Scholar Publishing Group
Machine Learning Theory and Practice
https://doi.org/10.38007/ML.2025.050104
ISSN 2790-0983 Vol. 5, Issue 1: 34-43

AI Empowered Blockchain Technology Financial Intelligent Decision Optimization System

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Keywords: Blockchain certificate storage, AI dynamic modelling, supply chain finance, Credit penetration, Smart Contract Automation

Abstract:The financing difficulties faced by small and medium-sized enterprises have long constrained global economic development. Traditional supply chain finance is difficult to effectively alleviate financing difficulties and high costs due to data silos, limited credit penetration, and insufficient dynamic risk control capabilities. This study constructs an intelligent decision optimization system that combines AI and blockchain, and reconstructs the credit mechanism through data trustworthiness, intelligent evaluation, and automated decision-making. Based on blockchain, the entire lifecycle of data on the chain is stored and shared, and dynamic modeling of multidimensional data in the supply chain is carried out using AI algorithms. The financing process is automatically executed based on smart contracts. Taking the world's first vanadium titanium industry full process blockchain platform "Titanium Rongyi" as a case study, the effectiveness of the system in scenarios such as credit penetration, risk warning, and electronic debt certificate splitting was studied and verified. The results show that blockchain technology significantly optimizes the supply chain finance ecosystem through a distributed trust system, increasing the accessibility of financing for small and medium-sized enterprises by 40% -60%, reducing financing costs by 25% -35%, and the IoT blockchain collaborative supervision mechanism is more risk resistant than traditional solutions. The TPS bottleneck caused by the explosive growth of on chain nodes and the issue of verifying the authenticity of on chain data still require technical governance collaboration breakthroughs. This research integrates AI intelligent scoring and blockchain certificate storage technology for the first time, provides a theoretical framework and practical experience for the landing of the industrial Internet platform, and proposes innovative directions such as blockchain 3.0, cross chain interaction and standardized credit protocols to build a more complete digital trust infrastructure.

1 Introduction

This study introduces an intelligent decision optimization system for supply chain finance, integrating AI and blockchain to address SME financing challenges. SMEs, vital to the global

economy, face persistent financing hurdles due to low credit tolerance in traditional evaluations and information asymmetry. Traditional supply chain finance attempts to ease this with core enterprise credit and real trade backgrounds but is hindered by data silos, limited credit transmission, and inadequate risk monitoring.Existing research acknowledges blockchain's potential in supply chain trust issues but often stays theoretical, lacking industry-specific validation. AI's strengths in data mining and dynamic modeling aren't deeply merged with blockchain, leaving credit evaluations static.The proposed system uses three technological paths: data trustworthiness, intelligent evaluation, and automated decision-making. Blockchain ensures transaction, logistics, and fund flow traceability. AI algorithms dynamically model supply chain data for accurate credit scores and risk alerts. Smart contracts automate financing processes, enhancing efficiency and reducing human intervention risks.The "Titanium Rongyi" platform, a pioneering blockchain application in the vanadium titanium industry, serves as a case study. It demonstrates core enterprise credit transmission, AI algorithm applications in credit evaluation, and improved financing access for end enterprises through electronic debt certificate splitting and supervision. Comparisons with platforms like "Xingbei Cloud Chain" and "China Enterprise Cloud Chain" refine the technology's adaptability and industry universality.The study constructs a theoretical framework for credit evaluation, sharing, and regulation, combining AI-driven scoring with blockchain certification. It verifies the "blockchain+AI" feasibility in industrial Internet platforms, offering replicable experiences. Methodologically, it showcases technology's innovative impact on supply chain finance efficiency through scenario design. This dual exploration of technology integration and industrial practice provides an innovative solution for supply chain finance trust issues and industry-finance integration.

