

Implementation Obstacles and Breakthrough Paths for FinTech-Driven SME Supply Chain Finance in Qingyuan's Manufacturing

Dongjin He¹, Jinpeng Zeng², Zhengqi Zhong³, Jiajun Zhou^{4,*}

¹ Department of Physical Education, Guangdong University of Finance, Guangzhou, China

² School of Credit Management, Guangdong University of Finance, Guangzhou, China

³ Faculty of Applied Sciences, Macao Polytechnic University, Guangzhou, China

⁴ General Education Department, Southern Medical University, Guangzhou, China

* Corresponding author: Jiajun Zhou

Abstract: Against the strategic backdrop of Qingyuan City's vigorous promotion of "Manufacturing as Priority" and the "Hundred, Thousand, and Ten Thousand Projects," solving the "difficult and expensive financing" problem for SMEs in the industrial chain is key to achieving high-quality regional economic development. FinTech-driven supply chain finance is regarded as an effective paradigm for breaking through the limitations of traditional "entity credit" and activating "transaction credit." However, in the transition from theoretical vision to practical implementation, the application of this innovative model in Qingyuan's manufacturing sector still faces numerous real-world obstacles. Using theoretical analysis and logical deduction, this paper systematically identifies four core obstacles to the promotion of FinTech-empowered supply chain finance among Qingyuan's manufacturing SMEs: (1) At the technology and infrastructure level, the "digital divide" and "information silos"; (2) At the data governance and security level, "data barriers" and "compliance dilemmas"; (3) At the ecosystem and collaboration level, the "chain leader's" lack of motivation and "multi-party interest imbalance"; and (4) At the financial and commercial sustainability level, "risk paradigm mismatch" and the "absence of an inclusive business model." In response to these obstacles, this paper, from a systems engineering perspective, further constructs a "four-in-one" breakthrough path framework: strengthening digital infrastructure and data governance (top-level design), building a multi-party synergistic ecosystem (meso-level coordination), lowering the digital threshold for SMEs (micro-level empowerment), and innovating financial supervision and business models (supporting guarantees). This study aims to provide theoretical references and policy support for Qingyuan and similar regions to promote the deep integration of FinTech and manufacturing, and to build an inclusive, efficient, and secure new ecosystem for supply chain finance.

Keywords: FinTech, Supply Chain Finance, Manufacturing SMEs, Implementation Obstacles, Breakthrough Paths, Qingyuan City.

1. Introduction

"Manufacturing is the foundation of a nation." As the "North Gate" of Guangdong Province's regional coordinated development strategy and a "bridgehead" for deep integration into the Guangdong-Hong Kong-Macao Greater Bay Area, Qingyuan City is at a key historical juncture of implementing the "Hundred, Thousand, and Ten Thousand Projects" and solidifying its "Manufacturing as Priority" foundation. Qingyuan's manufacturing system, especially in clusters like the Guang-Qing Industrial Park and Yingde High-Tech Zone, exhibits a typical "core-satellite" structure: a few leading enterprises co-existing with a massive number of SME suppliers. However, for a long time, the "difficult and expensive financing" dilemma for manufacturing SMEs at the "capillary" ends of the industrial chain has remained a core bottleneck restricting their transformation, upgrading, and innovation.

Traditional Supply Chain Finance (SCF) models, particularly the "1+N" model, attempt to use the credit endorsement of the core enterprise ("1") to provide financing for upstream and downstream SMEs ("N"). However, practice has proven that this "entity credit"-based model has inherent limitations: First, credit transmission decays at each level; the core enterprise's credit often only covers first-tier suppliers

and cannot penetrate to second or third-tier suppliers at the end of the chain [1]. Second, traditional risk control relies heavily on fixed asset collateral and historical financial statements, making it difficult to assess and monetize the most valuable "movable assets" (like inventory, semi-finished goods) and "credit assets" (like orders, accounts receivable) of SMEs. This leads to a severe mismatch between financial supply and real-sector demand.

The rapid development of FinTech, especially the fusion of blockchain, the Internet of Things (IoT), big data, and Artificial Intelligence (AI), offers a new paradigm revolution for breaking this impasse. The theoretical core of FinTech-driven supply chain finance lies in shifting financial services from "reliance on entity credit" to "activation of transaction credit" and "verification of asset credit" [2]. By using technology to achieve the "four flows in one" (commercial, logistics, information, and capital), it can, in theory, rebuild trust, achieve credit penetration, and enable precise, dynamic risk control, thereby constructing an efficient and inclusive financial service landscape.

