

Analysis of the Digital Supply Chain Finance Development in China

Weiguo Li*, Hui Liu, Xiaoying Zhong

Nanfang College of Guangzhou, Guangzhou, Guangdong, China

**Corresponding Author.*

Abstract: Digital supply chain finance (DSCF) has emerged as a promising solution to enhance the efficiency of supply chain finance (SCF) operations and address issues related to resource allocation, information transmission, and risk control in traditional SCF. This paper aims to introduce the concept of SCF and DSCF, analyze the development process and scale of DSCF in China, and discuss the challenges faced by DSCF. Solutions are proposed to promote the healthy and orderly development of DSCF in China.

Keywords: Supply Chain Finance (SCF); Digitalization; Digital Supply Chain Finance (DSCF); Digital Economy

1. Introduction

Small and medium-sized enterprises (SMEs) in China often face difficulties in obtaining financing, and supply chain finance (SCF) has become an essential solution to their financing problems. By providing guarantees for upstream and downstream SMEs in the supply chain, financial institutions can effectively promote the healthy development of the national economy. With the guidance of national policies, many local provincial and municipal governments have also issued supporting policies for the development of SCF, making it a strategic priority. However, there are still challenges such as unbalanced development of the SCF system, low enthusiasm of core enterprises, risks of information leakage, and lagging financial technology management. To address these issues, it is necessary to further integrate digital technologies into the SCF process, improve the coverage, cost, efficiency, risk control, and other aspects of SCF, and promote the healthy and orderly development of China's DSCF [1].

SCF is widely recognized in China as the best

way to solve the financing difficulties faced by small and micro enterprises. In Chinese SCF research, Ren Wenchao (1998) was the first to propose the concept of material bank, introducing chattel mortgage into the bank's guarantee financing services [2]. Subsequently, Luo Qi (2002) proposed the concept of "finance and storage warehouse," arguing that it serves as a third-party logistics service platform, bridging SMEs with banks and effectively addressing their financing difficulties [3]. In 2001, Feng Gengzhong defined two inventory financing models: inventory pledge financing and warehouse receipt pledge financing, and published a series of articles on the connotation, models, and risk management of logistics finance [4-7]. With the advent of the digital age, academia has started to focus on the development of DSCF [8]. Lu Minfeng (2022) found that by promoting the digitalization of enterprises and the coordinated development of digital SCF, the state can not only meet the high-quality financial service needs of all participants in the digital supply chain but also improve the operational efficiency of digital SCF, providing assistance for financial institutions to reasonably control risks in DSCF [9]. Song Xiaochen (2022) discovered that through the use of blockchain technology, adopting a DSCF development model from the aspects of system and reputation can effectively promote trust among online trading organizations, enhancing the efficiency of blockchain applications and promoting the development of DSCF [10].

Due to the limitations of traditional SCF, which mainly relies on commercial banks as primary fund providers and core enterprises as main guarantors, it can only reach first-tier suppliers and distributors, leaving behind SMEs in second and third-tier supply chains that have strong financing needs. Moreover, traditional SCF faces challenges such as

difficulty in integrating "four flows" (goods flow, capital flow, information flow, and human resources flow), forgery of warehouse receipts and invoices, low operational efficiency, and difficulty in risk prevention. These factors have become major obstacles hindering the development of the SCF industry.

In the era of industrial digitalization, the maturity of information technologies such as big data, blockchain, and the Internet of Things has been continuously improving. They have been applied in various fields, including finance, where they have achieved scene application and iterative upgrades. As a result, SCF has entered a digital development era.

DSCF is a development trend in SCF that combines cutting-edge technological means. It creates an efficient and transparent financial service system by integrating logistics, trade, capital flow, and information flow. It is not just electronic transformation of traditional SCF but also applies technologies such as the Internet, Internet of Things, big data, and artificial intelligence to comprehensively optimize and upgrade supply chain financial business processes.

2. SCF Digitization

SCF digitization is a trend in SCF that incorporates the latest technological advancements. It creates an efficient and transparent financial service system by integrating logistics, commercial flow, capital flow, and information flow. This goes beyond the electronic transformation of traditional SCF and utilizes technologies such as the internet, Internet of Things, big data, and artificial intelligence to optimize and upgrade the entire process of SCF business operations.

2.1 End-to-end SCF

End-to-end SCF encompasses not only traditional financing activities but also extends to the entire process of supply chain operations, including sourcing, agreements, procurement, invoicing, verification, and payment.

2.2 Application of Digital Technologies

By utilizing next-generation information technologies, it is possible to plan, execute, control, and optimize the business processes of SCF. This optimization improves the overall planning of logistics, information flow, capital

flow, and commercial flow.

