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Cross-Border Trade Financing Model for Textile SMEs Based on Blockchain: Taking the Confirmation of Accounts Receivable of Fabric Exporters in the Yangtze River Delta as An Example

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Article

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ABSTRACT

To address the financing challenges faced by small and medium-sized enterprises (SMEs) in the textile industry, particularly in the processing and trade of natural fiber products such as cotton and yarn, this study proposes an innovative blockchain-based cross-border trade financing model to promote the sustainable development of textile manufacturing. The model integrates Radio-Frequency Identification (RFID) technology with Internet of Things (IoT) devices, embedding tracking tags at the initial stages of textile production, such as the weaving process, to achieve full digital traceability from textile raw materials to exported finished products. A comparative case study of 10 textile enterprises in China's Yangtze River Delta region demonstrates that this model significantly reduces the financing cycle from an average of 18–25 days to just 5–7 days. Its core value lies in shifting the foundation of trust from corporate reputation to verifiable, tamper-proof transaction data, which meticulously records key textile processing parameters like yarn specifications, fabric structure, and processing flows. This study not only confirms a viable technological pathway for solving the financing problems of textile SMEs but also presents a new application for textile materials in supply chain verification and management.

KEYWORDS

textile industry, blockchain, trade financing, sustainable development, textiles

INTRODUCTION

With the implementation of the “Belt and Road” policy, China's integration into global trade continues to deepen. The textile industry, as a dominant industry in China’s export trade, accounts for a large proportion

of cross-border trade shares. Driven by the construction of the "Belt and Road," China's total foreign trade in goods and services increased from $4.4 trillion in 2012 to $6.9 trillion in 2021 [1]. Through investigation and research, some studies have shown that customs can build a blockchain digital ecosystem to empower trading companies and financial institutions, and develop a digital real economy through the effective combination of digital technology and traditional real economy, which can improve customs clearance efficiency, accelerate the return of trading companies' funds, and form a strong competitive advantage [2]. Other studies have indicated that owing to various factors, such as exchange rate fluctuations, payment uncertainty, and credit risk, cross-border trade financing has always been one of the challenges faced by foreign trade companies [3]. Blockchain technology, as a disruptive new technology, has begun to demonstrate its unique advantages in the field of international trade financing [4], such as reconstructing cross-border payment, factoring financing business models, and improving the efficiency of domestic factoring financing companies and suppliers' collection of payments [5]. Therefore, the current application of blockchain technology in the field of supply chain finance is mainly concentrated in supply chain, smart contracts, Internet of things (IoT), and risk management [6]. In the context of the continuous digitalization of the economy and society, blockchain has brought hope for addressing unresolved challenges, making it an increasing concern by academia, practitioners, and policymakers [7,8].

In 2019, there were nine demonstration enterprises for intelligent manufacturing in the textile industry in Jiangsu Province, three in Zhejiang Province, and one in Anhui Province. On December 9, 2021, Zhejiang Province issued the first national guiding document titled, "Several Opinions on Vigorously Developing Digital Trade," for the development of digital trade [9]. Overall, the digital economy and high-quality development of the textile industry in the Yangtze River Delta region are highly correlated and in a high-level coupling stage. The coupling coordination degree has been steadily improving year by year, transitioning from the initial stage of severe coordination to the stage of high-quality coordination. The relative development degree is always in a synchronous development stage [10]. Therefore, cross-border trade research in this region shows high representativeness and necessity. Blockchain technology is a decentralized digital ledger that has performed well in various applications in the financial field, from smart contracts automating processes, such as loan issuance and trade financing, to digital currencies providing solutions for cross-border payments, small payments, and remittances, thereby enhancing financial inclusion [11]. The textile industry is China's main export industry. The digital economy has effectively promoted the digital development and transformation of many domestic textile companies, giving companies a new opportunity to restructure their models [12].

Therefore, cross-border e-commerce, as a new business model, has become an important means to innovate new ways of international trade [13].