However, an undeniable reality is that although the theoretical vision of FinTech is highly attractive, its practical application and promotion (i.e., "landing") in Qingyuan's manufacturing sector have been fraught with difficulty, falling far short of expectations. Existing research has largely focused on elucidating the empowering "mechanisms" [3] or

measuring the "effectiveness" of FinTech, while lacking a systematic theoretical analysis of the specific "obstacles" and "paths" to implementation in specific regions (especially non-core cities).

Given this, the present study, grounded in the industrial characteristics of Qingyuan's manufacturing sector and the digital status of its SMEs, employs methods of pure theoretical analysis and logical deduction. It aims to answer the following core questions: What are the core implementation obstacles for FinTech-driven supply chain finance models in serving Qingyuan's manufacturing SMEs? What is the deep-seated logic behind these obstacles? And in response to these obstacles, how can a systematic and operable framework of breakthrough paths be constructed? This research seeks to bridge the gap between the "theoretical ideal" and "practical reality" of FinTech-empowered supply chain finance, providing targeted policy references for the Qingyuan municipal government, financial institutions, and manufacturing enterprises.

2. The Theoretical Vision: A Paradigm Shift in Supply Chain Finance Driven by FinTech

Before delving into the obstacles, it is essential to first clarify the "ideal form" of the FinTech-driven SCF service model and how it theoretically solves traditional dilemmas. The core logic of this model lies in substituting "relationship trust" with "technical trust," thereby constructing an entirely new foundation of "digital trust."

2.1. Blockchain Technology: Rebuilding "Transfer Trust" to Achieve Credit Penetration

The "credit fracture" in the traditional model stems from the inability of a core enterprise's credit to be transferred to N-tier suppliers. Blockchain technology, with its distributed, immutable, and traceable characteristics, creates "digital credit vouchers" (e.g., supply chain notes). The core enterprise confirms its accounts payable to a first-tier supplier "on-chain." This voucher can then be split to any amount and transferred between the first-tier, second-tier, and N-tier suppliers. Every transfer on the chain is clearly timestamped and backed by multi-party consensus. Financial institutions no longer need to rely on cumbersome manual verification; they can trust the voucher's authenticity and provide financing to any-tier SME holding it [4]. This, in theory, completely solves the "credit penetration" problem.

2.2. IoT Technology: Rebuilding "Asset Trust" to Activate Dormant Movable Assets

The failure of "movable asset" supervision in the traditional model is another dead knot in SME financing. IoT technology, through sensors, RFID, and visual recognition, assigns a unique "digital identity" to physical inventory, semi-finished goods, and production equipment, achieving "asset-account consistency." Financial institutions can remotely monitor the pledged assets 24/7 in real-time (e.g., changes in weight, location, temperature) via a platform and receive automatic alerts for anomalies. This "machine supervision" replaces "manual supervision," making the ownership and status of movable assets clear and trustworthy [5], thereby activating the largest portion of SMEs' dormant assets.

2.3. Big Data & AI Technology: Rebuilding "Risk Trust" to Enable Precise Risk Control

Traditional risk control relies on "lagging" financial reports and "rigid" collateral. Big Data and AI, by contrast, shift the focus to "real-time" operational data. By integrating "commercial flow" and "logistics flow" data from corporate ERP and MES systems, as well as external "alternative data" (e.g., tax, electricity, social security, judicial), AI algorithms can build a dynamic, multi-dimensional "corporate credit profile" [6]. This risk control model no longer assesses "what the company had in the past" but rather "what it is doing now" and "what it can do in the future" (e.g., performance capability). This emboldens financial institutions to provide credit to "asset-light" manufacturing SMEs that are rich in data and orders.

In summary, the theoretical vision of FinTech is to build an efficient service model of "full-chain penetration, full-asset activation, and full-data risk control." However, the implementation of this ideal vision encounters four core obstacles on the ground in Qingyuan.

3. Core Analysis: Implementation Obstacles for the FinTech-Driven Model in Qingyuan

Placing the theoretical model above into the real-world context of Qingyuan's manufacturing industry (especially its SME clusters, which are often recipients of industrial transfer), the obstacles to implementation are multi-dimensional and systemic.

