

Research on Supply Chain Financing Model for Technology-Based SMEs in Liaoning Based on Industrial Chain Chief System

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Abstract: Technology-based small and medium-sized enterprises (SMEs) serve as a critical driving force for industrial transformation and upgrading as well as high-quality economic development in Liaoning Province. Nevertheless, long-standing financing difficulties have severely restricted their growth. Focusing on technology-based SMEs in Liaoning, this paper first analyzes their financing dilemmas and the practical application status of supply chain finance. By introducing the Industrial Chain Chief System, an innovative industrial governance mechanism, this study constructs a new supply chain financing model led by industrial chain chiefs. It further identifies prominent obstacles in the current supply chain finance practices targeting Liaoning's technology-based SMEs. Leveraging the coordination and enabling strengths of the Industrial Chain Chief System, this paper proposes optimized development paths and countermeasures. The research outcomes aim to alleviate financing bottlenecks for such enterprises and strengthen the resilience and security of industrial supply chains in Liaoning.

Keywords: Industrial Chain Chief System; Technology-based SMEs; Supply chain finance; Financing model; Liaoning Province

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1. Research background and significance

Against the backdrop of accelerated restructuring of global industrial and supply chain layouts, enhancing the stability, security, and competitiveness of industrial chains has become a strategic priority for national and regional development. In China, technology-based SMEs represent the most dynamic market entities for technological innovation, forming the micro foundation of a modern industrial system and a key pillar for reinforcing industrial chain resilience.

As a time-honored industrial base in China, Liaoning Province is undergoing a pivotal phase of comprehensive revitalization and industrial transformation. Cultivating and expanding technology-based SMEs plays an irreplaceable role in fostering new growth drivers, upgrading traditional industries, and reshaping Liaoning's competitive advantages.

Similar to most regions nationwide, technology-based SMEs in Liaoning generally suffer from severe financing constraints, including high financing costs. Characterized by light asset structures, high growth

potential and high operational risks, these enterprises lack sufficient fixed assets as collateral, with their core value embedded in intellectual property, human capital and expected future earnings. This fundamental feature clashes with the risk control logic of traditional bank credit, which relies heavily on physical collateral and historical financial data. Exacerbated by severe information asymmetry, such enterprises struggle to obtain adequate capital through conventional financing channels, causing numerous promising innovation projects and high-growth firms to stall or even fail due to capital shortages.

Theoretically, supply chain finance addresses SME financing barriers by transferring and distributing credit from core enterprises along industrial supply chains. Grounded in authentic trade backgrounds, it integrates logistics, information, and capital flows to convert the uncontrollable risks of individual enterprises into manageable risks across the entire supply chain, thereby elevating the credit standing and financing accessibility of SMEs. However, supply chain finance has not fully delivered its intended effects in Liaoning's practical implementation. On one hand, core enterprises within local industrial chains lack sufficient incentives to extend credit support to upstream and downstream SMEs ^[1]. On the other hand, financial institutions maintain cautious service attitudes due to risk concerns regarding the authenticity and transparency of intra-chain transactions.

In recent years, the Industrial Chain Chief System, an innovative industrial governance model, has been widely rolled out nationwide to tackle complex external challenges and upgrade industrial chains. Typically headed by leading local government officials or departmental directors, industrial chain chiefs coordinate major issues concerning industrial planning, policy formulation and factor allocation within respective chains, with the core goals of strengthening regional industrial collaboration, mitigating industrial weaknesses and consolidating competitive strengths. The implementation of this system creates a new opportunity and top-level institutional tool to systematically resolve supply chain financing difficulties for Liaoning's technology-based SMEs. Transcending the limitations of individual market participants, industrial chain chiefs integrate governments, leading chain enterprises, financial institutions and SMEs from the perspective of regional industrial ecosystem development, improving overall industrial chain credit and information transparency and laying a solid foundation for innovative supply chain financing models.

Therefore, grounded in the practical demands of Liaoning's revitalization strategy, this study combines the coordination advantages of the Industrial Chain Chief System with the innovative financing functions of supply chain finance to develop a novel financing model tailored to technology-based SMEs in Liaoning. This research delivers direct practical value in easing corporate financing pressures and stimulating innovation vitality, while bearing profound strategic significance for advancing the modernization of Liaoning's industrial chains, safeguarding industrial security and achieving high-quality economic development.