Accordingly, note that contradictions exist between efficiency and cost in the application of blockchain in trade financing, as well as disputes over the balance between privacy protection and data sharing. Therefore, this study optimizes node deployment to control latency within an acceptable range and adopts a hierarchical authorization mechanism to solve this problem. Therefore, although existing literature has verified the feasibility of blockchain technology in cross-border trade financing for textile small and medium-sized enterprises (SMEs) in supply chain finance, shortcomings still exist in cross-border financing in the textile industry. These limitations include lack of technical standardization, insufficient cross-border regulatory collaboration, and weak IT capabilities of SMEs. This study takes the accounts receivable confirmation of fabric exporters in the Yangtze River Delta as an example to explore the blockchain-based cross-border trade financing model for textile SMEs. On the basis of the enrichment of similar research, the current study guides the textile industry on how to effectively carry out cross-border trade financing, thereby enhancing the industry's own competitive advantage in cross-border trade and contributing to the economic growth of China's cross-border trade.

RESEARCH CONTENT

Basic Concepts

Accounts receivable is a spontaneously formed commercial credit in commodity trading. As accounts receivable's scale increases year by year, its natural deficiencies in settlement and financing functions become increasingly prominent, resulting in difficulty to fully utilize its financial instrument's payment settlement and financing functions [14]. The review of contracts and vouchers ensures the authenticity and effectiveness of a series of business transactions conducted by enterprises by verifying original documents, such as sales contracts, invoices, and delivery notes. At present, the top five industries for accounts receivable are construction decoration, electronics, pharmaceuticals and biology, mechanical equipment, and electrical equipment. In particular, the accounts receivable of the construction decoration industry is significantly higher than that of the second-ranked electronics industry. The difference in accounts receivable scale between industries is related to the overall scale and characteristics of the industry [15].

Problems with Accounts Receivable of Fabric Exporters in the Yangtze River Delta

First, financing is difficult and costly. At present, small and medium-sized textile exporters in the Yangtze River Delta region generally suffer from insufficient credit qualifications, resulting in their difficulty obtaining low-cost financing from various financial institutions. Taking banks as an example, under the traditional supply chain finance model, banks generally only provide financing services to core enterprises or first-tier suppliers in the region owing to risk control factors. SMEs located downstream at multiple levels cannot obtain low-cost financing from banks because of lack of credit endorsement. For example, Jiangsu Province has successively built over 90 cross-border e-commerce industrial parks and incubation bases with certain scale, including 78 industrial parks and incubation bases established in 10 cross-border e-commerce comprehensive experimental zones, such as Nanjing and Suzhou [16].

Second, there are information islands and difficulty in confirming ownership. Given that the textile supply chain includes multiple links, such as raw material procurement, production and processing, logistics and transportation, and trade settlement, and multiple entities are involved, the ERP systems used are not compatible, which can easily lead to information islands. Such information islands will increase the difficulty for financial institutions to verify the authenticity of companies' trade background, increase the risk of corporate financing, and be unfavorable for financing. Simultaneously, core enterprises generally do not provide accounts receivable confirmation services for downstream multi-level suppliers for commercial privacy protection and management costs, thereby further increasing the difficulty of financing for SMEs.

Lastly, there are exchange rate and policy risks. The Yangtze River Delta region, as an important base for China's textile and clothing exports, has a relatively high annual textile and clothing export volume. However, in the complex and ever-changing international situation, textile SMEs in this region need to bear significant exchange rate fluctuations and policy risks. For example, in the European and American markets, as the main export regions in the past, textile and clothing exports in this region have fluctuated substantially owing to regional political conflicts, trade protectionism, and other reasons, which is not conducive to enterprise financing [17].

CONSTRUCTION OF ACCOUNTS RECEIVABLE FINANCING MODEL BASED ON BLOCKCHAIN

System Structure

By using the Hyperledger Fabric architecture, we build a blockchain-based accounts receivable financing

model, linking exporters, importers, commercial banks, third-party quality inspection agencies, and government agencies in cross-border trade, and maximizing the technical advantages of blockchain [18]. This model is shown in Figure 1.