3.1. Technology and Infrastructure Obstacles: The "Digital Divide" and "Information Silos"

The prerequisite for FinTech empowerment is "digitization." Qingyuan's manufacturing SMEs have an inherent disadvantage in this area.

1) The "Digital Divide" in SMEs Leads to a Lack of Data Sources. Many of Qingyuan's manufacturing SMEs have recently relocated from the Greater Bay Area's core cities. Their digital transformation is still in its infancy, often stuck at the level of manual bookkeeping or "Excel management." They lack basic information systems like ERP (Enterprise Resource Planning) or MES (Manufacturing Execution System). This means their core commercial, logistics, and production data is not "online" or "structured." This constitutes the most fundamental obstacle for FinTech application: big data risk control has no "data," blockchain "smart contracts" have no "commercial flow" information to execute, and IoT devices cannot be linked to corporate "order" systems.

2) "Information Silos" Lead to a Broken Data Value Chain. Even if some enterprises are digitized, data standards at the industrial chain level are highly inconsistent. The systems of core enterprises (M), SMEs (N), financial institutions (F), logistics (L), and even government (G) all operate independently. A bank's credit system cannot (or will not) interface with a core enterprise's ERP. A core enterprise's procurement system is not compatible with the heterogeneous systems of its N suppliers. Government tax and electricity data lack standard APIs to connect with bank risk control models. This landscape of "information silos" and "data

chimneys" makes the "four flows in one" technically unfeasible; the data value chain breaks down as soon it tries to cross enterprise boundaries.

3) The "Cost-Benefit" Calculation Dilemma for Technology Adoption. For an SME, deploying IoT sensors, retooling production lines for data collection, and paying for SaaS platform services are all significant, upfront, explicit costs. However, the "benefit"-financing-is uncertain before it is realized. This "cost-first, benefit-later" characteristic severely inhibits the enthusiasm of SMEs to participate in digital transformation.

3.2. Data Governance and Security Obstacles: "Data Barriers" and "Compliance Dilemmas"

If technological obstacles are a question of "can we," data governance obstacles are a question of "will we" and "dare we."

1) Multi-Party "Data Barriers" and Lack of Willingness to Share. This is the central conflict in ecosystem collaboration.

Core Enterprises (M): As "chain leaders," they control the most critical procurement, order, and quality control data. However, this data is also their core commercial secret and negotiating leverage. They lack sufficient motivation to share this "data advantage" with financial institutions (which might weaken their bargaining power) or SMEs (which might leak their supply chain layout).

SMEs (N): Highly sensitive to data privacy. They worry that once "on the cloud, on the platform," their sensitive information (production costs, client lists, process parameters) will be "spied on" by core enterprises, competitors, or the platform itself, making them "transparent" and causing them to lose all bargaining power.

Financial Institutions (F): Likewise, they have data protection barriers and are unwilling to share their core risk models and customer data with third-party tech platforms.

2) "Data Pollution" and the Challenge of Ensuring Source Authenticity. FinTech (especially blockchain) can only guarantee that data is immutable "after it is on-chain"; it cannot guarantee that the data was authentic "before it got on-chain." In IoT applications, sensors can be physically tampered with. In data collection, SMEs can falsify data at the source (e.g., in their ERP input). If this happens, any "smart risk control" or "trusted assets" based on "garbage data" will be a house of cards and may even amplify financial risk.

3) The "Compliance Dilemma" of Data Security and Privacy Protection. With the strengthening of regulations like the Data Security Law and the Personal Information Protection Law, financial institutions face unprecedented compliance pressure when aggregating multi-source data (especially alternative data like tax, social security, and utilities) to build "corporate profiles." Finding the compliant balance between "mining data value" and "protecting data privacy" is a major legal obstacle for financial institutions and platforms [7].

3.3. Ecosystem and Collaboration Obstacles: "Chain Leader" Apathy and "Multi-Party Interest Imbalance"

FinTech-driven supply chain finance is a multi-party "ecosystem," not something a single bank or company can manage alone. Building this ecosystem in Qingyuan faces severe collaborative headwinds.