2. Current development of supply chain finance for technology-based SMEs in Liaoning

Endowed with solid industrial foundations, Liaoning boasts competitive traditional industries including equipment manufacturing, petrochemicals and metallurgy. Meanwhile, the province is vigorously fostering strategic emerging and future industries such as integrated circuits, aviation equipment, biomedicine, new materials and new energy, which have gathered a large number of high-potential technology-based SMEs supporting large leading enterprises (potential chain leaders) through collaborative supporting services, forming fertile ground for supply chain finance application.

2.1. Expanding enterprise scale and accelerated cultivation of specialized, refined, unique, and innovative enterprises

By the end of 2025, the number of technology-based SMEs in Liaoning exceeded 45,000, representing a year-on-year growth of 12.8%. The cumulative number of provincial-level specialized, refined, unique and innovative SMEs reached 3,770 (471 newly added in two batches in 2025), alongside 399 national-level champion “little giant” enterprises of the same category.

Enterprise distribution has become increasingly diversified, with high-end equipment manufacturing (30.1%), new materials (21.4%), and biomedicine (17.2%) remaining dominant sectors. The proportion of electronic information and new energy industries has risen to 15.7%, accompanied by strengthened industrial chain collaboration.

2.2. Gradually improved policy support system with escalated support intensity

In 2025, Liaoning issued the Measures to Accelerate Science and Technology Financial Innovation to Support the Construction of a Strong Science and Technology Province, listing supply chain finance as a core task of science and technology finance. The provincial fiscal risk compensation fund for supply chain finance expanded to RMB 300 million, an increase of RMB 100 million compared with 2024 ^[2].

Shenyang expanded its supply chain finance development fund to RMB 80 million, raising the maximum interest subsidy ratio to 60%. Dalian set up a special RMB 50 million subsidy fund for technology supply chain finance, offering an extra 10% interest discount for online financing businesses.

2.3. Growing financing scale and continuous model innovation

The total supply chain financing volume of Liaoning reached RMB 21.7 billion in 2025, a year-on-year increase of 58.4%, surpassing the annual target of RMB 20 billion. Angang Group’s supply chain finance platform provided RMB 6.28 billion in financing to 216 upstream and downstream SMEs in aggregate, cutting average financing costs by 1.5 percentage points compared with traditional loans. Leading enterprises including Shengu Group and Neusoft built exclusive supply chain platforms, generating an additional RMB 1.83 billion in financing in 2025 ^[3].

In terms of financial institutions, Shengjing Bank’s industrial chain financing series disbursed RMB 6.87 billion in 2025, up 62.4% year-on-year; Anshan Bank’s industrial chain bill financing business volume hit RMB 4.21 billion, growing by 57.1% year-on-year. The supply chain financial asset trading segment of Liaoning Equity Exchange recorded a transaction volume of RMB 3.24 billion, a 65.3% year-on-year increase. State Grid Liaoning’s E-Finance Service platform facilitated RMB 21.7 billion in corporate financing in 2025, with cumulative transactions of RMB 66.2 billion serving 11,800 clients.

2.4. Persistent development gaps and untapped scale potential

Supply chain financing volume accounts for 9.2% of total SME loans in Liaoning, a moderate improvement yet still far below Zhejiang (17.5%) and Guangdong (20.1%). Additionally, financing services remain concentrated on primary suppliers (72.3%, down 6.3 percentage points), while coverage of secondary and deeper-tier suppliers stands at merely 31.7%. Although online business penetration rose to 45.8%, offline operations remain dominant, failing to generate large-scale industrial effects.

3. Major existing problems and dilemmas

The development of supply chain finance for Liaoning’s technology-based SMEs is constrained by multiple

intertwined challenges, leading to the awkward situation of widespread recognition yet limited practical outcomes.

3.1. Insufficient function of core chain-leading enterprises hindering credit transmission

The effective operation of supply chain finance heavily relies on active participation and credit endorsement from core industrial chain enterprises. However, many large state-owned enterprises in Liaoning retain outdated management models and market mindsets, lacking awareness of proactively constructing and maintaining supply chain ecosystems. Prioritizing self-cost control and risk isolation, they are reluctant to confirm creditor's rights, provide guarantees, or issue credit endorsements for supporting SMEs, rendering corporate accounts receivable ineligible collateral for financing^[4]. Meanwhile, emerging potential chain leaders in new industrial sectors are still in growth stages, with insufficient strength and credit capacity to drive the entire industrial chain. The absence or low motivation of core enterprises constitutes the biggest barrier to effective credit transmission to downstream SMEs.