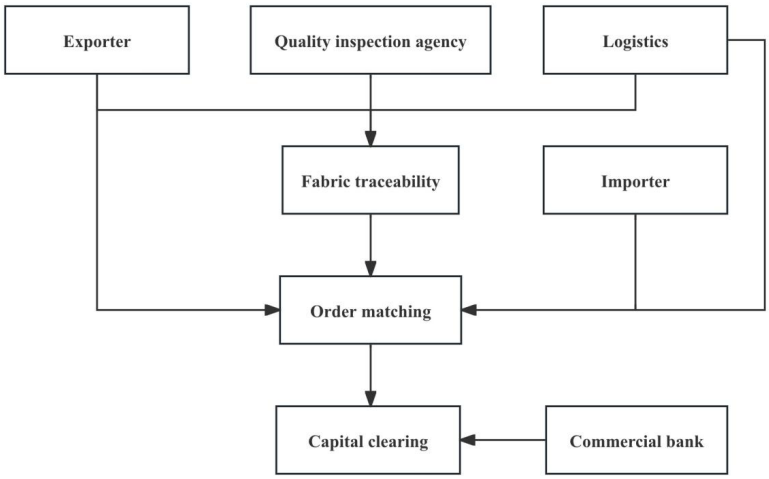

Figure 1. Blockchain architecture display of the textile industry

(1) Fabric traceability: A single fabric batch is implanted with an RFID tag with a fixed cost unit price, and the company's production data are collected in real time through IoT devices, including raw material information, production process details, and quality inspection data. Moreover, IPFS is used to distribute data storage, and file hash values are uploaded to the chain to ensure the authenticity and immutability of the data. After encrypting the RFID tag data, they are uploaded as RFID data → IPFS hash on chain. The hash value of the quality inspection report is uploaded to the chain, which is the basis for quality inspection data → financing review.

(2) Order matching: The blockchain smart contract template meets the ISO 10383 trade data standard and automatically compares the order data of the exporter's ERP system and the importer's procurement platform. The comparison mainly includes key information, such as fabric specifications, quantity, and delivery date. If the comparison fails, then the manual review process is triggered and a record is left on the blockchain. Order data are automatically synchronized through smart contracts, which is called order data comparison request → response. If the comparison fails, then the manual review process will be triggered, which is called comparison failure → manual review leaving a trace.

(3) Funds settlement: By connecting to the Cross-Border Payment System (CIPS), smart contracts are used to implement the operation of confirming ownership and releasing loans. When the order is successfully

matched and the logistics information shows that the goods have been shipped, the bank automatically releases a financing limit of up to 80% of the accounts receivable. Moreover, the funds are automatically deducted from the importer's account and transferred to the exporter's account on the due date. If there is a default, then the default will be handled through the dispute arbitration process of the blockchain. After the goods are loaded onto the ship, the logistics data are pushed to the bank through API, thereby triggering the financing loan process, which is the loading notification → financing loan. Payment will be automatically deducted from the due date, which is the importer node → bank node. Real time synchronization of regulatory data (i.e., full link data → compliance audit).

The Hyperledger Fabric's modular architecture, compared with the Corda and Quorum frameworks, supports flexible deployment of multiple nodes, and its privacy protection channel is suitable for multi subject data sharing in the textile supply chain. The aforementioned modular architecture also supports smart contract customization, such as fabric traceability rules. However, the consensus efficiency of this framework is affected by the number of nodes, and the distribution of nodes needs to be optimized in cross-border scenarios. In this study, the framework can be applied to the textile supply chain in the Yangtze River Delta involving over 10 entities, and Fabric's Channel mechanism can achieve hierarchical data isolation for exporters, banks, and regulatory agencies, thereby meeting industry privacy requirements. The integration technology process of RFID and IPFS is as follows.

Step 1: Fabric batch identification: Implant ISO 11784/85 standard RFID tags in the fabric production process to store batch number, weight, yarn count, and other information.

Step 2: Data collection and encryption: Real time reading of tag data through IoT devices, encrypted using AES-256 algorithm to generate hash values, such as 0x3a5f... 8d2e.

Step 3: IPFS distributed storage: Store the encrypted raw data in the IPFS node, and upload the file hash value to the chain for authentication, ensuring that the data are traceable and tamper proof.