2.3 Diversification of Participants

SCF involves various participants, including supply chain core enterprises and their upstream and downstream enterprises, financial service providers, warehousing and logistics providers, professional third-party service providers, and infrastructure service providers.

2.4 Ideal State of Four Flows Unification

In the ideal state of SCF digitization, all participants can achieve extreme collaboration, achieving online business processes, datamation of credit evaluation, automation of risk control decisions, visualization of operational management, trustworthiness of data transactions, dynamic risk monitoring, and intelligent movement property supervision.

The advancement of SCF digitization can significantly improve supply chain operational efficiency, reduce costs, enhance the value of the entire supply chain, and provide new solutions for small and medium-sized enterprises to overcome financing difficulties. It also helps banks and financial institutions better assess risks and credit, providing more accurate financial services. As technology continues to advance and innovate, SCF digitization will continue to deepen, bringing more opportunities and challenges to enterprises and financial institutions.

3. Development Status of DSCF in China

3.1 Evolution of Digitalization in SCF

SCF is currently in the initial stage of intelligentization through platform models, and the large-scale digitalization of inventory financing and prepayment financing will become the next milestone for the industry. Since Shenzhen Development Bank began to explore business such as cargo mortgage credit in 1999, the development history of SCF in China has begun. In 2003, Shenzhen Development Bank introduced the "1+N" SCF model, and since then, many banks have gradually developed internet technologies. Business information at various stages of the supply chain has been connected, and some standardized business/products have taken the lead in achieving digitalization, leading to the

launch of online SCF.

Since 2015, with the development of big data, blockchain, and other digital technologies and the increasing maturity of SCF business, professional third-party technology companies such as Zhongqiyunchain and Lianyi Rong have been established one after another. They have innovatively launched solutions such as electronic debt circulation and supply chain ABS, and quickly gathered and served multiple core enterprises and financial institutions through platform models. The digitalization level of the SCF industry continues to deepen, with various participants including banks, core enterprises, upstream and downstream enterprises in the supply chain, and third-party financial enterprises joining the construction of SCF platforms. The industry presents a flourishing situation with diverse developments. In 2020, with the outbreak of COVID-19, the importance of SCF has received further attention. The government has introduced a series of encouraging policies at the national level, including the trial operation of supply chain bill platforms, nationwide implementation of unified registration of movable property and rights guarantees, and deep integration and application of financial technology technologies to accelerate the digitalization process of SCF. Electronic debt circulation, supply chain ABS, and other innovative products under the account receivable model have become relatively mature. More professional technology companies specializing in blockchain, Internet of Things, etc. have joined in, and business models that require warehousing intelligence systems such as prepayment financing and inventory financing have been empowered and developed into new growth points. Intelligitization is the ultimate state of digitalization in SCF, which is also a long-term process requiring higher technology and system coordination. The large-scale digitalization of inventory financing and prepayment financing will become the next milestone for the industry.

3.2 The Digitalization Scale of China's SCF Industry

The growth rate of China's digital economy continues to maintain high-speed operation, with "industrial digitization" being the main

field of development in China's digital economy. In 2021, the added value of industrial digitization in China was 37.2 trillion-yuan, accounting for 32.4% of GDP. According to research by Dell Technologies on the Digital Transformation Index, significant changes have occurred in the digitalization landscape of Chinese enterprises in 2016, 2018, and 2020. A large number of latecomers in digitalization have gradually entered the stages of digitalization pursuit, evaluation, and practice. Although achieving a highly digitalized and fully chain-digitalized supply chain is a long and difficult process, the process of supply chain digitalization is an inevitable trend. According to estimates by iResearch, the revenue scale of supply chain digitalization services in China reached 2.8 trillion yuan in 2021, and it is expected to grow to 4.4 trillion yuan by 2026. The penetration rate of DSCF in China has increased from 5% in 2018 to 30% in 2022, and it is expected to reach 50% by 2027 (e.g., Figure 1. Balance scale of SCF industry).

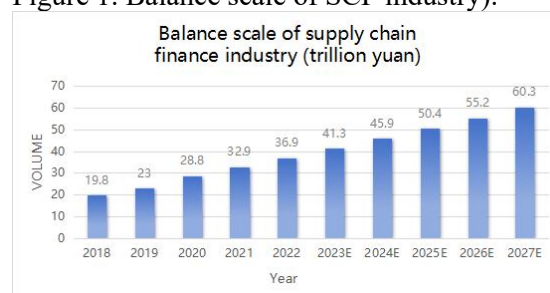


Figure 1. Balance Scale of SCF Industry

Based on whether the core enterprise participates in supply chain transactions, DSCF financing modes can be classified into two categories: firstly, the digital transformation of traditional SCF models that rely on core enterprises; secondly, innovative DSCF models that rely on B2B e-commerce platforms. The digital penetration rate of accounts receivable financing mode has reached 45%, while that of other modes is still less than 10%. Platforms serve as the fundamental carriers for SCF digitization. Currently, there are over 200 operational digital platforms, and in the future, the number of comprehensive platforms established through multi-party cooperation and the establishment of financial technology companies will increase. The main suppliers of DSCF include four categories, each with different resource endowment advantages:

financial institutions have abundant funds and products, core enterprises understand users and industries, third-party technology companies specialize in technology and products, and supply chain service providers control trade relationships.

