes do not need to trust each other through the use of data encryption, timestamp, distributed consensus, and economic incentives. This provides a solution to the common problems of high cost, low efficiency, and insecure data storage in centralized institutions.

The blockchain system is a peer-to-peer, end-to-end platform composed of countless nodes. Information accounting and storage are parallel and distributed, and there is no centralized node or management platform in any sense. This design strengthens the equal position of different transaction entities, making information more transparent and significantly reducing transaction costs. Moreover, due to the distributed nature of blockchain networks, all nodes in the network store local record copies, so attackers must control more than 50% of peer nodes to successfully tamper with stored information, which is obviously difficult to achieve, thus ensuring the robustness of the system. At the same time, blockchain builds trust relationships based on consensus mechanisms using technical endorsements rather than authoritative intermediary endorsements to avoid default or fraud.

Supply chain finance is similar to banks focusing on the core enterprises in the supply chain, implementing unified management and supervision of the information flow, fund flow, and logistics of their upstream and downstream enterprises, ultimately achieving a shift from individual enterprise risk control to overall supply chain risk control, and giving rise to various financial services. These derived financial services will effectively ensure the survival of the supply chain, further enhance the application rate of supply chain funds, and effectively reduce overall operating costs.

3. The Current Development Status of Supply Chain Finance

3.1. The current development status of blockchain technology in supply chain finance

With the rapid development of information technology, blockchain technology, as an emerging distributed ledger technology, has gradually become a research hotspot in the field of supply chain finance. This article will conduct an in-depth analysis of the current development status of blockchain technology in supply chain finance, aiming to provide reference and inspiration for relevant enterprises and researchers.

(1) The application scope of blockchain technology in supply chain finance is constantly expanding

In recent years, more and more enterprises and financial institutions have begun to realize the potential and value of blockchain technology in supply chain finance, and have increased investment to promote the research and development and promotion of related applications. From initial attempts to large-scale applications today, blockchain technology is playing an increasingly important role in supply chain finance. For example, Ant Financial has partnered with Foxconn to provide financing services to suppliers through blockchain technology; JD collaborates with Budapest University of Science and Technology to develop a blockchain based supply chain financing system; SF Express and WeBank have launched blockchain based logistics information platforms. These cases indicate that the application of blockchain technology in supply chain finance has shifted from theoretical exploration to practical application, and has been widely applied in an increasing number of scenarios.

(2) Blockchain technology brings innovative business models to supply chain finance

Traditional supply chain finance faces problems such as cumbersome operations and limited risk control measures, while the application of blockchain technology has brought innovative business models and opportunities to supply chain finance. Through smart contracts, automated lending can be achieved, financing costs can be reduced, and cross-border payments can be made through digital currency. These innovative models make supply chain finance more efficient, flexible, and convenient. At the same time, blockchain technology can also provide more transparent and trustworthy information exchange platforms for enterprises on the supply chain, reduce information asymmetry and trust costs, and improve the collaborative efficiency and competitiveness of the entire supply chain.

(3) Blockchain technology enhances supply chain finance risk control capabilities

Blockchain technology provides a more secure and reliable risk control method for supply chain finance through features such as decentralization, traceability, and encrypted protection. Enterprises can comprehensively monitor the supply chain through blockchain technology, reducing operational and credit risks. At the same time, blockchain technology can also help enterprises achieve the ownership and circulation of digital assets, protect their intellectual property rights and brand value. In addition, blockchain technology can also achieve automated default handling and dispute resolution through smart contracts, improving the

efficiency and fairness of risk disposal.

(4) Increase policy support to promote the application of blockchain technology in supply chain finance

Governments and regulatory agencies around the world have begun to recognize the importance and potential of blockchain technology in supply chain finance, and have introduced relevant policies to support its development. For example, the Chinese government proposed in the "14th Five Year Plan" for the development of digital economy to vigorously develop digital supply chain finance, support cooperation between financial institutions and core supply chain enterprises, and carry out accounts receivable pledge loans and other businesses. In addition, countries and regions such as Europe and the United States have also introduced relevant policies to encourage and support enterprises to explore the application of blockchain technology in the field of supply chain finance. The introduction of these policies will further promote the application and development of blockchain technology in supply chain finance.