Step 4: On chain verification mechanism: When banks review financing, they call IPFS hash values through smart contracts, compare them with on chain certificates, and verify the authenticity of the fabric traceability data. System security is founded on standard cryptographic hash algorithms, which ensure the integrity of data recorded on the blockchain. In our interviews, banking partners frequently emphasized that this high-level data immutability is a key reason they are willing to place trust in the platform and streamline their risk assessment processes.

Key Process Optimization

The Chinese government has stated in the 14th Five Year Plan and 2035 Long Range Objectives Outline that it will "accelerate the development of new models such as cross-border e-commerce and market procurement trade" to promote the coordinated development of imports and exports, and accelerate the cultivation of new advantages in participating in international cooperation and competition [19]. Furthermore, overall business efficiency can be effectively improved based on blockchain technology, particularly by restructuring and optimizing key financing processes, as shown in Table 1.

Table 1. Traditional and blockchain financing models

Key Processes	Traditional Model	Blockchain Model
Document Submission	Manual mailing takes 3–5 days	Real-time upload on the chain, automatic verification
Title confirmation review	Manual verification by multiple departments takes 10–15 days	Smart contract automatic verification, takes one hour
Financing and loans	Mortgage guarantee, limited amount	Pure credit financing, real-time payment
Risk control	Manual due diligence	Dynamically monitor the entire transaction process data

As shown in Table 1, the key process of cross-border trade financing for textile SMEs based on blockchain technology, compared with the traditional model, can achieve real-time on-chain uploading and automatic authenticity verification of documents in document submission, significantly shortening the time investment of traditional manual mailing and inspection. The smart contract method is adopted in the title confirmation review to automatically verify the title confirmation, thereby shortening review time to one hour. Blockchain technology emphasizes pure credit financing in financing and lending and adopts a real-time payment method to substantially improve the capital application efficiency of enterprises. In risk control, the method of dynamically monitoring the data of the entire transaction process is adopted to effectively prevent possible problems in the manual due diligence process and improve the ability to control financing risks.

If research suggests that blockchain plays an important role in cost and security when used in P2P energy trading by eliminating any involvement from the outside world and third parties, then this study designs and

develops a three-layer architecture analysis model and hybrid algorithm for network analysis in blockchain based P2P energy trading systems. The research results indicate that by analyzing the fitting results of the proposed model and algorithm, and benchmarking them with the most advanced existing technologies, the proposed algorithm clearly shows significant improvements in network latency generation results [20].

CASE STUDY ANALYSIS

To explore the practical implications of blockchain-based financing models, this study adopts a multiple-case study approach. This methodology enables an in-depth examination of the processes, participant experiences, and contextual factors influencing the effectiveness of financing models, thereby offering extensive insights that purely quantitative data cannot capture.

Case Selection and Data Collection

We deliberately selected 10 small and medium-sized textile exporters from the Yangtze River Delta region and divided them into two comparison groups. The experimental group (Cases AE) consists of five companies that have actively used blockchain-based trade financing platforms (as described in Section 3) for over a year. The control group (Cases FJ) includes five companies matched to the experimental group in terms of firm size (annual export volume within ±15%), primary export markets (e.g., North America, EU), and years of operation (±3 years), but which continue to rely on traditional financing methods.

A purposive sampling strategy was utilized for case selection. We first obtained a list of textile exporters from the Yangtze River Delta Textile Industry Association. From this initial sample of over 300 companies, we screened 40 potential candidates based on such criteria as being registered as SMEs and having engaged in cross-border trade for over five years. Thereafter, we contacted these companies to gather information on their financing practices. Among the respondents, we identified seven companies using blockchain platforms and selected five, based on their willingness to participate, for inclusion in the experimental group. For each selected experimental case, we identified a matched control case from the candidate pool that met our predefined criteria (e.g., firm size, export market) and secured their participation.

Data were collected between February and May 2024, through triangulation to ensure reliability.

Semi-structured interviews: In-depth interviews were conducted with the financial managers of the 10 companies to understand their workflows, perceived costs, risks, and overall experiences.