4. Key Technologies for DSCF

The significant investment in technology and the preference for financing and lending businesses have provided strong momentum for the digitalization of SCF. Since the Central Bank released the Financial Technology Development Plan in 2019, China's financial industry has made substantial progress in digital transformation, with continuous growth in technology and capital investment from financial institutions. Among them, banks are the main force driving the digital transformation of financial institutions. In 2020, the total technology and capital investment of Chinese banking institutions reached 207.8 billion yuan, far exceeding the investment of insurance and securities companies. According to a survey by iResearch in January 2023, among the business practices that financial institutions focus on when applying financial technology, lending and financing are the top priorities, and their future attention will further increase. This indicates that the technological environment for SCF is more favorable compared to other businesses, and a good technological environment will also provide sufficient nutrients for the digital transformation of SCF.

4.1 Four-layer Architecture for DSCF

The DSCF architecture is composed of four layers: the perception layer, data layer, process layer, and model layer. Each layer primarily utilizes different technologies, but they are interconnected and collaboratively enable DSCF. The digitization of SCF necessitates the integration of various technologies. In the 2.0 stage of SCF, digitization was mainly manifested in online processes and information management of operations, relying mainly on traditional ICT and other communication technologies. With the emergence, development, and application of emerging technologies such as big data, blockchain, artificial intelligence, cloud computing, edge computing, and the Internet

of Things, SCF has gradually entered the platform and intelligent stages of 3.0 and 4.0, leading to innovations in products and industry solutions.

A comprehensive DSCF can be divided into four layers: perception, data, process, and model. Each layer has its primary technologies applied:

1) In the perception layer, sensors, radio frequency identification (RFID), and other Internet of Things technologies are used to perceive and obtain information about supply chain business activities.

2) In the data layer, big data, artificial intelligence, cloud computing, and edge computing technologies are employed to process and analyze the data obtained in the perception layer and make relevant decisions.

3) The process layer is primarily achieved through blockchain technology to enable electronic flow and management of supply chain documents, bills, vouchers, and related processes, enhancing the trustworthiness and transparency of SCF operations.

4) The model layer primarily relies on traditional ICT technology to implement supply chain process management and establish and manage business models, thereby realizing the informationization of SCF operations.

Although different layers have their primary technologies applied, technologies are an interrelated whole. Different technologies have varying effects but are interconnected, providing a combined effect greater than the sum of its parts for DSCF.

4.2 Typical Technologies in SCF Applications

The depth of technology application in DSCF decreases as each layer of the four-layer architecture is addressed. The model layer serves as the foundation, while the process and data layers have achieved initial applications. However, the perception layer still requires further development. This is primarily due to the maturity level of technology itself, with blockchain, big data, artificial intelligence, and cloud computing being more mature than edge computing and the Internet of Things. Additionally, different business models have varying demands for technology. For example, the massive demand for bill verification in accounts receivable models has accelerated the

application of blockchain technology. On the other hand, edge computing and Internet of Things technologies are mainly applied in prepayment financing and inventory financing models with higher risk levels. However, the industry's main providers lack sufficient motivation to develop these two technologies, resulting in insufficient demand for them.

Traditional ICT integrates information systems and processes various types of information, facilitating integration of different processes and enabling information exchange between different parties. Blockchain achieves authenticity constraints on transmitted information through consensus mechanisms, smart contracts, decentralization, etc. It transfers credit throughout the entire industrial chain to upstream suppliers, improving efficiency and flexibility in document circulation. Big data establishes user portrait models based on internal and external data to accurately identify financing targets and conduct risk review and monitoring before, during, and after loans. It addresses issues such as information asymmetry in financial markets, high transaction costs, and imperfect risk control models overall. Artificial intelligence iteratively refines risk management models through data mining, deep learning, knowledge graphs, etc. It accurately identifies and quantifies fraud risks to assist organizations in decision-making and achieve efficient operation and automated management of businesses. Cloud computing provides system connectivity and open data interfaces to link various systems across the entire industrial chain and achieve information integration within it. It offers real-time visibility of transactions to improve operational efficiency.