(5) Technological development faces challenges and requires continuous breakthroughs in bottleneck constraints

Although blockchain technology has made some progress in supply chain finance, it still faces some technical challenges and bottlenecks. For example, the performance and scalability of blockchain technology, data privacy protection, cross chain interoperability, and other issues still need to be further addressed. At the same time, the application of blockchain technology also faces issues of security and compliance, and it is necessary to strengthen technological research and regulatory cooperation, promote the formulation and improvement of relevant standards and specifications. Therefore, it is necessary to continuously strengthen technological research and innovation, break through bottleneck constraints, and promote the widespread application and development of blockchain technology in supply chain finance. The current development status of blockchain technology in supply chain finance.

3.2. Analysis of the advantages of blockchain technology in supply chain finance

(1) Decentralization and Transparency

The core feature of blockchain technology is decentralization, which means it does not require any central institutions or third-party intermediaries to verify transactions. Each node has a complete copy of the ledger, and once transactions are verified and added to the blockchain, they are permanently recorded and traceable. This decentralized feature not only eliminates reliance on third-party intermediaries, reduces transaction costs, but also enhances the transparency of supply chain finance. All participants can view transaction status, logistics information, and fund flow in real-time, eliminating the problem of information asymmetry and enhancing trust.

(2) Security and Tampering Prevention

Blockchain technology ensures the security of transactions through encryption algorithms. Once data is written into the blockchain, it becomes very difficult to tamper with or be illegally modified. This security benefits from the distributed nature and consensus mechanism of blockchain, which means that any malicious tampering with data will be detected by other nodes and therefore rejected from being added to the blockchain. This feature is crucial for supply chain finance as it protects the integrity and authenticity of transaction data and reduces the risk of fraud.

(3) Automation and Intelligence

The combination of blockchain technology and smart contracts can achieve automated transaction execution. A smart contract is a computer program that automatically executes and manages protocols between multiple parties. Once the preset conditions are met, the relevant operations

will be automatically executed without the need for manual intervention. This greatly improves the efficiency and accuracy of transactions, reducing human errors and delays. In supply chain finance, smart contracts can be used for automated payment, clearing, and recording operations, optimizing the entire process.

Table 1. Practical Cases of Blockchain Technology in Supply Chain Finance

Case Name	Description
ShuLian Technology	The digital supply chain service platform of the commodity industry through blockchain technology achieves the authenticity, reliability, and traceability of transaction information.
Provenance	Provides a blockchain platform for full-process information recording to enhance the transparency of the global retail supply chain.
Collaboration between OGYDOCS and Barclays Bank	Puts trade documents such as letters of credit and bills of lading on the public blockchain for immutable verification, promoting the digital application of trade finance and supply chain operations.
Ant Financial & Foxconn	Provide financing services to suppliers through blockchain technology.
JD.com & Budapest University of Technology and Economics	Develop a blockchain-based supply chain financing system.
SF Express & WeBank	Launch a blockchain-based logistics information platform.
Walmart & IBM	Use blockchain technology to track food supply chains.
Deloitte & ZhongAn Online	Provide a blockchain-based supply chain financing solution.
ZhongAn Insurance & Budapest University of Technology and Economics	Collaborate to develop a blockchain-based supply chain financing system.
New Hope & Budapest University of Technology and Economics	Collaborate to develop a blockchain-based agricultural traceability system.
JD Finance & Budapest University of Technology and Economics	Collaborate to develop a blockchain-based supply chain financing system.
China Federation of Logistics & Purchasing Sub-branch of Bulk Commodity Exchange Market & Budapest University of Technology and Economics	Research on blockchain-based supply chain financing system.

(4) Flexibility and Scalability

Blockchain technology has high flexibility and scalability, and can adapt to various supply chain finance application scenarios. By customizing smart contracts and developing appropriate blockchain platforms, enterprises can flexibly configure and adjust according to their own needs and business logic. In addition, with the continuous development and innovation of technology, the scalability of blockchain is gradually improving, enabling it to handle larger scale transactions and data.

In summary, blockchain has shown many advantages in supply chain finance. The characteristics of decentralization and transparency, security and tamper resistance, automation and intelligence, as well as flexibility and scalability have brought tremendous value enhancement to supply chain finance. These advantages not only improve the efficiency and security of transactions, reduce risks and costs, but also strengthen trust and cooperation among participants. With the further development and maturity of blockchain technology, its application in the field of supply chain finance will be more extensive and in-depth. Enterprises should seize this opportunity and actively explore blockchain solutions that meet their own business needs to improve the management and operational efficiency of supply chain finance. At the

same time, the government, regulatory agencies, and research institutions should also increase their support for blockchain technology, formulate corresponding policies and standards to promote its healthy development in supply chain finance.