Document analysis: We reviewed financing documents from both groups (e.g., contracts, invoices, bills of

lading) and mapped out their end-to-end financing processes.

Illustrative transaction data: We gathered descriptive data on typical financing cycles and cost structures for specific transactions to validate the interview findings.

The interview transcripts and documents were analyzed using thematic analysis to identify recurring patterns and key differences between the two groups.

Comparative Analysis of Financing Models

The analysis revealed substantial differences between the two financing models, primarily centered around three core themes:

(1) Process efficiency,

(2) Trust mechanisms and risk perception, and

(3) Cost structure and access to financing.

Theme 1: Process Reengineering and Efficiency Gains

The most immediate difference lies in the radical simplification of financing procedures under the blockchain model. Figure 2 presents a comparative flowchart of the two processes.

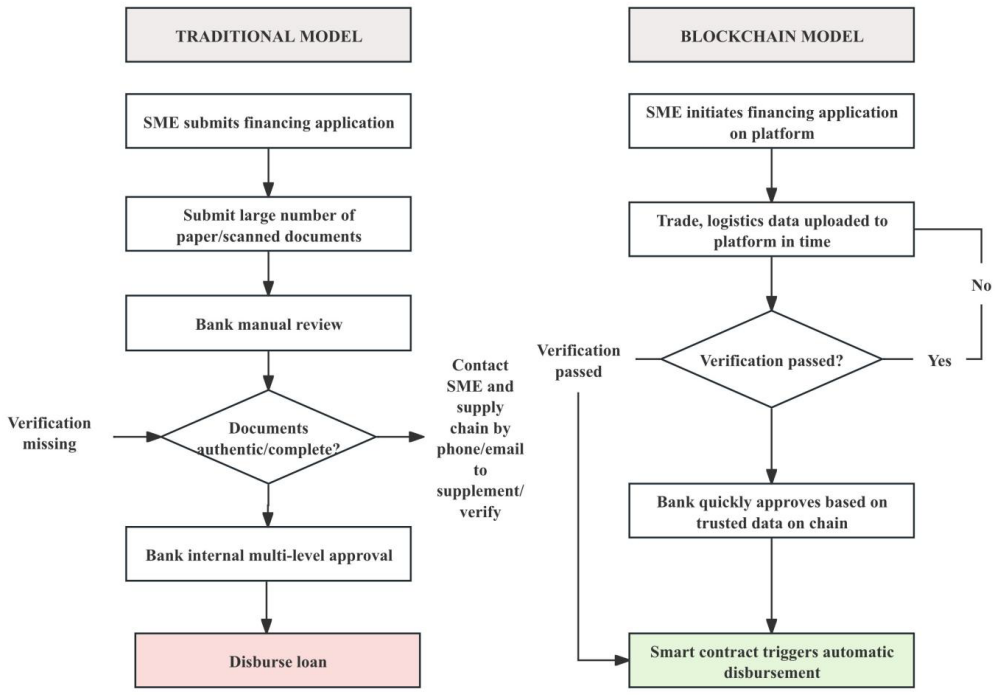

Figure 2. Comparative Workflow Diagram of the Financing Processes

In the traditional model, the financing process was consistently described as fragmented and labor-intensive. As the manager of Company F noted: "*Every time we apply for financing, it feels like running a marathon. We have to email the bank a pile of scanned documents. A week later, they might call back because a number on the invoice is blurry. Then we have to get our overseas client to reconfirm the order via email. The back-and-forth is a nightmare.*"

This manual, sequential process led to long and unpredictable financing cycles. Companies in our study reported that it typically took 18–25 days from application to loan disbursement. By contrast, the blockchain model demonstrated a streamlined and integrated workflow. The technology reengineers the process from a series of handoffs into a single, shared source of data. A manager from Company A described the experience: *"It's a night-and-day difference. We upload the purchase orders and shipping documents directly to the platform. The system automatically verifies the goods against the order using RFID data from the warehouse. The bank can access everything in real time. There's no need for calls or emails to confirm details. What used to take weeks now takes just 5–7 days."* Although occasional complications, such as unique customs requirements, may still cause minor delays, the five participants from the experimental group reported that the average financing cycle had become significantly shorter and far more predictable compared with their previous experiences with traditional methods.

