Frontiers in Business, Economics and Management
ISSN: 2766-824X | Vol. 12, No. 3, 2023

Innovation of Supply Chain Finance Business Model in the Blockchain Era: Case Study on a Chinese E-Commerce-Centered SCF Adopter

Longhuai Zhang[1, a]

[1]College of Transportation Engineering, Dalian Maritime University, Dalian, Liaoning, 116026 China
[a]zhanglonghuai@dlmu.edu.cn

Abstract: The swift advancement of information technology has facilitated the evolution of supply chain finance (SCF) into a novel financial tool, experiencing substantial global growth. Numerous e-commerce platforms in China, capitalizing on the "Internet Plus" era, have introduced SCF services to mitigate the financing challenges encountered by small and medium-sized enterprises (SMEs). To overcome the limitations prevalent in conventional SCF, the integration of blockchain technology has led to the innovative "Blockchain + SCF" model. This paper scrutinizes JD SCF model as a case study to examine the implications of blockchain-empowered SCF, employing methods such as case analysis, comparative analysis, and literature review. It first offers an in-depth examination of JD "Blockchain + SCF" model, shedding light on the advantageous effects of blockchain technology. Further, it acknowledges the novel issues and hurdles that this model encounters, necessitating collective efforts for resolution through illustrative case studies. Ultimately, the study reaffirms the strong competitiveness of JD "Blockchain + SCF" model among peer organizations, emphasizing its strengths and suggesting potential future trajectories. This research may contribute valuable perspectives for both theoretical and practical applications in related domains.

Keywords: Supply chain finance; Blockchain technology; E-commerce companies; JD.

1. Introduction

Influenced by advancements in information technology and the Fourth Industrial Revolution, SCF has emerged as a transformative financial concept that reshapes traditional financial market structures previously dominated by banking institutions. It functions by fundamentally integrating the commercial, logistic, and informational flows among businesses within a supply chain, thereby reducing operational costs and offering financial services. It differs from conventional financial activities, such as bank lending and risk investment, and serves as an effective tool for inclusive finance. The core attributes and functionalities of SCF reside in utilizing the creditworthiness of key businesses within the supply chain and the transactional data between upstream and downstream entities. This aids in mitigating information asymmetry between fund providers and companies and ameliorating the funding deficit faced by small and medium-sized enterprises. As the business models of SCF continue to innovate alongside information technology advancements, there is an increasing research focus on the role of IT in SCF. SCF is now transitioning to a stage characterized by digitalization and intelligence [1], with blockchain technology integration in SCF products emerging as a novel development approach for businesses. This nascent business model, which merges blockchain with SCF, effectively addresses the challenges inherent in classical SCF. In China, leading e-commerce corporations such as JD and Alibaba have launched SCF services under the "Internet Plus" initiative to cater to the financial needs of small and medium-scale enterprises, thus ensuring supply chain stability. However, the current SCF system in e-commerce companies still requires refinement to overcome certain challenges. Consequently, it is essential to conduct a systematic review and analysis of present SCF models in e-commerce. This paper examines the application of blockchain technology in JD SCF operations as a case study, exploring the innovative "Blockchain + SCF" model, which holds substantial potential.

2. Literature Reviews

2.1. Investigation into SCF

Berger A. N. piloted groundbreaking research on models of SCF, establishing a fundamental framework for SCF, thus laying the cornerstone for the evolution of SCF theory [2]. Hofmann E. introduced a logistics-driven model for inventory financing that employs collateral [3]. Expanding on this, More and Basu classified SCF models into three categories: pre-shipment financing, in-transit financing, and post-delivery financing, corresponding to different stages of goods transit in the logistics process [4]. One of the most recognized definitions of SCF comes from Gelsomino et al., who identified two dimensions of SCF: the "financial-oriented" and the "supply chain-oriented" dimensions. The financial-oriented dimension pertains to a financial perspective on solutions, tools, technologies (Fintech), activities, and relationship management, while the supply chain-oriented dimension primarily focuses on financing objects or participants generated around supply chain entities and their collaborative roles [5].