1) Lack of Intrinsic Motivation from "Chain Leader" Core Enterprises. As mentioned, the core enterprise (M) is the "engine" needed to start this model. In reality, many of "chain leaders" in Qingyuan have strong financing capabilities and dominant market positions. They are often more inclined to use long payment terms to occupy their suppliers' capital, treating it as a "zero-cost" financing tool. Pushing for supply chain finance to "solve problems" for their SMEs may directly "conflict" with their own business interests. Unless the government or market provides sufficient "positive incentives" (e.g., enhanced supply chain resilience, ESG rating benefits, policy bonuses), "chain leaders" will lack the will to empower their suppliers.

2) "Multi-Party Interest Imbalance" and Ambiguous Platform Positioning. A sustainable ecosystem must be "win-win-win." In practice, the distribution of benefits is easily skewed [8]:

Who leads the platform (P) construction? If a bank leads, the platform will be overly focused on financial risk control, neglecting the conveniences of industrial collaboration. If a core enterprise leads, the platform may be distorted into a tool for the "chain leader" to strengthen control, silencing SMEs. If a tech company leads, it may fall into the trap of being "tech-heavy, finance-light," and its business model (e.g., charging for data) may conflict with the interests of banks and enterprises.

Who bears the cost? Who pays for the enormous costs of platform construction, technological upgrades, and data maintenance? Will it be the banks (passed on as financing costs), the core enterprises (as supply chain management costs), or the SMEs (as platform service fees)? This lack of clarity on rights, responsibilities, and benefits leads to a severe "free-rider" problem, where no party is willing to take the lead and invest.

3.4. Financial and Commercial Sustainability Obstacles: "Risk Paradigm Mismatch" and "Lack of an Inclusive Business Model"

Finally, the obstacles return to the essence of finance: risk and return.

1) Financial Institutions' "Risk Paradigm Mismatch." Traditional banks' credit approval and risk control systems are built around "entity credit" and "fixed collateral." The FinTech-advocated model, based on "transaction credit" and "dynamic data," is a "risk paradigm revolution" for banks. Bank loan officers lack the capability to understand and evaluate "digital assets." Their internal risk models and due diligence exemption mechanisms have not kept pace with technology. When faced with new "technical risks" like smart contract loopholes, AI algorithm bias, or platform operational failures, banks generally adopt a "wait-and-see" and risk-averse stance.

2) The "Inclusive Finance" Commercial Sustainability Problem. The original intent of FinTech is "inclusion," i.e., lowering financing costs for SMEs. However, if the construction and operation costs of the platform (tech investment, compliance costs, data costs) are too high, these costs will inevitably be passed on in the form of higher interest rates. If the final financing cost remains high, or if the process remains cumbersome (e.g., requiring complex "on-chaining" procedures), SMEs will be "unable to afford" or "unwilling to use" it. This leads to a platform that "has a price but no market," fails to achieve economies of scale, and

ultimately falls into a "high-cost, low-traffic, unsustainable" business dilemma.

4. Breakthrough Paths: Constructing a "Four-in-One" Collaborative Governance Framework

Overcoming the four major obstacles above cannot be achieved by a "single-point" breakthrough from one technology or one party. It requires a systematic solution based on Qingyuan's regional characteristics, one that involves the synergistic efforts of government, industry, finance, and technology in a "four-in-one" framework.

4.1. Top-Level Design: Strengthening Digital Infrastructure and Data Governance to Break "Technology" and "Data" Barriers

This is the "foundation" of the new ecosystem. To address the digital divide and data barriers, the government must lead the top-level design.

1) Build a "Government-Guided, Market-Operated" Regional "Industrial-Financial Data Hub." It is recommended that the Qingyuan government take the lead, in conjunction with core parks like Guang-Qing, to establish a regional "Industrial-Financial Data Hub." The role of this hub is not to "replace" banks or tech platforms, but to act as an "infrastructure" provider. Its core functions are: unifying data standards (e.g., establishing uniform API specifications for the park) and providing public data services (e.g., opening query interfaces for government data like tax, electricity, social security, and public records to financial institutions, with enterprise authorization).

2) Comprehensively Promote "Privacy-Preserving Computation" (PPC). To break the "data barriers" and "compliance dilemmas," the "data hub" and financial institutions should be required to adopt "data-usable-but-not-visible" PPC technologies (e.g., Federated Learning, Multi-Party Computation). Under this framework, data from all parties (banks, core enterprises, government) never leaves its local environment. Only encrypted models are used for joint modeling and risk calculation. This both protects commercial secrets and data privacy while unlocking data value, making it the key technical path to solving the lack of data-sharing willingness [9].