3.2. Severe information silos driving high risk control costs

The risk control foundation of supply chain finance lies in verifying authentic trade backgrounds and closed capital flows, which requires transparent and integrated logistics, information, and capital flows. In practice, disjointed internal information systems and inconsistent data standards across Liaoning's industrial chains create widespread information silos. ERP systems of core enterprises, financial records of SMEs, warehousing and logistics data of logistics firms, and capital transfer information of banks cannot be effectively shared or cross-verified. To verify transaction authenticity, financial institutions bear substantial labor and material costs for offline due diligence, resulting in high operational costs, slow approval procedures, and persistent risks including fake transactions and repeated financing. Severe information asymmetry pushes up transaction costs and risk premiums for supply chain finance.

3.3. Mismatched financial services with industrial characteristics and single product supply

Technology-based SMEs exhibit distinct capital demand characteristics across research and development, pilot production, and industrialization phases: early-stage enterprises prioritize venture capital, while mature entities demand debt financing based on orders and accounts receivable. Nevertheless, current supply chain financial products offered by local financial institutions predominantly focus on short-term accounts receivable and inventory financing, lacking flexibility in terms, quotas, and repayment methods to accommodate the long-cycle, high-risk, and light-asset operational features of technology firms. Exploration of financing models backed by intangible assets such as intellectual property, future income rights and equity remains insufficient. Financial institutions lack an in-depth understanding of emerging industrial chains and fail to develop specialized risk control models and customized financial solutions for niche sectors including integrated circuits and biomedicine.

3.4. Inadequate policy coordination and infrastructure support

While provincial-level policy guidance exists, implementation involves multiple government departments including industry and information technology, science and technology, financial supervision and finance, leading to weak policy coordination and low execution efficiency. Regarding risk-sharing mechanisms, government-backed financing guarantee systems provide limited coverage and credit enhancement for supply chain finance businesses, requiring innovative bank-guarantee cooperation models. Furthermore, public

infrastructure supporting supply chain finance—including a unified authoritative registration and disclosure system for movable property and rights, efficient judicial enforcement mechanisms and regional integrated supply chain service platforms—remain underdeveloped, exposing participants to elevated legal and operational risks ^[5].

3.5. Shallow application of fintech and lagging model innovation

Big data, blockchain, and the Internet of Things (IoT) represent core tools to mitigate information asymmetry and low operational efficiency in supply chain finance. However, Liaoning lags behind in integrating financial technology with supply chain scenarios. The province lacks influential third-party supply chain fintech platforms, while self-built platforms operated by core enterprises and financial institutions vary widely in technical capacity and data integration capabilities. Advanced applications such as blockchain-enabled transaction confirmation and traceability, and IoT-based intelligent movable asset supervision remain limited to sporadic pilot projects without large-scale popularization, restricting the digital, automated, and intelligent transformation of supply chain finance ^[6].

4. Optimized paths and development countermeasures based on the Industrial Chain Chief System

The core strength of the Industrial Chain Chief System lies in the coordination function of industrial chain chiefs, which overcomes limitations of spontaneous market behavior, addresses market failures from the perspective of overall regional industrial interests, and eliminates bottlenecks and pain points. Targeting the aforementioned challenges, a new supply chain finance ecosystem for Liaoning's technology-based SMEs can be constructed and improved relying on the Industrial Chain Chief System through the following measures:

4.1. Strengthening coordination functions of industrial chain chiefs and stimulating initiative of chain-leading enterprises

Industrial chain chiefs (typically provincial and municipal government officials) shall leverage their coordinating authority to advance supply chain finance development. First, establish a positive incentive mechanism by incorporating core enterprises' support for SME financing into evaluation criteria and policy support references such as project application and fiscal subsidies. Second, industrial chain chief offices shall organize regular government-bank-enterprise matchmaking conferences mandating attendance by core industrial chain enterprises to disclose supply chain management strategies, facilitating the signing of cooperation memorandums between core enterprises, financial institutions, and supporting SMEs to commit to creditor's right confirmation and data sharing. Third, encourage core enterprises to initiate or invest in supply chain finance platforms, converting their corporate credit into transferable, financeable electronic creditor certificates via digital platforms to benefit multi-tier suppliers.

4.2. Building a regional integrated supply chain finance infrastructure platform to break information barriers

Industrial chain chiefs shall coordinate relevant government departments, state-owned enterprises, financial institutions and third-party technology firms to co-invest in or authorize the operation of a unified Liaoning Provincial Integrated Supply Chain Finance Service Platform. The platform shall deliver the following core functions:

Unified interface standards enabling authorized interconnection with ERP, financial, warehousing and

payment systems of core enterprises, SMEs, logistics providers and financial institutions to realize cross-subject data sharing.