2.2. Research on the Integration of Blockchain Technology and SCF

In the realm of supply chain, many researchers have identified a strong symbiosis between blockchain and supply chain. Omran argued that blockchain technology can heighten transparency, streamline financing processes, enhance financing efficiency, ensure secure fund flows, and foster mutual benefits among entities in the supply chain, thus achieving a harmonious integration of efficiency and security

[6]. Tsan-Ming Choi contrasted traditional SCF with blockchain-supported SCF, discovering that the latter presented lower financing risks and more secure, reliable data during the financing process [7]. Using Alibaba as a case, Wang, S. et al. highlighted that the operational efficiency of logistics and fund flows in its SCF business could be elevated by approximately 70% with the assistance of blockchain technology [8].

In conclusion, current research on the application of blockchain technology in SCF is primarily theoretical. Although these studies reveal some detailed insights for SCF practice in E-commerce platforms in China, they still are not comprehensive enough because the majority of the research focus lies on the exploration of the emergence of motives and the existing forms of its early stages [9]. JD, being one of the first e-commerce platforms to venture into the field of SCF, has recently drawn considerable attention in China. However, JD's market share still significantly lags behind the leading Chinese e-commerce company Alibaba. Consequently, when investigating the Chinese e-commerce industry, scholars and professionals seldom choose JD as a case study. Even when research focuses on JD, it primarily centers around e-commerce development, with scant attention given to SCF, especially from a blockchain perspective. To fill this research void, this paper selects JD as a representative domestic e-commerce platform to analyze its blockchain-based SCF model, thereby enriching relevant research through case analysis.

3. Case Study

3.1. Research Approach

This study employs three research methodologies: literature review, case study, and comparative analysis, with JD chosen as the case for examination. The investigation begins with an analysis of JD's SCF model, underpinned by blockchain technology, with a particular focus on financial elements. Subsequently, a comparison is made between JD's traditional SCF, considering financing efficiency and risk management, and the advantages of blockchain-enabled SCF. The aim of the study is to assess the impact and efficacy of blockchain technology on the evolution of JD's SCF operations. The study concludes with the derivation of relevant findings and the provision of apt recommendations.

3.2. Introduction to JD's "Blockchain + SCF" Model

The global economic downturn has exacerbated a credit crisis in commodity markets, characterized by a spike in defaults and fraudulent loans. This disrupts the financial order as non-performing loans escalate and lending declines more rapidly, intensifying debt collection efforts. Additionally, the circulation of bulk commodities is hindered, and traders face a restrictive funding chain, obstructing loan accessibility and business growth. Blockchain technology can effectively alleviate information asymmetry problems in areas such as warehousing, logistics, and regulation. In JD's current SCF operations, the company actively leverages the technical benefits of blockchain, including distributed ledgers, traceability, immutability, and automated execution of smart contracts. These features enable the smooth circulation of electronic vouchers among core supply chain enterprises, streamline transaction flow division, payment obligations for small and medium enterprises, and facilitate financing. Moreover, data related to logistics, fund flows, information flows, commercial flows, and relevant financing information is uploaded and preserved on the blockchain. The data's security is maintained through the consensus mechanism of the blockchain. Furthermore, SCF participants establish connections through this secure and efficient platform, promoting data sharing within the supply chain and increasing collaboration efficiency. Blockchain technology also supports the issuance, acceptance, verification, payment, transfer, pledge, and redemption of credit vouchers for core enterprises as digital assets, thereby enhancing the security and trustworthiness of the business. The smart contracts' automated execution mechanism boosts overall operational efficiency and reduces the chance of human errors. Finally, regulatory bodies and fund providers use blockchain access to monitor fund flows and verify information, ensuring compliance and transparency in SCF operations.

