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Cross-border supply chain finance research review: challenge response and model innovation

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Abstract. Cross-border supply chain finance supports the financing of Small and Medium-sized Enterprises (SMEs) participating in the global division of labor by integrating logistics, information flow, and capital flow in cross-border trade. However, its development faces prominent challenges, such as cross-border information asymmetry, exchange rate and policy risks, difficulties in credit transmission, and complex regulatory coordination. In recent years, the application of fintech and blockchain technologies has driven the evolution of cross-border supply chain finance from a traditional bank-led single financing model toward a platform-based, digital, and ecosystem-oriented direction. This paper adopts a systematic literature review method to systematically examine the research progress of cross-border supply chain finance from three dimensions: challenges—responses—model innovation. At the challenge level, it focuses on barriers to cross-border credit transmission, exchange rate and compliance risks, and the difficulty of coordinating logistics, capital and information flows. At the response level, it summarizes strategies such as fintech empowerment, blockchain-based credit penetration, and multi-agent collaborative governance. At the model innovation level, it synthesizes emerging models, including cross-border e-commerce platform-led financing, blockchain-driven digital credit, and cross-border asset securitization. The study finds that existing research still has deficiencies in risk pricing, technology integration, and cross-regional regulatory coordination for cross-border supply chain finance. This paper proposes a three-dimensional analytical framework of "cross-border credit—technology empowerment—ecosystem synergy" and points out that future research can be deepened in directions such as digital credit infrastructure, smart contract risk control, cross-border regtech, and scenario expansion in emerging markets.

Keywords: cross-border supply chain finance, supply chain finance, challenge response, model innovation, blockchain, fintech

1. Introduction

With the deepening of global industrial division of labor and the rapid development of cross-border e-commerce, cross-border supply chain finance has gradually become an important tool for alleviating SME financing constraints and enhancing global supply chain resilience. However, cross-border supply chain finance faces more complex information asymmetry, longer capital turnover chains, and higher policy uncertainty. Traditional supply chain finance models are built upon domestic institutional environments and

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the credit of core enterprises, making them difficult to replicate directly in cross-border contexts [1]. Institutional differences and information barriers in cross-border scenarios further exacerbate this difficulty [2]. Academic research on cross-border supply chain finance started relatively late but has grown rapidly in recent years, with research themes expanding from conceptual definition and model comparison to technology empowerment, risk governance, and ecosystem building [3]. Existing reviews mostly focus on general supply chain finance and pay insufficient attention to the unique institutional, technological, and organizational challenges in cross-border scenarios, especially lacking a systematic integrative analysis from "challenge response" to "model innovation".

Based on this, this paper addresses the following research questions: (1) What are the core challenges faced by cross-border supply chain finance that distinguish it from domestic supply chain finance? (2) What response strategies have been proposed in existing research, and what are their mechanisms and applicable boundaries? (3) What evolutionary logic and future trends are demonstrated by the model innovations in cross-border supply chain finance? This paper adopts a systematic literature review method, retrieving relevant literature from the past fifteen years from databases such as CNKI, Web of Science, and ScienceDirect, and synthesizes and evaluates the literature from three dimensions: challenges, responses, and model innovations. It further proposes a three-dimensional analytical framework of "cross-border credit—technology empowerment—ecosystem synergy" to provide a reference for future research and practical decision-making.

2. Conceptual evolution and theoretical foundations of cross-border supply chain finance

2.1. From supply chain finance to cross-border supply chain finance

The core of supply chain finance lies in extending core enterprise credit upstream and downstream to optimize the availability and cost of capital throughout the entire chain. Cross-border supply chain finance extends this logic to international trade scenarios, involving multiple actors such as exporters, importers, cross-border logistics providers, customs authorities, and financial institutions from multiple countries, making the credit structure, capital flows, and regulatory environment more complex [4]. Existing research has not yet formed a unified definition of cross-border supply chain finance, often defining it from overlapping perspectives such as international trade finance, cross-border e-commerce finance, and global supply chain finance. This paper defines it as a system that relies on cross-border supply chain transaction scenarios, based on core enterprise credit or transaction data, and provides comprehensive financial services, including financing, payment, settlement, and risk management to enterprises along the cross-border chain through financial instruments and technological means.

