Asia Pacific Science Press

Asia Pacific Economic and Management Review
ISSN(O):3005-9275
ISSN(P):3005-9267
Vol. 2 No.3 (2025)

Research on the Application of Blockchain Technology in Supply Chain Finance

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Abstract: At present, blockchain, with its distributed structure, trust mechanism, openness and transparency, and tamper-ability, has significantly optimized the information flow in supply chain finance, constructed a multi-body cooperation and coordination mechanism, and effectively solved the risk control problems. This paper analyzes the practice of Ant Gold's "Double Chain" platform, which demonstrates the role of blockchain technology in simplifying the financing link, aggregating multi-value chain, and promoting the innovation of supply chain finance. Finally, policy recommendations are put forward, including the development of supply chain finance, alleviating financing constraints and strengthening blockchain applications to promote the technology and the healthy development of supply chain finance. The study shows that the application of blockchain technology not only improves the efficiency and security of supply chain finance, but also brings innovative solutions for supply chain management

Keywords: Supply Chain Finance; Blockchain Technology; Dual-Chain Pass; Trust in Institution

Published: Jun 5, 2025

DOI: https://doi.org/10.62177/apemr.v2i3.364

1.Research background

1.1 Blockchain Overview and Characteristics

The essence of blockchain technology is to jointly maintain a continuously growing distributed database by multiple parties, also known as distributed shared ledger (distributed shared ledger), the core of which lies in the establishment of a trust relationship between each other through a distributed network, time-ordered tamper-proof cryptographic ledger and distributed consensus mechanism, and the use of automated script code composed of smart contracts to program and manipulate data, ultimately realizing the evolution from information interconnection to value interconnection. to program and manipulate data, and ultimately realize the evolution from information interconnection to value interconnection[1]。

Blockchain technology, as a trust-creating machine, has the following main characteristics

1.1.1 Distributed Architecture

Blockchain technology is built on a decentralized network architecture, its ledger information is not stored in a single server or data center, and is not subject to the control and record of any single authority, but is dispersed in the network of each node, each node has a copy of the ledger, and all copies are synchronously updated.

1.1.2 The Confidence Mechanism

Blockchain technology utilizes mathematical foundations and algorithmic procedures to ensure the openness and transparency of its operating rules, enabling both parties to a transaction to build trust through a consensus mechanism without the need for

a third-party authority to provide proof of credit.

1.1.3 Openness and Transparency

Characterized by its openness and transparency, it allows anyone to join and query its block records. In this system, all participants have access to the same shared ledger and can view the history of all transactions recorded therein. This design ensures consistency and traceability of transactions, allowing each user to witness every transaction that occurs on the ledger.

1.1.4 Time-series and Tamper-evident

Blockchain stores data by using a chained block structure with timestamps, which gives blockchain a high degree of traceability and verifiability[2]. Since each block contains a timestamp, this not only ensures the authenticity of the transaction record, but also allows each transaction to be traced and verified through the chain structure. Cryptographic algorithms ensure the security of the data, while the consensus mechanism ensures consistent recognition of the data by all nodes in the network.

1.2 The Current State of Blockchain Technology Development

As of 2024, blockchain technology continues to develop rapidly globally, especially in China, with rapid growth in market size, continuous optimization of the policy environment, continuous breakthroughs in technological innovation, consolidation of the application foundation, and remarkable results in ecological structure and standardization. China's blockchain market scale will grow at a CAGR of 73% between 2019 and 2023, showing strong growth momentum. Meanwhile, blockchain standardization is active both at home and abroad, with fruitful results in the development of domestic blockchain technology and application standards, and a large number of group standards covering various fields such as terminology specifications, technical specifications, security, and performance indicators. In addition, the in-depth integration of blockchain technology with various economic and social fields has continued unabated, and the application and industrial development of blockchain technology has continued to make breakthroughs, and its key role in serving the efficient collaboration of multi-party business and establishing a trustworthy value network has further gained recognition in the industry[3].

1.3 Overview and Characteristics of Supply Chain Finance

Relying on core users, with real trade backgrounds, applyingSelf-reimbursable trade financein a manner that is closed by specialized means, such as registration of pledges of accounts receivable and third-party supervisionFinancial flowsor control of property rights, for upstream and downstream enterprises, integratedfinancial productsand services[4].