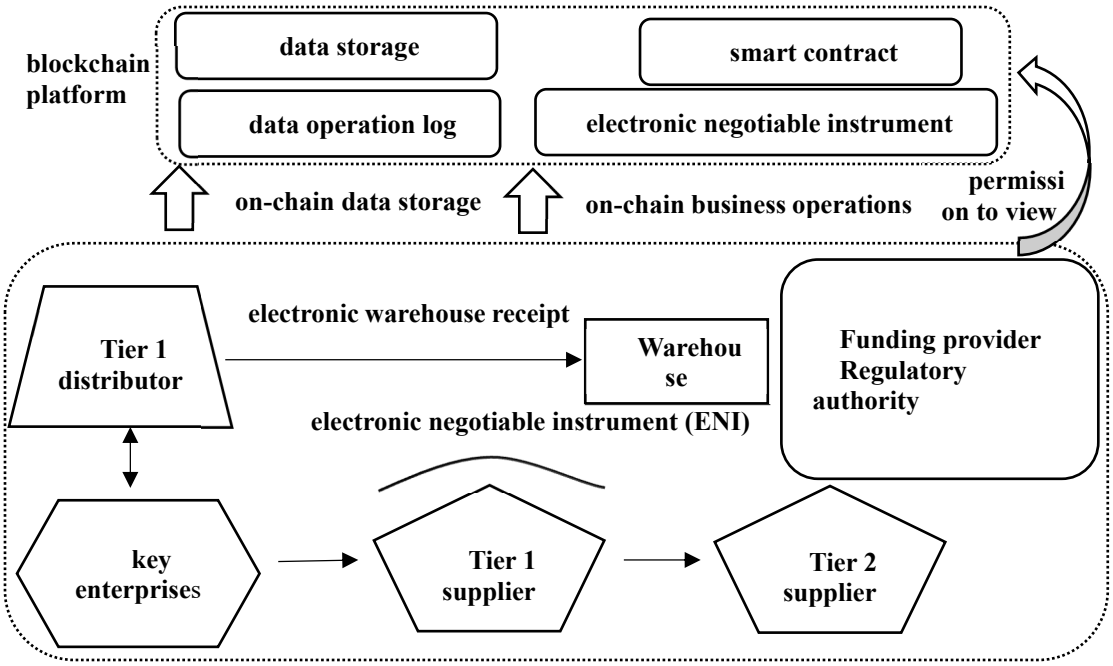

Figure 1. Blockchain + SCF Framework Diagram

3.3. Application Effects of Blockchain Technology on JD's SCF Business

3.3.1. Application Effects of Blockchain on SCF Financing Products

JD's SCF operations include a financial service product known as "Jingbaobei." Leveraging blockchain technology, credit assets such as accounts receivable from core enterprises can be continually authenticated, segmented, and circulated within the supply chain, facilitating its continuous expansion. The target users of the "Jingbaobei" service extend beyond simply the suppliers associated with JD Mall, encompassing any company engaged in commercial relations with JD Mall or core enterprises on JD's "Blockchain + SCF" platform, given they hold accounts receivable. These entities can secure financing through the "Jingbaobei" platform.

Simultaneously, blockchain's smart contract technology enhances the automation aspect of the "Jingbaobei" product. The signing and financing process is streamlined and expedited, featuring daily interest calculations and flexible repayment structures. This reduces the risk of moral hazards due to human intervention and enables automated data management, thereby augmenting security to a significant extent.