Theme 2: Trust Mechanisms and Risk Perception

Beyond efficiency gains, one of the blockchain model's core contributions lies in its ability to fundamentally reshape the foundations of trust.

In the traditional model, trust was gradually built through reputation and enforced through costly and repetitive manual verifications. Banks often perceived a high level of information asymmetry and risk of fraud. As a banking representative working with Company G noted: *"Our biggest challenge is verifying the authenticity of the underlying transaction. We're expected to trust, but we still have to manually check everything—which increases our operational risk and cost."*

By contrast, the blockchain model embeds trust systematically throughout the entire process. The immutability and transparency of the ledger provide a verifiable record of the complete transaction history—from fabric production to shipment. This situation shifts the foundation of trust from subjective reputation to objective, shared data. As the manager of Company C explained: *"In the past, banks funded us based on*

our reputation. Now, they fund us based on our data. They no longer have to rely solely on trust in us—they can trust the system. That's crucial for getting our receivables recognized as legitimate assets."

Theme 3: Cost Structure and Access to Financing

The transformation of processes and trust mechanisms has a direct impact on cost structures and the accessibility of financing. Although this study does not aim to provide a precise statistical comparison of costs, our interviews and document analysis revealed clear differences in perceived cost structures and the factors affecting financing accessibility, as summarized in Table 2.

Fundamentally, the high operational costs and elevated risk perceptions associated with the traditional model are passed on to SMEs in the form of significantly high fees and strict lending criteria. By reducing these costs and mitigating risk, the blockchain model enables lower financing costs and improved access for SMEs in our experimental group.

Table 2. Comparative Analysis of Financing Cost and Accessibility

Comparison Dimensions	Traditional Model	Blockchain Model
Core Processes and Efficiency	The process is described as "fragmented" and "sequential." It relies on emails, phone calls, and physical documents exchanged among multiple parties, with each step dependent on the completion of the previous one. *"What we fear most is the back-and-forth. We send the documents to the bank, then they reach out to the core client for verification. That alone takes a week."* — Financial Manager, Company F	The process is described as "integrated" and "synchronized in real-time." All parties access and verify information on a shared platform, shifting the process from sequential to parallel. *"There's no more 'back-and-forth.' Once we upload the data, both the bank and logistics providers can see it simultaneously—and know it's tamper-proof. The efficiency gains are revolutionary."* — Financial Manager, Company A
Trust-building Mechanisms	Based on "relationships" and "repetitive verification." Trust is built through long-term business relationships and redundant manual checks of each transaction. SMEs are heavily reliant on their personal or corporate creditworthiness. *"The bank trusts us, but they trust their own eyes more. So, no matter the size of the deal, they recheck all the documents every time."* — Financial Manager, Company G	Based on "system architecture" and "data consensus." Trust is embedded in the technological framework. Banks place their trust in immutable, consensus-validated on-chain data, rather than in unilateral assertions by the enterprise. *"Now, the bank trusts the data—not me. Ironically, that makes it easier for SMEs like us to earn their trust. Our transaction data itself becomes our best credit."* — Financial Manager, Company C
Cost Perception and Composition	Costs are described as "high and unpredictable." Key components include (1) relatively high interest rates to offset bank risk and operational costs, (2)	Costs are described as "transparent and manageable." Key components include (1) predictable platform service fees; (2) generally lower

	significant "hidden labor costs" spent on communication and document management, and (3) "opportunity costs" resulting from slow processes.	interest rates, as reported by participants; and (3) a significant reduction in internal labor costs. *"Previously, costs were vague—you never knew how much time staff spent chasing payments. Now it's just a platform fee—clear and visible. We can budget much better."* — Financial Manager, Company E
Access to Financing	High barriers based on entity credit. Banks prefer to finance large enterprises or high-value orders with strong credit ratings. Small, frequent transactions are often deemed "uneconomical" and declined. *"If it's a small order worth just a few thousand dollars, the bank won't even consider it—the cost of processing the paperwork alone makes it unviable."* — Financial Manager, Company J	Lower barriers based on transactional credibility. Automation reduces the cost of verifying individual transactions, making financing more dependent on the authenticity of the transaction than on company size. *"Now, we can package all of our legitimate orders—big or small—on the platform for financing. This has unlocked a huge amount of working capital that used to be stuck. It was unthinkable before."* — Financial Manager, Company B