1.3.1 Based on Supply Chain Management

Taking the core enterprise in the supply chain as the hub, it provides financial services around its upstream and downstream enterprises, covering the full range of processes from research and development, purchasing to logistics, information management and sales, as well as the status of coordination between these links and activities.

1.3.2 Integration of the three streams

In the real transaction background, through the integration of capital flow, logistics, information flow and other information, it builds a comprehensive financial supply and risk assessment system centered on core enterprises and connecting upstream and downstream enterprises in the supply chain, provides systematic financial solutions, and improves the transparency and efficiency of the supply chain.

1.3.3 Serving small and medium-sized enterprises

The main service targets are growing small and medium-sized enterprises (SMEs), solving the problem of financing difficulties by filling the gap of SMEs' capital, making the transactions between upstream and downstream enterprises in the supply chain smoother, and enhancing the overall competitiveness of the supply chain network[5].

1.3.4 Relying on information technology

Utilizing big data, blockchain and other technologies to improve the accuracy and security of financial services. Thanks to the progress of modern information technology, especially the application of big data and blockchain technology. Enabling financial institutions to more accurately assess the risks of each link in the supply chain and improve the efficiency and security of financing。

1.4 The Status of Supply Chain Development

1.4.1 The environment for the development of supply chain finance has gradually become better

Despite the impact of the epidemic, compared with the international situation, under the government's control, the domestic economy is less affected by the epidemic and recovers faster, and the situation is rising steadily. The General Office of the Central Committee of the Communist Party of China (CPC) has put forward specific measures to address the problems of difficult and expensive financing for small and medium-sized enterprises (SMEs) in China, and local governments have successively introduced and implemented relevant policies to create a favorable environment for the healthy development of supply chain finance.

1.4.2 There have been significant upgrades in the infrastructure, technology related to supply chain finance

Human society is currently experiencing a hundred years of unprecedented changes, a new round of industrial revolution has promoted the transformation and upgrading of enterprise network, intelligence, digitalization, enterprise digital transformation and upgrading is conducive to the development of supply chain finance, the technology is gradually popularized and slowly matured to improve the overall operational efficiency.

2.Blockchain technology to optimize the effects of supply chain finance

2.1 Significantly optimizing the information flow problem in supply chain finance.

With the globalization of division of labour and the deepening of international trade, the structure of supply chains has become more complex, and the number of links involved is also increasing. Systematic differences among enterprises have led to interruptions in information transmission and the phenomenon of silos, especially in transnational supply chains, where real-time information sharing is difficult. Different data standards and quality of supply chain enterprises make it difficult for small and medium-sized enterprises (SMEs) to meet the credit standards of financial institutions, which affects the effective operation of supply chain finance. Blockchain technology promotes the informatization of the whole chain of supply chain and realizes the transparency, smoothness and security of information through appropriate structure and guarantee mechanism. It can open up the underlying data of the supply chain, promote the integration of logistics, information flow and capital flow, and is especially suitable for complex supply chain finance scenarios involving multiple trading entities[4] Blockchain technology. By centralizing the processing of financing-related data, blockchain technology creates transparent and complete transaction records and allows participants to share a unified data source. At the same time, its encryption and distributed ledger features guarantee the security and non-tampering of data, meeting the needs of financial security and effectively preventing document forgery and data loss.

2.2 Blockchain builds a multi-body cooperation and coordination mechanism for supply chain finance

Blockchain technology plays a crucial role in supply chain finance, especially in the construction of cooperation and coordination mechanisms involving multiple parties. Private chains lack openness and transparency, centralized control models, which can easily lead to trust issues and do not conform to the basic trend of diversified technological development[6].Under this model, with the increase of transaction nodes, the financing chain is lengthened, and the difficulty and cost for financial institutions to process the transactions increase and the efficiency decreases. Blockchain technology utilizes a distributed ledger structure to facilitate the establishment of trust and the transfer of credit between the two parties in the supply chain. It eliminates the single maintenance role of a centralized institution, ensures data inerrancy, and establishes a direct peer-to-peer connection between supply chain participants. This structure simplifies complex business processes and provides a solid foundation of trust for supply chain finance. Regardless of which level of the supply chain a supplier is located in, holding a pass means obtaining credit support from the core enterprise, thus solving the problem of multi-level supplier credit transfer[5]。