Table 1. Comparison of "Jingbaobei" Product Before and After Blockchain Empowerment

"Jingbaobei" Product	Before Empowerment	After Empowerment
Source of Loan Funds	Bank funds	JD funds
Coverage of Merchants	JD's primary suppliers	All suppliers
Loan Disbursement Speed	Application submitted in the morning, funds disbursed by the afternoon	3 minutes
Loan Amount	Average of 800,000-1,100,000 CNY	Up to several million CNY

3.3.2. The Effects of Blockchain on the Efficiency of SCF

(1) Cost Reduction

With blockchain technology supporting JD's SCF operations, the transmission of credit from core enterprises within the supply chain is simplified, leading to substantial reductions in financing costs. Suppliers at the end of the chain can access credit and financing at lower rates. As per JD's official website, the "Jingbaobei" product offers an annual interest rate of 9% to 14.5%, while "Jingxiaodai" provides a daily rate of 0.033% to 0.066%. Comparable SCF products offer similar daily rates of around 0.04%. This meaningful reduction in financing costs is particularly beneficial to small and micro enterprises, compared to traditional SCF. JD's annual report indicates that their "Support Program for Small and Medium-sized Enterprise Growth" helped nearly 210,000 such enterprises during the first half of 2020, amidst the COVID-19 pandemic, saving them approximately 350 million CNY in purchasing funds.

(2) Streamlined Financing Process

Blockchain technology enables JD to classify small and micro enterprises within and outside its supply chain and create a range of financing products. These products have entirely online operations, from application to fund disbursement, simplifying application and approval procedures. Also, automated settlement processes have drastically cut the overall processing time. Transactions that used to take over ten days can now be completed in a few days, or even on the same day. The "Jingxiaodai" product even offers immediate loan disbursement, significantly enhancing financing efficiency for smaller enterprises. Moreover, blockchain's smart contracts allow for automatic repayment, further improving financing operation efficiency.

(3) Expanded Financing Channels

JD uses blockchain technology to merge credit granting and lending, enhancing interconnection between upstream and downstream enterprises in the supply chain. Even enterprises without direct trade engagement or movable collateral can benefit from relevant SCF based on supply chain information. In JD's "Blockchain + SCF" operations, credit certificates can be divided and transferred among suppliers at various levels, expanding coverage to a wider supplier range and lowering the financing threshold for smaller enterprises. Nearly 90% of enterprises, barring those with operational issues, can access loan services, a significant increase from the modest 15% approval rate in traditional SCF.

From the aforementioned analysis, Jingbaobei serves as an accounts receivable financing tool for upstream supply chain enterprises, offering an efficient method that significantly improves these enterprises' cash flow speed. This accelerates the movement of goods between upstream suppliers and core enterprises, effectively increasing JD's inventory turnover. At the same time, downstream distributors in the supply chain quickly procure goods from JD. JD also utilizes blockchain technology to facilitate swift access to accounts receivable in SCF, thereby enhancing the turnover rate of accounts receivable and reducing the days sales outstanding.

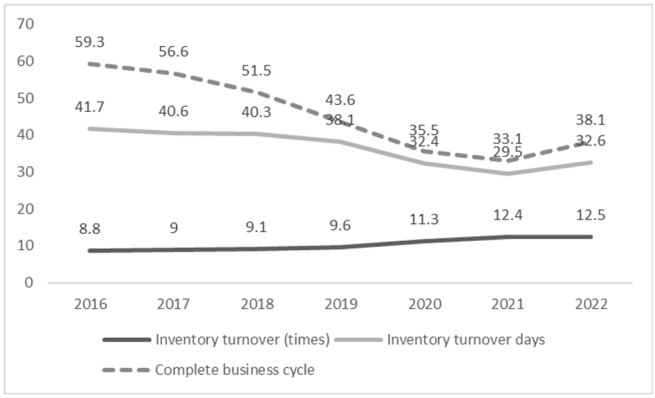

Figure 2: Inventory turnover situation of JD Group from 2016 to 2022

3.3.3. Application Effect of Blockchain on SCF Risk Control

(1) Enhanced Risk Control Measures and Reduced Operational Risks

In the "Blockchain + SCF" framework of JD, the incorporation of blockchain technology and smart contracts minimizes manual intervention, standardizes business procedures, and mitigates operational risks. Blockchain safeguards information systems, while smart contracts decrease manual involvement and reduce points of human-machine interaction. For instance, during the contract signing process preceding a loan, restrictive clauses and repayment

conditions are encoded into the blockchain. Smart contracts execute automatically when the contract matures or if the enterprise violates any terms, allowing for automated signing and repayment, and significantly curtailing operational risks.