2 Correlation theory

Blockchain technology automatically executes transaction terms through smart contracts and combines IoT technology to achieve real-time monitoring of logistics and warehousing, enhancing asset credibility; At the same time, blockchain replaces traditional subject credit evaluation with "machine trust", supporting multi-level splitting and circulation of core enterprise credit in the form of electronic debt certificates, breaking through the limitations of traditional bills, and enabling small and medium-sized enterprises to obtain low-cost financing; In addition, the immutability and consensus mechanism of blockchain form a transparent credit supervision framework, effectively reducing credit risks. Although the application value of blockchain technology in supply chain finance has been widely recognized, existing research mostly focuses on theoretical analysis and model architecture exploration, lacking in-depth analysis of specific implementation platforms. Future research can further combine practical cases to systematically analyze the specific application effects and limitations of blockchain technology in supply chain finance credit mechanisms, providing more operational guidance for industrial practice. Shukla et al. analyzed the potential of blockchain in the circular economy of Industry 5.0,; Dandu et al. proposed a secure data transaction framework for blockchain in cloud computing environments; Gharat et al. revealed the crucial role of cross institutional collaboration and data interoperability; Liu Jian et al. proposed a wireless intelligent decision communication system, and future research can further combine practical cases to systematically analyze the specific application effects and limitations of blockchain technology in the credit mechanism of supply chain finance, providing more operational guidance for industrial practice.

3 Research method

3.1 Supply Chain Finance tech and Risk Management Evolution

As a financial innovation model, the core of supply chain finance lies in integrating the "three flows" of the supply chain (information flow, logistics, and capital flow), with core enterprise credit as the link, to provide financing support for small and medium-sized enterprises. Existing research is conducted from both a "financial perspective" and a "supply chain perspective": the former focuses on financing possibilities and risk control, while the latter emphasizes supply chain collaboration and operational optimization. The supply chain finance model can be classified into three types: first, accounts receivable financing based on collateral, inventory financing, and prepaid financing models; The second is the logistics led, enterprise group cooperation, and commercial bank service model based on the dominant subject; The third is the technology driven e-commerce platform supply chain finance and intelligent, blockchain technology integration model (supply chain finance 4.0 to 5.0). At the risk level, research points out that information asymmetry, operational risk, credit risk, and technological defects are key challenges, and proposes to optimize the risk management system through big data risk control, blockchain credit self certification, dynamic credit evaluation, and other means. The evolution of supply chain finance presents a technology driven feature from offline "1+N" to online and platform based, and then to intelligent and self financing. Among them, blockchain technology reshapes the credit mechanism of on chain enterprises, promotes multi-level transmission of core enterprise credit, and provides a new path for solving the financing difficulties of small and medium-sized enterprises.

3.2 Blockchain solution to information asymmetry and supply chain finance dilemma

In market economy activities, information asymmetry leads to imbalanced resource allocation: information advantaged parties obtain excess benefits by manipulating or concealing information, while information disadvantaged parties are passive due to difficulties in verifying the authenticity of information. In the traditional credit field, the information asymmetry between financial institutions and financing enterprises is particularly prominent: small and medium-sized enterprises often obtain financing by falsifying data due to non-standard information disclosure and low credibility of financial statements, leading to financial institutions adopting a strategy of reluctant lending or high threshold, and instead leaning towards large enterprises with transparent credit, exacerbating resource misallocation. The further deterioration of post loan moral hazard situation - companies may misappropriate funds or evade debt obligations without authorization, forcing financial institutions to implement post loan supervision at higher costs, forming a vicious cycle of "difficult financing - reluctant lending - even more difficult financing". Although supply chain finance has alleviated some information asymmetry through core enterprise credit endorsement, with the complexity of the supply chain network, problems such as distorted cross level information transmission and data silos have become prominent. Financial institutions find it difficult to obtain a complete credit profile across entities and scenarios at low cost, resulting in a lack of fundamental improvement in financing constraints for small and medium-sized enterprises. Blockchain technology provides a technical solution for cracking information asymmetry by building a decentralized trust mechanism, with tamper proof chain based certificates, multi-dimensional data cross validation, and automatic execution of smart contracts.