4.2. Ecosystem Governance: Building a Multi-Party Collaborative Ecosystem with the "Chain Leader" as the Fulcrum to Break "Collaboration" Barriers

This is the "gearing" of the new ecosystem. To address the "chain leader's" lack of motivation and the interest imbalances, effective incentive and coordination mechanisms must be established.

1) Establish Positive Incentive Mechanisms for "Chain Leader" Core Enterprises. The government should issue special policies to provide clear financial incentives (e.g., interest subsidies, tax reductions, "green-light" approvals) for "chain leader" enterprises that proactively open their data and use blockchain platforms to confirm "digital vouchers" for their upstream SMEs. Their "empowerment" of SMEs should be linked to their "industrial cluster contribution" and "Social Responsibility (ESG)" ratings, turning their "unwillingness to act" into "proactive action."

2) "Pilot First" and "Model-Led" Approach. Select 1-2 key industrial clusters in Qingyuan with good digital foundations and high "chain leader" willingness (e.g., smart home, new materials) as "test beds" for "FinTech + SCF." Concentrate government, bank, and tech resources to "dissect the sparrow," creating a "model room" of a "M+N+F+P+G" multi-win ecosystem. By verifying the business model, smoothing out the operational processes, and accumulating risk data from successful pilots, the model can then be rolled out from "point to plane."

3) Cultivate Neutral "Ecosystem Operation Service Providers (P)." Clarify the market positioning of the platform. Encourage the formation of a mixed-ownership, neutral "Ecosystem Operation Service Provider," jointly funded by financial institutions, core enterprises, and tech companies. This service provider would be responsible for the platform's technical iteration, daily operation, and customer service. Its profit model should be guided by the government to ensure its "quasi-public good" nature, preventing it from being distorted into a "profit tool" for a single party [10].

4.3. Micro-Level Empowerment: Lowering the Digital Threshold for SMEs to Break the "Digital Divide"

This is the "nerve endings" of the new ecosystem. To address the "no data, no willingness" problem of SMEs, they must be "helped onto the horse and given a push."

1) Promote "SaaS-based" Lightweight Digital Tools. The government should partner with tech platforms to promote low-cost, standardized, "SaaS-based" (Software as a Service) cloud ERP and MES systems tailored to Qingyuan's manufacturing SMEs. It is recommended that the government issue "digital service vouchers" to specifically subsidize SMEs for "moving to the cloud and onto platforms." This move can quickly solve the data source gap for SMEs, giving them the "entry ticket" to the SCF ecosystem.

2) Strengthen "Digital Literacy" and "Financial Literacy" Training. The park management committees and industry associations should take the lead in organizing regular, specialized training for SME owners. This training should, on one hand, help them understand the new concept of "data as an asset," and on the other hand, familiarize them with the operational procedures for "digital credit vouchers" and "IoT financing," thereby eliminating their "mysticism" and "fear" of new technologies and boosting their motivation to participate.

4.4. Supporting Guarantees: Innovating Financial Supervision and Business Models to Break "Sustainability" Barriers

This is the "lifeblood" for the ecosystem's long-term operation. To address "risk mismatch" and "business model absence," guarantees must be provided through financial supervision and innovation.

1) Actively Apply for a "FinTech Regulatory Sandbox." Qingyuan should proactively petition national and provincial financial regulators to establish a "FinTech Regulatory Sandbox." This would allow financial institutions within its jurisdiction to pilot new risk control models based on "dynamic data" and "IoT movable asset" credit products, all within a "risk-controlled, limited-scope" environment. The sandbox mechanism provides banks with "room for trial and error" and a "fault-tolerance mechanism" for innovation,

accelerating the iteration of their internal risk paradigms [10].

2) Construct a "Government-Bank-Insurance" Multi-Level Risk-Sharing Mechanism. In the initial promotion phase, to leverage banks' willingness to issue "first loans," it is recommended to establish a multi-level risk-sharing system composed of a "government risk compensation fund," "bank credit," and "insurance/guarantee companies." If a default occurs on an inclusive loan issued under the new model, the loss would be shared by the three parties according to a pre-agreed ratio, thereby mitigating the risk concerns of financial institutions.