2.3 Blockchain technology to solve supply chain finance risk control challenges

At present, China's supply chain finance lacks a unified enterprise credit evaluation system, especially in factoring business, there is a lack of perfect legal framework, blockchain reduces the potential fraud under the traditional model by promoting cooperation and supervision between institutions. Under the blockchain mechanism, there is a common recognition of the credit status of the institutions, which reduces repeated audits of the authenticity of documents. This kind of transaction behavior of mutual verification enhances the self-proof and value-added of credit, thus improving the credit level of supply chain finance. Blockchain promotes the fairness and credibility of the transaction environment. Take the bill market as an

example, the risk events of "one vote selling more than one" and false bills of exchange occur frequently, and the application of blockchain technology in this field is particularly important. Blockchain technology-supported digital bills make use of distributed storage to enhance data security, reduce dependence on centralized institutions, automate bill exchange activities through smart contracts, control risks from various restrictions, provide intelligent technical support for credit management, and provide credit guarantee for bill transactions.

3.Innovation and Practice of Blockchain Technology in supply chain finance

3.1 Innovative applications

3.1.1 Multi-party data sharing and transparency mechanisms

Blockchain technology achieves instant recording and sharing of information in the supply chain through a decentralized node verification system, which improves transparency. This enables participants to quickly adjust production and distribution strategies and reduce resource wastage. At the same time, blockchain provides a shared real data environment, which facilitates the establishment of trust relationships, and this data-based transparent trust mechanism effectively reduces the uncertainty of transactions, enabling the supply chain to operate more closely and efficiently.

3.1.2 Agreeing to self-executing supply chain financing agreements

Blockchain technology in supply chain finance provides the basis for automatically enforcing protocols through its decentralized ledger system. Transaction records, once verified and added to the blockchain, are immutable, ensuring tamper-proof evidence of the flow of funds. This simplifies, automates, and improves the timeliness of the use of funds by streamlining and automating the traditional cumbersome financing process that relies on financial institutions and intermediaries. Blockchain enhances transaction transparency, allowing all authorized parties to access transaction details in real time, identify supply chain bottlenecks and risk points, and optimize strategies.

3.1.3 Blockchain solutions for cross-border payments

Traditional cross-border payments involve multiple intermediaries, resulting in high costs and delays. Blockchain technology supports peer-to-peer payments, reducing costs and time and enabling funds to arrive quickly, which is critical for fast money flows. Distributed authentication mechanisms and encrypted storage of transaction records enhance security while ensuring transparency and privacy, with only authorized users having access to detailed information. This technology enhances the efficiency and security of payments and represents a major innovation in the financial sector.

3.2 Ant Gold's supply chain finance practice based on blockchain technology

The "double chain" launched by ant gold service is a supply chain collaboration network system based on blockchain technology, double chain is blockchain and supply chain finance. Through the blockchain technology to realize the whole chain coverage of supply chain finance, the traditional supply chain financial model, the first level supplier is the main object of Ant Financial Services to provide financing, while the double chain mode will be the financing of the second, third, fourth and fifth level suppliers into the scope of the bank's financing object, which is conducive to alleviating the financing difficulties and financing problems of small and micro enterprises, and continue to promote the cost of the real economy, and to reduce cost[7].

3.2.1Autonomous and innovative blockchain technologies

The "Double Chain" supply chain finance platform adopts the blockchain technology independently developed by Ant Group, which covers the underlying technologies such as hardware, network, storage, computing, cryptography, consensus, block formation, etc., as well as the business links such as the confirmation, circulation, financing, and clearing of accounts receivable, which ensures that the information and business of each segment of the supply chain can be securely controlled, effectively protecting the privacy of each enterprise and financial institution. It ensures that the information and business data of each business link in the supply chain are safe and controllable, and effectively protects the privacy of enterprises and financial institutions[8].