(2) Reduced Fraudulent Activities and Lowered Credit Risks

Blockchain's distributed ledger feature and consensus mechanism tackle credit problems by ensuring the authenticity and real-time sharing of all enterprise and transaction details. JD leverages this to gain comprehensive insights into the operations and transaction status of financed enterprises, thus maximizing the reduction of default incidents. If a financed enterprise defaults, JD terminates the partnership and liquidates the warehouse goods to minimize losses. Furthermore, JD establishes electronic contracts through a digital evidence platform, using blockchain technology to encrypt transaction data and ensure the legal validity of electronic data for on-chain enterprises. The uniqueness of signatures in SCF contracts is guaranteed by blockchain technology, while timestamp technology ensures the traceability and resistance to tampering of data, effectively minimizing credit risks.

Table 2. Comparison of JD's Supply Chain Finance Risk Control Indicators Before and After Blockchain Optimization

Risk Control Indicators	Specific Indicators	Before Optimization	After Optimization
Operational Risk Control Indicators	Degree of Manual Involvement	Paper Contracts	Smart Contracts
		High Degree of Manual Involvement	Low Degree of Manual Involvement
	Information System Security	Centralized Database	Distributed Database
		Low Security Level	High Security Level
	Degree of Settlement Automation	Manual Debt Collection	Smart Contracts
		Low Degree of Automation	High Degree of Automation
Credit Risk Control Indicators	Degree of Information Transparency	Voluntary Disclosure by Enterprises	Data On-Chain
		Low Degree of Information Transparency	High Degree of Information Transparency
	Asset Supervision Capability	Weak Regulatory Capability	Achieve Real-Time Online Supervision

3.4. Challenges Encountered by JD's "Blockchain + SCF" Model

3.4.1. Insufficient Regulation and Legal Framework

While the integration of blockchain technology in JD's SCF operation is highly compatible and advantageous, the current regulatory framework for blockchain lags behind technology advancements, leading to uncertainties and potential legal issues. Certain blockchain applications' legality is often disputed due to unclear definitions for secondary and tertiary transfers in debt assignments, potentially undermining involved parties' rights. Furthermore, as blockchain technology and SCF rapidly evolve, emerging products may pose security risks. The lack of industry-wide standards can result in varying blockchain project quality across different enterprises. Therefore, comprehensive standards applicable to the entire financial industry need to be established for SCF's long-term development.

3.4.2. Difficulties in Securing Participation of Core Enterprises

Whether in traditional SCF or technology-enhanced SCF systems, core enterprises play a pivotal role in the supply chain. SMEs depend on the credit support of core enterprises to access on-chain financing. Without their participation, the entire SCF system cannot be established. However, widely recognized core enterprises currently face uncertainties in their financial and operational conditions due to factors like the pandemic, which may affect their willingness to participate in the SCF system.

3.5. Effective Strategies to Encourage Blockchain Use in SCF

3.5.1. Continual Reinforcement of Technological Innovation

As an emerging technology, blockchain carries technical risks and may encounter unexpected challenges during practical applications. Therefore, SCF entities should promptly address issues and prevent risks from spreading. Establishing robust management systems to mitigate technological risks and improve information security capabilities is crucial to ensure the safety of on-chain participants' information. Given blockchain's consensus characteristics, where malicious individuals gaining access to one node can potentially access information across the entire chain, platform operators should prioritize identity verification, authentication, and control measures. Access to the blockchain should be granted only to individuals meeting specific criteria.