5. Problems and Solutions in the Digitalization of SCF

In comparison to the rapid development of supply chain economy, the progress of SCF has been slower. This is primarily due to an unbalanced supply system in SCF, a lack of initiative from core enterprises, potential risks of information leakage, and relatively backward financial technology management. To tackle these issues, more digital solutions need to be incorporated into SCF. Financial technology should be fully integrated into the entire process of SCF, breaking through

industry bottlenecks in terms of coverage, service costs, operational efficiency, risk control, and other areas. The main challenges faced by the development of SCF are as follows:

5.1 Unbalanced Development of the Supply System of SCF

Banks are the primary suppliers, but a significant number of joint-stock banks, city commercial banks, and rural commercial banks have low coverage and small business scope, which contradicts the natural cross-regional attributes of SCF. State-owned large banks face challenges such as relatively fragmented internal business lines, insensitive response to the market, and slow information system development and response. Regional banks still lack sufficient financial technology capabilities and need to enhance the level and scope of DSCF applications.

5.2 Low Initiative and Enthusiasm of Core Enterprises

In order to maintain the quality of their loans, financial institutions must have in order to maintain the quality of their loans, financial institutions must have a comprehensive understanding of various aspects of the operations of core enterprises. However, these core enterprises are often reluctant to fully disclose their business information to banks. Furthermore, when providing rights confirmation or guarantees for upstream and downstream enterprises, core enterprises bear significant risk responsibilities. Unfortunately, there is currently a lack of clear risk compensation or subsidy mechanisms under existing policies, which makes it difficult for core enterprises to assume guarantee responsibilities for their suppliers and customers. Therefore, it is necessary to implement policies that encourage core enterprises to take on differentiated interest rates and other responsibilities related to SCF.

5.3 Potential Risks of Information Leakage in SCF

The presence of numerous participants in the supply chain and intricate business channels poses a significant risk of information leakage during the process of risk management by banks to comprehend the actual operational

conditions of various enterprises. Therefore, it is imperative to enhance the financial technology information management system and mitigate the risk of information leakage by business personnel.

5.4 Backwardness of Financial Technology Management in SCF

The development cycle for business systems and internal management processes in banks and other financial institutions is lengthy, resulting in a slow response to the demands of SCF. This is not conducive to the fast-changing and diverse demands characteristic of SCF. Standardized services are inadequate, and personalized service capabilities have yet to be established. It is crucial to maintain coordination and integration between commercial bank information technology management systems and supply chain economy and finance.

6. Conclusions

The digitization of China's SCF has witnessed rapid development and continues to permeate various sectors, fostering the growth of SCF. Leveraging information technologies such as ICT, blockchain, big data, AI, cloud computing, edge computing, Internet of Things, and others, industries are actively constructing diverse SCF platforms in China, attracting attention from both central and local governments. As the digital penetration rate of China's SCF keeps on rising, it will eventually achieve the objective of "four flows integration," enabling the completion of online processing for supply chain financial business procedures, automation of overall decision-making, visualization of operational management, trustworthiness of data transactions, dynamic risk monitoring, and intelligent warehousing surveillance.

Reference

[1] Ren Wenchao. Material Bank and its

Practice. *Scientific Decision Making*, 1998,2(2),18-20.

- [2] Zheng Mingxuan, Dou Yaqin, Zuo Xuteng. Innovation of Digital Supply Chain Finance Credit Aggregation Model under the Guidance of Agglomeration Advantage. *Technological Management Research*, 2022,42(13).
- [3] Luo Qi, Zhu Daoli, Chen Boming. Third Party Logistics Service Innovation: Initial Exploration of Financing Warehouse and Its Operation Mode. *China's Circulation Economy*, 2002 (2),11-14.
- [4] Li Yixue, Xu Yu, Feng Gengzhong. Evolutionary Process Study of Inventory Quality Financing Business at Home and Abroad. *Economic and Management Research*, 2007 (3),22-26.
- [5] Feng Gengzhong. Analysis of Logistics Finance Business Innovation. *Forecast*, 2007,26(1),49-54.
- [6] Li Yixue, Xu Yu, et al. Comparative Analysis and Case Study of Inventory Pledge Financing Business at Home and Abroad. *Business Economics and Management*, 2007 (7),35-40.
- [7] Li Yixue, Xu Yu, et al. Comparative Analysis and Case Study of Domestic and Foreign Logistics Finance Business. *Management Review*, 2007,19 (10), 55-62.
- [8] Liu Xuguang, Li Gen. Exploring the Development Model of Digital Supply Chain Finance. *China Finance*, 2022, (11).
- [9] Lu Minfeng. Research on the Integration and Development of Enterprise Digitization and Digital Supply Chain Finance. *Friends of Accounting*, 2022, (22).
- [10] Song Xiaochen, Mao Jiye. Study on the Process of Building Inter-organizational Trust Based on Blockchain - Taking the Digital Supply Chain Finance Model as an Example. *China Industrial Economics*, 2022, (11).