2.2. Theoretical foundations: information asymmetry, transaction costs and network governance

The theoretical foundations of cross-border supply chain finance mainly include information asymmetry theory, transaction cost theory, and network governance theory. Information asymmetry theory explains why adverse selection before lending and moral hazard after lending are more prominent in cross-border scenarios, transaction cost theory reveals how high transaction costs arising from cross-border settlement, logistics, and compliance inhibit financing efficiency, the network governance theory provides analytical tools for understanding the coordination mechanisms among core enterprises, third-party platforms, and financial institutions [5]. On this basis, the "credit penetration" logic of supply chain finance becomes a core mechanism

for addressing information asymmetry, while institutional distance and cultural differences in cross-border contexts further reinforce the need for synergy between technology and institutions.

3. Major challenges faced by cross-border supply chain finance

3.1. Barriers to cross-border credit transmission and information asymmetry

The International Finance Corporation (IFC) estimates that the financing gap for Micro, Small, and Medium-sized Enterprises (MSMEs) in developing countries worldwide amounts to as much as US$5.2 trillion, with the gap being particularly significant for trade-related financing due to information asymmetry and risk identification difficulties [6]. In cross-border supply chain finance, the chain of core enterprise credit transmission to upstream and downstream is longer, and cross-border data are scattered across different countries, platforms, and regulatory systems, making it difficult to form a complete and reliable corporate profile [7]. SMEs lack cross-border transaction records and international credit data, making it difficult for financial institutions to assess their true repayment capacity and the authenticity of trade backgrounds. In addition, differences in language, legal systems, and accounting standards across cross-border trade further increase information verification costs, and traditional offline due diligence methods cannot cover the high-frequency, small-amount, and dispersed cross-border financing needs.

3.2. Exchange rate fluctuations, policies, regulations and compliance risks

Cross-border supply chain finance involves multi-currency settlement and cross-border capital flows. Exchange rate fluctuations directly affect financing costs and repayment capacity, introducing additional uncertainty into risk pricing [8]. At the same time, significant differences exist among countries in trade policies, foreign exchange controls, Anti-Money Laundering (AML), and data protection regulations, exposing enterprises to complex compliance requirements and cross-border legal conflicts. International trade frictions and geopolitical volatility can also lead to supply chain disruptions and chain reactions of credit defaults, making the risk exposure of cross-border supply chain finance more exogenous and contagious. For example, during the 2022 US dollar interest rate hike cycle, some cross-border trading enterprises in emerging markets experienced a marked rise in default rates due to local currency depreciation increasing repayment costs, highlighting the systemic impact of exchange rate risk in cross-border supply chain finance.

3.3. Difficulties in coordinating logistics, capital flow and information flow

Cross-border supply chain finance relies heavily on the "integration of three flows"—logistics, capital flow and information flow. However, cross-border logistics have long cycles and multiple nodes, making cargo status tracking difficult, cross-border payment and settlement involve multiple banks and clearing systems, resulting in low capital transfer efficiency and high costs, and information flow is scattered among customs, logistics providers, e-commerce platforms, and financial institutions, lacking unified data standards and sharing mechanisms. The fragmentation of the three flows makes it difficult to verify the authenticity of trade backgrounds and constrains dynamic risk control based on transaction data. According to industry practice, the average processing time for traditional cross-border letters of credit can reach 5-10 working days, with a significant portion of that time consumed by document transmission and manual verification, resulting in substantial capital occupation costs.

4. Response strategies for cross-border supply chain finance

4.1. Fintech empowerment for credit penetration and intelligent risk control

Fintech, represented by big data, artificial intelligence, and cloud computing, is becoming a key tool for overcoming cross-border information asymmetry. By integrating customs data, e-commerce platform transaction data, logistics tracking, and payment records, financial institutions can build more comprehensive corporate credit profiles, improving the accuracy and dynamism of credit assessment. Machine learning models applied to cross-border trade fraud detection and default prediction enhance the real-time and adaptive nature of risk control. Fintech also reduces the operating costs of cross-border supply chain finance, making small-amount, high-frequency financing feasible. For example, some cross-border payment institutions use transaction records and e-commerce platform data to build credit scoring models, reducing loan approval times for small sellers from several days to a few minutes while maintaining low non-performing loan ratios [9].