3.3. The problems of blockchain technology in supply chain finance

(1) The problem of information asymmetry is prominent

Currently, supply chain financial services in China are mostly aimed at core enterprises. This is because banks and financial institutions are more willing to credit the accounts receivable of core enterprises due to factors such as risks, costs, and returns. Usually, these types of enterprises are mostly liquid and productive, with independent legal personality, excellent capital credit, and promising market and industry prospects. Therefore, such enterprises can reduce the risk of lending funds to banks and financial institutions, while increasing the credit of node enterprises. This has great practical significance in the entire supply chain, whether for funding parties or node enterprises. However, in practical operation, the credit of such enterprises cannot achieve a positive transmission. Throughout the entire supply chain, the ERP systems of all enterprises are unable to achieve uniformity, leading to a gradual decrease in their level of

informatization. In addition, although most enterprises in the entire supply chain finance may appear to be on the same chain on the surface, they are essentially independent of each other. Many enterprises attach great importance to self-protection, treating information such as fund flow, information flow, and logistics as trade secrets and not easily disclosing them to the outside world. This can lead to slow response and operational difficulties in the entire market. At the same time, the overall information is prone to islands, unable to achieve effective sharing, and banks and financial institutions cannot obtain effective and real credit support data.

(2) Offline credit and financing businesses are relatively complex

The offline credit process requires a cumbersome approval process, as well as running back and forth between banks and relevant departments. The overall front line is long, and certain standards are set in each process, which makes it difficult for small and medium-sized enterprises to be easily granted credit. The financing business process formulated by banks also has certain problems. Once non-standard operations occur, it will exacerbate risks, and the entire process cannot achieve basic transparency, and information cannot be transmitted in a timely manner.

(3) Insufficient amount of information held by financial institutions

Under the development of the Internet, competition between financial institutions and enterprises has evolved into competition in terms of information breadth and depth of information processing. Under the power of science and technology, the ability to process, analyze, and transform various information has gradually improved. However, from the current information held by financial institutions, it can be found that scattered, lagging, and one-sided problems are still extremely prominent. Most financial institutions are still unable to timely and effectively grasp the various real information generated in the management and operation process of enterprises, resulting in deviations in the judgment of enterprise financial strength, operating conditions, and credit limits, leading to an increasing number of bad debts on the books of financial institutions.

(4) Insufficient technological maturity

Although blockchain technology has many advantages, its technological maturity still needs to be further improved. At present, blockchain technology still has some problems in terms of processing speed, scalability, and security. For example, the processing speed of blockchain technology is limited, making it difficult to meet the needs of large-scale transactions; Meanwhile, the data privacy protection of blockchain technology still needs to be strengthened to ensure that sensitive information is not leaked. These issues require technology developers to continuously improve and refine blockchain technology to enhance its maturity and reliability.

(5) Compliance issues

The decentralization and anonymity of blockchain technology pose challenges to regulation. In the field of supply chain finance, regulatory authorities need to ensure the compliance and transparency of transactions. However, existing regulatory frameworks and legal systems may not fully adapt to the characteristics of blockchain technology, leading to regulatory gaps or conflicts. Therefore, it is necessary to strengthen legislative and regulatory cooperation, formulate regulatory rules and legal systems suitable for blockchain technology, in order to promote the healthy

development of blockchain technology in supply chain finance.

(6) Cost and resource investment

The development and application of blockchain technology require a significant amount of cost and resource investment. For small and medium-sized enterprises, the cost of applying blockchain technology is relatively high, which may increase the burden on the enterprise. At the same time, professional talents in blockchain technology are relatively scarce, and enterprises need to invest more resources in talent cultivation and introduction. Therefore, it is necessary for the government, financial institutions, and enterprises to jointly increase their investment in blockchain technology and promote its popularization and application.

(7) Data security and privacy protection

Although blockchain technology has high security, there are still issues with data security and privacy protection. In supply chain finance, a large amount of transaction information and sensitive data are involved. Once leaked or illegally obtained, it will cause serious damage to the reputation and interests of enterprises. Therefore, it is necessary to strengthen data security and privacy protection measures to ensure the security and confidentiality of transaction information and sensitive data. For example, encryption technology, access control, and other means can be used to strengthen data security and privacy protection.