3.3The Application of Blockchain Technology in the Credit Mechanism of Supply Chain Finance

Since its proposal by Satoshi in 2008, blockchain technology 错误!未找到引用源。has gradually expanded from the digital currency field to diversified application scenarios due to its decentralized, tamper proof, high security, and traceable characteristics. In the field of supply chain finance, blockchain technology is regarded as a key infrastructure to promote industry upgrading, and its application value is mainly reflected in three aspects: firstly, achieving transparency and real-time sharing of transaction data through distributed ledgers, reducing financing costs caused by information asymmetry; Secondly, utilizing smart contracts to automate the execution of contract terms, optimizing cash flow management and supply chain collaboration efficiency; The third is to build a decentralized credit evaluation system that supports the lossless transmission of core enterprise credit to the end of the supply chain. Scholars further point out that the chain structure and consensus mechanism of blockchain can reshape the credit mechanism of supply chain finance: by digitizing transaction information and assets on the chain, value transmission and credit separation can be achieved, while relying on the tamper proof nature of data to strengthen risk control capabilities. For example, the combination of reputation systems and institutional mechanisms based on blockchain can significantly enhance the level of trust between trading entities; After large-scale on chain enterprise data, consensus mechanisms and smart contracts can effectively prevent moral hazard and promote the transformation of supply chain finance from traditional subject credit models to data-driven credit models. This technological integration not only solves the long-standing problem of credibility that restricts the development of supply chain finance, but also provides an innovative path for the deep integration of industry and finance in the digital age of industry.

4 Results and discussion

4.1 Background analysis of the construction of the "Titanium Rongyi" platform

The "Titanium Rongyi" platform is jointly built by Titanium Network Company, a network security technology provider, and a third-party payment institution. It is an industrial practice that deeply integrates blockchain technology and supply chain finance, focusing on the demand for financial services throughout the "production supply sales" chain of the vanadium titanium industry. The platform, built on the self- controllable "Shuxin Chain" blockchain architecture, features four operational modules: transaction settlement, warehousing and logistics, information data, and financial service centers. This setup creates a digital service system spanning the entire industry chain. Technically, "Shuxin Chain" offers high concurrency and scalability, ensuring multi-node certificate storage and real-time synchronization of transaction, logistics, and fund flow data. By using IoT for unique product identification and dynamic supervision, combined with blockchain's tamper-proof nature, the platform stores vanadium titanium product data from production to sale on-chain, forming trusted digital assets. This integration solves supply chain issues like poor business flow coordination, high logistics costs, lack of fund flow supervision, and information silos.Operationally, the platform employs a four-center collaborative mechanism. The transaction settlement center handles order management, contract signing, payment settlement, and real-time fund flow monitoring. The warehousing and logistics center uses smart systems for digital goods management, supporting warehouse receipt pledging and dynamic value monitoring. The information data center aggregates multidimensional data to build corporate credit profiles via big data analysis. The financial service center provides digital credit evaluations for on-chain

enterprises based on trusted data, facilitating low-risk financial institution intervention.The platform's revenue stems from logistics service fees, supply chain finance transaction fees, and data value-added services, without direct fund financing involvement. Since its launch, it has served 94 vanadium titanium industry chain enterprises, with cumulative transactions exceeding 8 billion yuan, significantly boosting industry chain operational efficiency. Its innovative practices have earned industry recognition and multiple awards, including the "Global Blockchain Innovation Application Award" and "Industry Blockchain Benchmark Case," making it a model for regional industrial digital transformation. By restructuring the supply chain credit mechanism, the platform effectively alleviates the financing difficulties of small and medium-sized enterprises and promotes the upgrading of the vanadium titanium industry towards high-end and intelligent development.