4.2. Blockchain and smart contracts driving trust reconstruction

The decentralized, immutable, and traceable features of blockchain technology provide a new technological path for solving trust issues in cross-border supply chain finance. By recording cross-border trade contracts, logistics documents, and payment vouchers on the blockchain, participating parties can achieve data sharing and cross-verification without relying on a single centralized institution, effectively preventing fraudulent trade and duplicate financing. Smart contracts can automatically execute disbursement, repayment, and settlement when preset conditions are met, reducing manual intervention and operational risks. In 2019, HSBC completed the world's first blockchain-based cross-border RMB letter of credit transaction, reducing the processing time of traditional letters of credit from 5-10 days to within 24 hours, significantly improving cross-border trade financing efficiency [10]. This case demonstrates that the implementation of blockchain in cross-border payments and trade finance has become practically feasible.

4.3. Multi-agent collaboration and ecological governance

Response strategies for cross-border supply chain finance are gradually shifting from a single financial institution-led approach to multi-agent collaboration among core enterprises, e-commerce platforms, logistics providers, fintech firms and regulatory authorities. Core enterprises enhance credit transmission through rights confirmation and data openness, e-commerce platforms become new financial organizers by leveraging transaction scenarios and data advantages, logistics providers provide risk mitigation through control over cargo and warehousing information, and fintech firms offer technological infrastructure. Ecological governance emphasizes the establishment of unified data standards, mutually recognized credit systems, and coordinated regulatory frameworks in cross-border contexts to reduce systemic risks. Blockchain technology provides a distributed trust infrastructure for multi-agent collaboration, enabling participating parties to share data reliably without the need for a central authority [11].

5. Model innovation in cross-border supply chain finance

5.1. Cross-border e-commerce platform-led supply chain finance model

Cross-border e-commerce platforms, with their centralized control over transaction, logistics, and payment data, have become important organizers of cross-border supply chain finance. By building their own financial services or cooperating with banks and factoring companies, platforms offer order financing, accounts

receivable financing, and inventory financing based on transaction data to small and medium-sized sellers on the platform. The core advantage of this model lies in the data closed loop and scenario embedding, enabling automatic verification of trade backgrounds and closed-loop fund management. Typical cases include supply chain finance services offered by platforms, such as Amazon and Alibaba International Station, which essentially transform data assets within the platform ecosystem into credit assets. For example, Amazon Lending provides short-term loans to platform sellers based on sales data, with amounts ranging from thousands to hundreds of thousands of US dollars, effectively relieving sellers' capital pressure for peak season inventory preparation.

5.2. Blockchain-driven digital credit model

The blockchain-driven digital credit model represents a frontier exploration in cross-border supply chain finance. This model digitizes and records all cross-border trade documents on the blockchain, forming verifiable and traceable digital credit certificates that enable multi-level splitting and cross-border circulation of core enterprise credit. Compared with traditional models, the blockchain digital credit model reduces reliance on single-core enterprise rights confirmation, allowing credit to be transmitted and combined across a wider supply chain network. Its challenges include cross-chain interoperability, legal validity recognition, and cross-border data compliance issues that remain to be resolved. Pilot projects such as the People's Bank of China's Trade Finance Blockchain Platform and Hong Kong's TradeLink platform have verified the feasibility of blockchain in cross-border trade financing, but large-scale promotion still requires solutions to cross-regional standard unification and regulatory mutual recognition.