(8) Lack of unified standards and norms

At present, there is no unified standard and specification for the application of blockchain technology in the field of supply chain finance. Different enterprises and institutions may adopt different blockchain technologies and platforms, leading to issues of data interoperability and interoperability. Therefore, it is necessary to strengthen the standardization of blockchain technology, establish unified standards and specifications, and promote the interoperability and compatibility of blockchain technology. Only by establishing unified standards and norms can we promote the widespread application and development of blockchain technology in supply chain finance.

4. Application Strategy

(1) Collecting various financial information under blockchain technology

Under blockchain technology, information integration can be highly refined, and the data information of each transaction can be accurately extracted and automatically run under pre-set computer programs, effectively reducing the process of human operation and ensuring the objectivity, accuracy, and authenticity of data to the greatest extent possible. It can also effectively ensure the confidentiality of enterprise information itself. In addition, supply chain finance will use the endorsements provided by authoritative enterprises as credit guarantees, and then monitor the financial transactions and pledge guarantee information of other small and medium-sized enterprises on the supply chain in real time, thereby maximizing the security of all enterprise funds on the entire supply chain. The effective combination of these two can promote real-time monitoring of enterprise accounting development, achieve the confirmation of ownership of real estate and movable property, and ultimately strengthen the operational efficiency of capital in supply chain finance.

(2) Strengthening the credit rating of all enterprises in the supply chain benefits

Under blockchain technology, the repayment and payment

records generated during the buying and selling process of supply chain enterprises can be used as an important content for financial institutions and banks to evaluate their credit rating, thus forming an intelligent calling program that maximizes the credit benefits of most enterprises. For example, accounts receivable can be used as an important measure of a company's credit and repayment ability. During the process of signing a sales contract and conducting goods transactions, accounts receivable are formed on one company's books against another, and then automatically converted into smart assets on the platform. This way, shipping companies can apply for loans from banks or financial institutions based on these contents, Financial institutions or banks then check their transaction information according to pre-set procedures, thereby saving the process of submitting and reviewing paper materials. Once the smart assets of the loan application enterprise match the lending standards of the financial institution, the funds will be automatically transferred to the enterprise's reserved account. This basic process not only maximizes the efficiency of bank information review, but also ensures the accuracy, completeness, and authenticity of information review, minimizing the risk of loan disbursement by banks or financial institutions.

(3) Solving the problem of information asymmetry

Under blockchain technology, relevant enterprises and financial institutions that were originally dispersed in various supply chain links can directly use distributed ledger technology to enable multiple entities to participate in the supply chain financial system, while achieving the sharing of various transaction data information and payable data information. At the same time, this technology can effectively protect the privacy information of participants, ensuring that it can only be shared among corresponding authorized enterprises. For example, suppliers can query financial activity data information for authorized financing institutions, and these financial information can also be directly placed on the accounts payable of core enterprises.

(4) Clarify application goals and scenarios

Before applying blockchain technology, enterprises need to clarify their application goals and scenarios. Different supply chain finance business scenarios have different needs and characteristics, and enterprises need to choose scenarios that are suitable for their own business needs for application. At the same time, enterprises also need to choose blockchain technology and platforms that are suitable for themselves based on their business scale and technological level, to ensure the feasibility and effectiveness of their applications.

(5) Strengthen technological research and innovation

As an emerging technology, blockchain technology requires continuous research and innovation. Enterprises need to increase investment, introduce and cultivate blockchain technology talents, strengthen the research and innovation of blockchain technology, and improve the performance and scalability of blockchain technology. At the same time, it is necessary to strengthen the security and privacy protection measures of blockchain technology, ensuring the security and confidentiality of transaction information and sensitive data.

(6) Establish a cross enterprise cooperation mechanism

Supply chain finance involves multiple enterprises and participants, and requires the establishment of cross enterprise cooperation mechanisms to jointly promote the application and development of blockchain technology. Enterprises can establish cooperative relationships with upstream and

downstream enterprises, financial institutions, etc., jointly formulate application standards and specifications for blockchain technology, and promote the popularization and application of blockchain technology in supply chain finance. At the same time, it is necessary to establish an effective communication and coordination mechanism to solve problems and contradictions that arise during the application process, ensuring the smooth progress of the application.

(7) Emphasize compliance and regulatory requirements

The application of blockchain technology needs to comply with relevant laws, regulations, and regulatory requirements. Enterprises need to strengthen their learning and understanding of compliance and regulatory requirements to ensure the legal and compliant application of blockchain technology. At the same time, it is necessary to actively communicate and coordinate with regulatory agencies, understand regulatory requirements and policy directions, and provide compliance and regulatory support for the application and development of blockchain technology.