3) Explore "Profit-Sharing" Sustainable Business Models. The operation of the new ecosystem should abandon the traditional "high-interest-margin" model and move towards a new model of "low-profit, high-volume, multi-party profit-sharing." For example, the bank earns a basic interest margin, the platform charges a low "technical service fee" or "data risk control fee," and the core enterprise benefits indirectly from a more stable supply chain. This ensures that the "cost-reduction and efficiency-gains" of FinTech ultimately benefit the SMEs, achieving the commercial sustainability of "inclusive finance."

5. Conclusion

FinTech-empowered supply chain finance offers an unprecedented historical opportunity to solve the financing dilemma of Qingyuan's manufacturing SMEs. However, the "last mile" from "theoretical vision" to "practical reality" is by no means a simple technical issue; it is a complex "systems engineering" problem involving technology, data, ecosystems, business, and regulation. This study has shown that Qingyuan, in advancing this work, faces fundamental technical obstacles (the "digital divide" and "information silos"), data governance obstacles ("data barriers" and "compliance dilemmas"), ecosystem collaboration obstacles ("chain leader" apathy and "interest imbalances"), and commercial sustainability obstacles ("risk paradigm mismatch" and "absence of an inclusive business model").

Overcoming these obstacles requires moving beyond "single-point" technical thinking and shifting to "collaborative governance" ecosystem thinking. Qingyuan must use top-level government design as its guide, "data infrastructure" (especially privacy-preserving computation) as its foundation, "pilot models" and "chain leader incentives" as its fulcrum, and "SME SaaS adoption" as its entry point, all while supplemented by supporting guarantees like "regulatory sandboxes" and "risk-sharing." This "four-in-one" systematic breakthrough framework is the only way for the

"inclusive water" of FinTech to truly penetrate all barriers and precisely irrigate the "capillaries" of Qingyuan's manufacturing industry, providing a solid, efficient, and sustainable financial pillar for the "Manufacturing as Priority" strategy.

Acknowledgments

Funding Support:

Qingyuan Science and Technology Think Tank Special Project Funding for "Research on the Innovation of Supply Chain Financial Service Models for Small and Medium-sized Manufacturing Enterprises in Qingyuan City Driven by Financial Technology" (QYZKYB-2025-08).

References

- [1] Song, H. (2017). Innovation in Supply Chain Finance: Models, Mechanisms, and Trends. *Finance & Trade Economics*, 38(07): 5-16.
- [2] Huang, Y., & Gou, Q. (2023). The Essence, Impact, and Regulation of FinTech. *Economic Research Journal*, 58(08): 1-19.
- [3] Li, Y., & Tu, M. (2020). How Blockchain Reconstructs the Credit Mechanism of Supply Chain Finance. *Economist*, (04): 73-81.
- [4] Huo, J., Zhang, Q., & Wang, Y. (2023). The Credit Enhancement Effect and Realization Mechanism of Blockchain Application in Supply Chain Finance. *Journal of Finance and Economics*, 49(05): 173-188.
- [5] Wan, J., & Li, J. (2022). How IoT Technology Solves the Dilemma of Movable Property Pledge Financing? - A Theoretical Analysis Framework. *Financial Forum*, 27(03): 24-33.
- [6] Zhang, Y., & Liu, H. (2022). Big Data Credit Reporting, Credit Resource Allocation, and SME Financing. *Journal of Financial Economics*, 37(01): 85-100.
- [7] Qi, S., & Wang, Z. (2021). The "Digital-Intellectual" Dilemma and Solutions for FinTech-Empowered Supply Chain Finance. *Financial Theory & Practice*, 42(06): 120-128.
- [8] Jiang, Z., et al. (2020). Supply Chain Finance Ecosystem: Evolution, Obstacles, and Chinese Experience. *International Financial Research*, (08): 76-86.
- [9] Shen, L., & Sun, F. (2021). Smart Supply Chain Finance Driven by IoT, Big Data, and AI: A Conceptual Framework and Future Prospects. *Management Review*, 33(10): 331-341.
- [10] Yang, D., & Yao, S. (2021). The Chinese Path of "Regulatory Sandbox": From FinTech to the Digital Economy. *Law Science*, (06): 134-149.