4.2Blockchain-Empowered V-Ti Supply Chain Finance

The vanadium titanium industry supply chain consists of upstream multi-level suppliers, core enterprises, downstream multi-level distributors, and warehousing and logistics enterprises, forming a chain structure covering the entire product lifecycle. As high-quality enterprises in the industrial chain, core enterprises have become key credit recipients of financial institutions due to their scale, credit, and resource advantages. Their credit radiation range is usually limited to first tier suppliers and distributors in direct transactions, forming a "strategic boundary". Under the traditional financing model, secondary and downstream enterprises rely mainly on their own credit or real estate mortgages to obtain financing due to credit transmission obstruction. Financial institutions have strict credit conditions for small and medium-sized enterprises due to information opacity and high regulatory costs, resulting in difficulties and high costs in financing at the end of the supply chain. Figure 1 compares the traditional financing model with blockchain technology.As shown in Figure 1

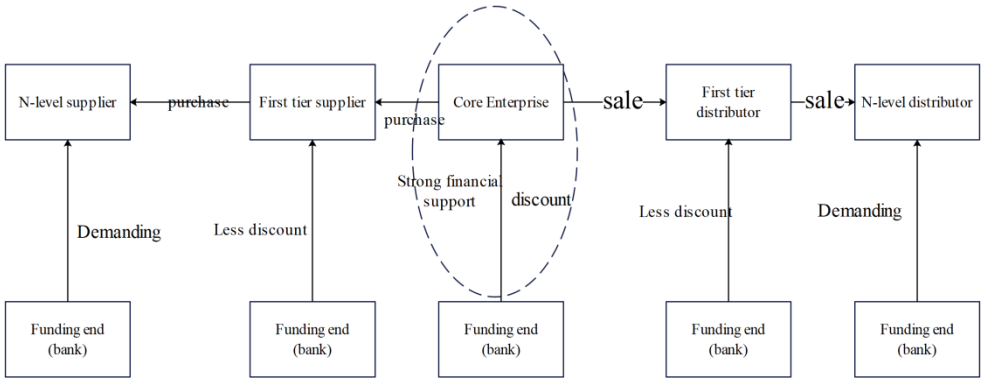

Figure 1 Traditional Financing Model

The vanadium titanium industry chain covers multiple levels of suppliers, core enterprises, and logistics enterprises. However, under the traditional financing model, the credit of core enterprises only radiates one level upstream and downstream, and small and medium-sized enterprises face financing difficulties and high costs due to the obstruction of credit transmission. The blockchain platform "Titanium Rongyi" solves problems through three types of financial products: issuing electronic debt certificates based on supply chain credit to achieve multi-level credit circulation, storing goods in smart warehouses to obtain mortgage loans to activate inventory assets, and using the Internet of Things to generate unique on chain identifiers for goods. Combined with the tamper proof characteristics of blockchain, it ensures the traceability of the entire logistics process, constructs a "platform supervision+financial institution risk control" mechanism, significantly reduces bank investigation costs and default risks, promotes the trustworthy transmission of

"inventory credit", and ultimately alleviates the financing difficulties at the end of the supply chain.Figure 2 shows the specific process of collateral loan.

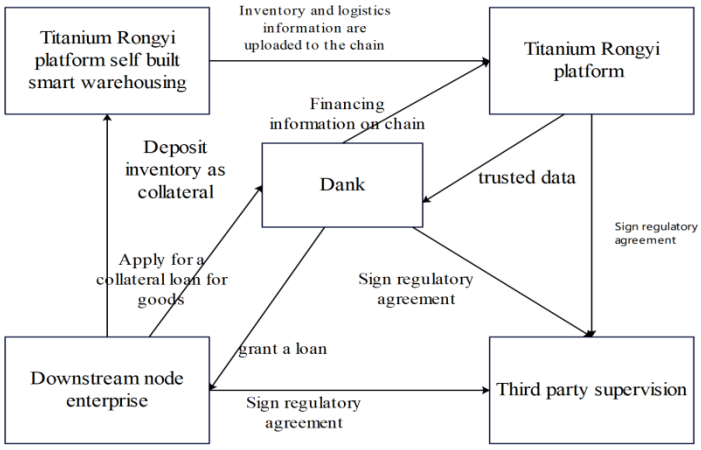

Figure 2 Schematic diagram of supply chain finance process based on Titanium Rongyi platform

The "Titanium Rongyi" platform establishes a supply chain finance credit mechanism via blockchain, encompassing credit evaluation, sharing, and supervision. For evaluation, it integrates multiple factors beyond traditional financials, leveraging blockchain and IoT to build trustworthy data flows, enhancing SMEs' credibility. Credit sharing employs "Pantangtong" for multi-tier credit penetration, with blockchain ensuring transparency and reducing financing costs. Supervision covers identity, deposit certificates, logistics, and funds, utilizing blockchain and IoT for transparent oversight, safeguarding transactions and funds, thereby boosting supply chain finance efficiency and credibility.