(8) Continuous optimization and improvement of application effectiveness

The application of blockchain technology in supply chain finance is a continuous optimization process. Enterprises need to continuously collect and analyze application data, evaluate application effectiveness and benefits, and continuously optimize and improve for existing problems and shortcomings. At the same time, it is also necessary to pay attention to industry development trends and technological innovation dynamics, adjust and update application strategies in a timely manner, and maintain the forefront and competitiveness of applications.

In summary, the application of blockchain technology in supply chain finance requires a series of strategies and measures to be taken. Enterprises need to clarify application goals and scenarios, strengthen technological research and innovation, establish cross enterprise cooperation mechanisms, focus on compliance and regulatory requirements, continuously optimize and improve application effectiveness, cultivate professional talent teams, and strengthen risk management and security protection. Only by comprehensively considering and implementing these strategies and measures can we promote the widespread application and development of blockchain technology in supply chain finance, enhance the competitiveness and sustainable development ability of the entire industry.

5. Conclusion

With the rapid development of the global economy, supply chain finance has become an important area for cooperation and competition among enterprises. As an emerging distributed ledger technology, blockchain technology has brought unprecedented opportunities and challenges to supply chain finance. This article conducts in-depth research on the application of blockchain technology in supply chain finance and draws the following conclusions.

(1) Blockchain technology has significant value enhancement for supply chain finance

Through practice, it has been proven that blockchain technology can effectively improve the transparency, security, and efficiency of supply chain finance. Firstly, the distributed nature of blockchain ensures real-time synchronization of data between various nodes, eliminates the problem of information asymmetry, and enables all parties in the supply chain to trust and rely more on shared information. Secondly,

the encryption technology and smart contract function of blockchain enhance the security and traceability of transactions, greatly reducing the risk of fraud and the cost of dispute resolution. Finally, by simplifying transaction processes and automating execution, blockchain technology has improved the operational efficiency of supply chain finance and reduced related costs.

(2) The main challenges faced by blockchain technology in supply chain finance

Although blockchain technology has brought significant value enhancement to supply chain finance, it still faces some challenges in practical applications. Firstly, technological maturity is a key issue. At present, blockchain technology is still in the process of continuous development and improvement, and its performance, scalability, and interoperability still need to be improved. Secondly, data privacy protection is also a major challenge. In supply chain finance, there is a significant amount of sensitive information and transaction data involved, and ensuring the security and privacy of these data is an urgent issue that needs to be addressed. In addition, compliance and regulation are also issues that cannot be ignored. With the rapid development of blockchain technology, relevant laws, regulations, and regulatory policies also need to be updated and improved in a timely manner.

(3) Promote the widespread application and development of blockchain technology in supply chain finance

In order to better leverage the advantages and role of blockchain technology in supply chain finance, a series of measures need to be taken. Firstly, it is necessary to further strengthen technological research and innovation, and continuously improve the maturity and reliability of blockchain technology. By improving consensus mechanisms and optimizing data structures, the performance and scalability of blockchain can be enhanced. At the same time, data privacy protection measures should be strengthened to ensure the security and confidentiality of transaction information and sensitive data. Secondly, the government, regulatory agencies, enterprises, and research institutions should strengthen cooperation and exchange, and jointly promote the formulation and improvement of relevant laws, regulations, and regulatory policies. Only by establishing a regulatory framework and legal system suitable for blockchain technology can we provide guarantees for its widespread application and development in supply chain finance. In addition, establishing unified standards and regulations is also an important measure to promote the

widespread application of blockchain technology in supply chain finance. By establishing unified standards and specifications, the interoperability and compatibility of blockchain technology can be promoted, and the application threshold and cost can be reduced. Finally, international cooperation and exchanges should be actively carried out to jointly explore application scenarios and business models suitable for blockchain technology. By sharing successful cases, best practices, and lessons learned, the application and development of blockchain technology on a global scale can be accelerated.

Overall, applying blockchain technology to supply chain finance business can promote the establishment of credit systems and the role of relevant data information for various enterprises in the supply chain, and help enterprises reduce operating costs, promote resource integration, and further solve the problem of financing difficulties for small and medium-sized enterprises. Therefore, in order to fully realize the value of this technology and provide opportunities and platforms for the development of small and medium-sized enterprises, relevant departments should continue to increase research and practice on this technology in the future, in order to promote the effective implementation of various financial activities

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