5.3. Cross-border asset securitization and diversified financing models

Asset-side innovation in cross-border supply chain finance is also accelerating, manifested in the securitization of cross-border receivables and order assets, as well as diversified financing through cross-border factoring, forfaiting, supply chain bills, and other instruments. Asset securitization can revitalize existing assets and optimize balance sheet structures, but the confirmation of asset rights, rating, and cross-border fund flow regulation are more complex in cross-border contexts. Some studies have explored supplier financing model choices from the perspective of joint optimization of operations and financing, providing theoretical references for financing structure design in cross-border supply chain finance [12]. In addition, industry practice has begun to focus on a combined model of "financing + insurance + exchange rate hedging", embedding export credit insurance and exchange rate derivatives to reduce comprehensive risks in cross-border supply chain finance.

6. Discussion

6.1. Contributions and limitations of existing research

Existing research has accumulated relatively rich findings in the conceptual definition, model classification, and risk identification of cross-border supply chain finance. In particular, the introduction of fintech and blockchain has provided new ideas for overcoming cross-border information asymmetry. However, there are still obvious limitations: first, most studies focus on a single technology or a single model, lacking in-depth analysis of the overall ecosystem and multi-agent interaction mechanisms of cross-border supply chain finance, second, empirical research is insufficient, especially quantitative analyses and case comparisons for emerging market cross-border supply chain finance remain scarce, third, discussions on cross-border

regulatory coordination and data governance mostly remain at the level of policy recommendations, lacking actionable institutional design.

6.2. Future research agenda

Future research can be deepened in the following directions: first, constructing a digital credit infrastructure for cross-border supply chain finance, and exploring integrated solutions of cross-chain data sharing and privacy computing, second, examining the legal validity and automatic execution mechanisms of smart contracts in cross-border risk control, third, focusing on cross-border regtech and studying feasible paths for automated compliance and cross-border regulatory coordination, fourth, strengthening empirical research on cross-border supply chain finance scenarios under regional cooperation frameworks such as the Belt and Road Initiative and RCEP, fifth, exploring the potential application of generative AI in risk assessment and scenario simulation for cross-border supply chain finance.

6.3. Practical and policy implications

For financial institutions, it is important to avoid a disconnect between technology and business, and to deploy technology based on genuine pain points in cross-border scenarios. For core enterprises and e-commerce platforms, they should promote data openness and ecosystem collaboration, transforming supply chain management capabilities into financial service capabilities. For regulators, while encouraging innovation, they need to establish legal frameworks for cross-border data flows, smart contracts, and digital assets, providing institutional safeguards for the healthy development of cross-border supply chain finance.

7. Conclusion

This paper provides a systematic review of the challenge responses and model innovations in cross-border supply chain finance. The study finds that cross-border supply chain finance, beyond traditional supply chain finance, faces unique challenges, including barriers to cross-border credit transmission, exchange rate and compliance risks, and difficulties in coordinating logistics, capital and information flows. The huge financing gap for global SMEs is further exacerbated by information asymmetry and risk identification difficulties in cross-border trade scenarios. To address these challenges, fintech has improved credit penetration efficiency through data integration and intelligent risk control, blockchain and smart contracts have reduced cross-border transaction costs through trust reconstruction, and multi-agent collaboration and ecological governance provide systemic solutions from an organizational perspective.

In terms of model innovation, models such as cross-border e-commerce platform-led financing, blockchain-driven digital credit, and cross-border asset securitization are driving the evolution of cross-border supply chain finance from a single financing tool toward an integrated financial service ecosystem. Cases such as HSBC's blockchain letter of credit demonstrate that technology-driven model innovation has moved from proof-of-concept to practical implementation. The common trend across these models is shifting from "relying on core enterprise credit" to "relying on data and technology credit", and from "single-point financing" to "networked and ecosystem-based services".

The contribution of this paper lies in proposing a three-dimensional analytical framework of "cross-border credit—technology empowerment—ecosystem synergy", incorporating scattered research themes into a unified logic, and revealing the internal mechanisms of cross-border supply chain finance innovation through specific cases and data. The limitations of this paper are that, as a review study, its exploration of case and practical details is still limited, and its literature coverage is primarily based on core journals in Chinese and

English, with insufficient inclusion of industry reports and policy documents. Future research can conduct in-depth case studies and empirical tests in specific cross-border supply chain finance scenarios while continuing to pay attention to directions such as digital credit infrastructure, cross-border regtech, and emerging market contexts.

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