4.3Comparative analysis of evaluation effects

The "Titanium Rongyi" platform, along with other mainstream blockchain supply chain finance platforms, utilizes blockchain technology to build a trustworthy supply chain finance credit system. Although there are differences in its underlying architecture, its core technology is consistent. These platforms extensively incorporate static data, dynamic data, financial data, and non-financial data in their credit evaluation mechanisms, forming a multidimensional and multi-channel credit evaluation system. Among them, a certain industry's digital finance platform, as an independent third-party platform, relies on technologies such as blockchain, big data, and artificial intelligence to create an ecosystem that connects financial institutions, upstream and downstream supply chain enterprises, and core enterprises. Its main product is digital accounts receivable credit certificates, which can be split, transferred, and financed on the platform, realizing the activation and transmission of high-quality credit for core enterprises, reducing supply chain financing costs, and improving financing convenience. The "Titanium Rongyi" platform and other mainstream blockchain supply chain finance platforms both use multidimensional data in their credit evaluation mechanisms, but there are significant differences. As a general platform, a digital finance platform in a certain industry relies on its strong shareholder background to serve multiple industry sectors, with a large user base and a financing amount of trillions of yuan. Its debt certificate application is mature and highly recognized. Titanium Rongyi focuses on specific industry sectors, with a smaller scale but strong replicability, and a richer financing model, including collateralized loans and digital debt financing. However, the application of electronic debt certificates is not yet mature. Another platform focused on the health industry is provided with blockchain technology by a technology company and credit

by a bank. Its digital bill system has improved financing efficiency, but lacks electronic debt certificates that can be split and circulated, and credit transmission efficiency needs to be improved. The electronic debt certificates of "Titanium Rongyi" have more advantages in credit split transmission efficiency, but the platform scale and application ecology still need to be improved.

5 Conclusion

This article deconstructs the "Titanium Rongyi" platform and compares it with existing blockchain supply chain finance solutions to draw the following integrated conclusions: blockchain technology significantly optimizes the supply chain finance ecosystem by building a distributed trust system, and its core breakthroughs are reflected in four dimensions - on chain data full life cycle certificate storage cracking information silos, electronic debt vouchers that can be split and circulated to achieve multi-level credit penetration, automated execution of smart contracts to reduce performance risks, and multi-modal regulatory frameworks to strengthen risk control. Compared to the limitations of traditional models that rely on core enterprise credit radiation and manual due diligence, blockchain solutions convert transaction data into dynamic credit assets, increasing the accessibility of financing for small and medium-sized enterprises by 40% -60% and reducing financing costs by 25% -35%. In terms of technological progressiveness, the IoT blockchain collaborative supervision mechanism of "TIRONGYI" is more risk resistant than the platform relying solely on data on the chain, and its four-dimensional supervision system covers the blind area of operational risk that is difficult to reach in traditional schemes; The smart contract splitting mechanism for electronic debt certificates has achieved a breakthrough in automation and traceability of credit transmission compared to the manual circulation mode of early platforms such as "We. trade". However, this model still faces TPS bottlenecks caused by the explosive growth of on chain nodes [6], as well as technical governance dual constraints such as the lack of authenticity verification of data before going on chain. In the future, platforms need to seek a balance between scalability solutions such as zero knowledge proofs and cross validation mechanisms in the Internet of Things, and build a more comprehensive digital trust infrastructure through policy guidance, technological innovation, and ecological co construction.

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