3.5.2. Encouraging More Core Enterprises to Adopt Blockchain

While SCF can partially meet the financing needs of micro, small, and medium-sized enterprises (MSMEs), it heavily depends on the creditworthiness of on-chain core enterprises. Core enterprises occupy a central role in the supply chain, exerting significant influence over other enterprises. While MSMEs have addressed their financing difficulties through SCF platforms, core enterprises, apart from delayed payment terms, haven't gained substantial benefits and have limited incentives to partake in on-chain operations. To rectify this, businesses should formulate preferential policies that encourage core enterprises to join and offer them increased profits and benefits. For instance, extending the repayment period for core enterprises, based on overall risk control, can

enhance their capital utilization efficiency.

3.5.3. Building Robust Legal and Regulatory Frameworks

The advent of digital technologies, including blockchain, has brought innovation and development to traditional industries. However, in China, blockchain technology regulation is still in its infancy. Current regulations and standards lag, leading to regulatory gaps. Technology application must be grounded in solid legal foundations. Firstly, JD and other enterprises should actively engage with regulatory authorities and maintain proactive communication to update the SCF operation models in response to dynamic policy changes. Secondly, regulators could draw from relevant experiences in foreign countries, combine them with domestic conditions, and study applicable laws to continually improve industry standards. On the one hand, blockchain in SCF scenarios requires ample development space, but on the other hand, measures should be taken to prevent potential risks. Furthermore, security audits of blockchain smart contract technology should be reinforced, and the legal effectiveness of smart contracts should be clearly defined, along with improving relevant market norms. Only with clear legal definitions can enterprises and institutions involved in relevant businesses have legal guidance on their innovation paths, eliminate unnecessary concerns, and consistently follow legal standards to avoid legal infringements.

4. Conclusion

Prominent internet corporations such as Ant, Suning, and Tencent have instituted their own platforms for managing accounts receivable. However, these platforms generally concentrate solely on a single accounts receivable model. In contrast, JD, a company firmly established in the supply chain, has expanded its model to include not just accounts receivable financing, but also prepaid accounts and inventory financing. This diversified business approach substantially bolsters its competitiveness within the industry.

The benefits of JD's "blockchain + SCF" strategy are primarily demonstrated in three areas: First, the blockchain technology allows core enterprises' bills and other credit documents to be easily divided and circulated among SMEs, reducing data transfer costs substantially by storing all relevant logistics, capital flows, business transactions, and information. Second, the blockchain platform verifies various assets like accounts receivable and inventory from supply chain enterprises without duplication, thereby enhancing financing efficiency. Third, blockchain's decentralized nature and data sharing mechanisms bolster the security of the SCF process. By integrating fintech into SCF, JD has significantly improved its risk management and expedited its supply chain operations.

In 2021, JD launched the JD Technology Group, consolidating JD Digits and JD Cloud with the goal of further developing technologies such as blockchain and the Internet of Things to better serve various applications. With the advent of blockchain technology, SCF has seen innovative growth. The future emphasis will be on furthering the development of blockchain in SCF and incorporating other advanced technologies such as the Internet of Things into the SCF process. It is essential for regulators to establish a legal framework for blockchain debt transfer platforms to ensure market stability. As technology continues to advance, SCF is expected to become more intelligent, providing comprehensive and convenient financing services for SMEs, thereby addressing their financing challenges.

Nevertheless, this paper has three limitations. First, it overly relies on qualitative methods to examine the impact of blockchain, lacking sufficient data collection and analysis. Future research could introduce quantitative techniques to compare the pre- and post-application effects of blockchain, enhancing the research quality. Second, this study lacks a comparative analysis as it focuses on JD's blockchain application in SCF using qualitative methods, which precludes a comprehensive cross-comparison. Future research could expand its scope to include other industries and businesses inside and outside the SCF sector. Lastly, this study is limited to Chinese e-commerce companies applying blockchain technology in SCF, which may not be universally applicable to businesses with different characteristics. Therefore, future research should not be confined to specific sectors and should strive for broader applicability by considering different regions and businesses.

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