Blockchain-enabled storage and traceability of key supply chain documents including transaction contracts, purchase orders, logistics receipts and accounts receivable to guarantee immutable data and authentic trade verification.

Integration of public data from industrial and commercial administrations, tax bureaus, judicial authorities and social security agencies to generate comprehensive enterprise portraits and support risk control for financial institutions. The platform will substantially reduce information acquisition costs and improve risk control efficiency.

4.3. Diversifying financial products and services to precisely match industrial demands

Industrial chain chiefs shall organize industry experts, financial institutions and representative enterprises to research financing demands and risk characteristics of technology-based SMEs within respective industrial chains. Financial institutions shall be guided to develop differentiated and customized supply chain financial products:

Expand financing collateral categories by piloting financing backed by intellectual property pledges, equity pledges, and future income right pledges.

Innovate financing models including long-term purchase order financing, R&D-oriented risk compensation funds, and loan-equity linkage combining angel investment and venture capital.

Encourage insurance institutions to design insurance products covering supply chain disruption, product quality, and buyer default risks to provide additional credit enhancement for financing. The ultimate goal is to establish a multi-level supply chain financial service system covering the full enterprise lifecycle with matched risk and return profiles.

4.4. Improving policy support and risk-sharing mechanisms to optimize the development environment

Industrial chain chiefs shall coordinate with fiscal and financial regulatory authorities to introduce targeted supportive policies. First, set up special risk compensation funds for supply chain finance to cover a certain proportion of bad loan losses incurred by financial institutions issuing financing to SMEs within designated industrial chains, boosting lending willingness. Second, fully utilize government-backed financing guarantee institutions, mandating priority guarantee services for supply chain technology-based SMEs with appropriately reduced guarantee fees. Third, optimize the legal and judicial environment by establishing fast-track judicial channels for supply chain finance disputes to accelerate case filing, trial, and enforcement, clarify the legal validity of electronic creditor certificates, and safeguard creditor rights.

4.5. Deepening fintech empowerment to upgrade operational efficiency and risk control

The promotion of financial technology shall be designated as a key task for industrial chain chiefs to advance industrial chain modernization. First, encourage cooperation between core enterprises, financial institutions and fintech firms to deploy IoT-based intelligent warehouse supervision systems, big data credit risk models and AI intelligent approval systems. Second, support large-scale blockchain adoption in supply chain finance to realize multi-level splitting, circulation and financing of creditor certificates, ensuring clear and transparent credit circulation. Third, organize training programs for industrial chain participants to upgrade digital capabilities and data management proficiency, laying a foundation for deep fintech integration. Technology empowerment will ultimately achieve full online, automated, and intelligent supply chain finance operations, significantly lifting

service efficiency and user experience.

5. Conclusion and outlook

Financing difficulties constitute a core bottleneck restricting innovation capacity expansion and growth of technology-based SMEs in Liaoning. Conventional supply chain finance models fail to deliver full efficacy in Liaoning's practice due to insufficient motivation of core chain enterprises, severe information asymmetry, mismatched financial products, and inadequate environmental support. As an important institutional innovation, the Industrial Chain Chief System delivers robust top-level promotion tools through unique administrative coordination and resource integration capabilities to systematically address the aforementioned obstacles.

By leveraging the leading and coordinating role of industrial chain chiefs, policymakers can effectively strengthen accountability among chain-leading enterprises, facilitate the construction of public information-sharing platforms, guide financial institutions to innovate products and services, refine policy and risk-sharing frameworks, and accelerate the integrated application of financial technology. These measures will foster a new supply chain finance ecosystem built on authentic trade, data-driven credit and multi-stakeholder coordination, enabling more precise and efficient satisfaction of financing demands from Liaoning's technology-based SMEs.

Looking ahead, the supply chain financing model based on the Industrial Chain Chief System will not only ease short-term capital pressures on enterprises but also strengthen collaboration and cohesion between upstream and downstream industrial chain participants, elevating the overall competitiveness, resilience and security of industrial chains. This bears profound practical and strategic value for Liaoning amid its critical revitalization phase. Nevertheless, the maturation and popularization of this model require sustained joint efforts from governments, enterprises and financial institutions to continuously explore and refine relevant mechanisms in practice, ultimately injecting robust financial momentum into the comprehensive revitalization of Liaoning and the entire Northeast China.

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