3.2.2 Simplification of financing

Ant Financial Services' "Double Chain Link" platform integrates blockchain technology and online banking credit loan services, effectively simplifying manual processes in supply chain finance, facilitating automated system operations and

enhancing the speed of information exchange between different systems. The application of this technology not only shortens the financing cycle of small and microenterprises, but also effectively reduces their cost of capital.

3.2.3 Multi-value chain aggregation

'Dual Chain Connect' is the integration of blockchain technology into the supply chain, including alliance networks, enterprise operation services, and financial infrastructure services[9].Together with multiple partners, Ant Financial Services has launched a comprehensive open platform, which realizes a high degree of integration and deep integration of logistics, business flow, capital flow and information flow with the help of its powerful Internet payment and e-commerce system, thus stimulating the cluster effect of the value chain. This integrated supply chain financial service not only enhances Ant Financial's financial business, but also attracts more high-quality value chains to join, further promoting the continuous progress of Ant Financial's supply chain finance and blockchain financing model.

4.Policy Recommendations for Promoting Blockchain Technology in Supply Chain Finance

4.1 Vigorously developing supply chain finance

The government and financial institutions should jointly formulate policies to encourage financial institutions to innovate supply and marketing financial products to support the financial needs of business and trade circulation enterprises, especially small and medium-sized business and trade circulation enterprises, and effectively alleviate the financial pressure on business and trade circulation enterprises by providing more flexible and convenient financing channels, so as to enable them to focus on the development of their core business and innovation. Promote the construction of supply chain financial platform. The development of modern information technology provides a solid technical foundation for the construction of supply chain finance platform. The government should actively promote the construction of supply chain finance platform based on blockchain, big data and other technologies, create an open, transparent and efficient supply chain finance ecosystem, realize automated financing approval and settlement processes through smart contracts, reduce financing costs and enhance the efficiency of capital utilization.The government should establish a sound risk management system for supply chain finance, and utilize big data analysis and artificial intelligence technology for risk monitoring and early warning to ensure the healthy development of supply chain finance; improve laws and regulations, clarify the responsibilities of all parties, and safeguard the legitimate rights and interests of the main parties involved[10].

4.2 Sustained alleviation of financing constraints

It is necessary for relevant departments to strengthen policy support measures to promote the healthy development of small and medium-sized enterprises. By establishing a special guarantee fund and implementing loan interest subsidies, we can effectively reduce the operational burden on enterprises. Banks and other financial institutions need to adjust their lending strategies, increase the scale of funding supply for the real economy, and develop more diversified financial service products. Solving the funding problem requires innovative financial tools, and regulatory authorities should support banks and other institutions in developing financing solutions that meet market demand. Focus on promoting the application of financial technology, using intelligent risk control systems and data mining technology to optimize loan review processes, reduce information barriers, and improve the efficiency of fund utilization. A sound credit system is an important support for improving the financing environment. Suggest promoting the construction of cross departmental enterprise credit databases, standardizing the collection, processing, and application standards of credit data[11]. By constructing a scientific credit evaluation model and establishing a system of credit incentives and punishment for dishonesty, market entities are guided to enhance their credit awareness, thereby improving their opportunities and capabilities to access financial services.

4.3 Focusing on strengthening blockchain applications

Strengthen the promotion of blockchain technology, enhance enterprises' understanding and enthusiasm for using this technology. We can organize a series of activities such as special lectures and practical training to help related industries improve their technical application capabilities. Enterprises should actively explore the applicable scenarios of blockchain in the supply chain field, and promote its in-depth application in logistics monitoring, product traceability, supply chain collaboration, and other aspects. Specifically, by utilizing the tamper proof nature of blockchain, it is possible to achieve

open and traceable data throughout the entire supply chain process, thereby enhancing credibility and operational efficiency. While promoting the implementation of technology, it is necessary to simultaneously improve risk management mechanisms. Relevant departments should accelerate the formulation of normative requirements and regulatory frameworks for blockchain applications, guide the healthy and orderly development of technology, and ensure its stable operation and data security.

Funding

no

Conflict of Interests

The authors declare that there is no conflict of interest regarding the publication of this paper.

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