RECOMMENDATIONS FOR OPTIMIZATION BASED ON CASE STUDY FINDINGS

Although our comparative case study underscores the significant potential of the blockchain-based model, it also reveals several practical barriers and concerns that may hinder its broad adoption. We draw on insights gathered from the 10 participating companies and propose the following targeted recommendations.

Establishing Industry-Led Public Service Platforms

A recurring theme in our interviews, particularly among managers in the control group (Cases FJ), was the prohibitive cost and technical expertise required to develop or join private blockchain consortia. As the manager of Company H noted: *"The benefits sound promising, but as a small business, we can't afford to build such a system ourselves."* This idea highlights a critical barrier to adoption. To lower the entry threshold for SMEs, we recommend that industry associations, such as the China National Textile and Apparel Council, spearhead the development of industry-wide public service platforms. These platforms should operate on a software-as-a-service (SaaS) basis, enabling enterprises to pay subscription fees based on usage. This approach would transform heavy capital expenditures into predictable operating costs. The platform should provide standardized modules, such as basic node deployment, trade-financing smart contract templates, and data encryption services, which can be seamlessly integrated with existing enterprise systems.

Strengthening Cross-Border Regulatory Coordination

Our interviews revealed that managers of companies exporting to multiple regions—particularly the EU, as

in Cases A and G—expressed uncertainty about complying with varying data privacy regulations, such as GDPR. Such a regulatory ambiguity constitutes a significant risk. To ensure the long-term compliance and viability of blockchain-based models, we recommend establishing cooperative regulatory frameworks with major trading partners to create clear and harmonized standards for cross-border data sharing. A "compliance by design" framework should be developed, ensuring that platform architectures inherently respect regional data residency requirements. For example, data could be stored on domestic nodes while granting foreign regulators permissioned, auditable access for verification, thereby striking a balance between transparency and data sovereignty.

Enhancing Platform Trust and Privacy Mechanisms

One of the key findings from our case study is the "data trust paradox": managers value the transparency offered by blockchain but simultaneously worry about exposing sensitive commercial information to partners or competitors. As the manager of Company F expressed: *"If all my orders are on a shared ledger, what if my competitors can see my prices and client lists?"* To address this legitimate concern, we recommend implementing independent third-party security audits to review the platform's privacy algorithms and access-control protocols. Providing compliance reports to enterprises can strengthen trust in the actual platform. In addition, robust, multi-layered data authorization mechanisms should be deployed, enabling enterprises to set granular permissions, such as ensuring that importers can only view their own order data, while banks have access solely to financing applications under review.

Standardizing Industry-Specific Data Protocols

Our process analysis of the experimental group companies indicated that even when using blockchain platforms, inconsistent data formats posed challenges in integrating information from various logistics partners, suppliers, and internal ERP systems. Therefore, data interoperability is crucial for scalability. We recommend accelerating the development and adoption of the Textile Industry Blockchain Data Standards and embedding standardized validation gateways into the public service platform. All data should undergo automatic verification against these standards before being uploaded to the blockchain, thereby preventing the emergence of data silos on the actual ledger.

Developing A Pragmatic Roadmap for Technological Deployment

Beyond cost concerns, managers in the control group frequently cited the technical feasibility of integrating modern blockchain platforms with legacy ERP systems as a major challenge. A “rip-and-replace” strategy is not viable. Therefore, a phased deployment roadmap is essential: promote the adoption of standardized API protocols to serve as bridges between existing enterprise systems and blockchain platforms, thereby minimizing disruption during integration. For companies with relatively old systems, the public platform could offer data cleansing and conversion services, ensuring that legacy data are accurately and compliantly mapped onto the blockchain, thereby facilitating a considerably smooth transition.

CONCLUSION

This comparative case study of 10 textile SMEs provides an in-depth exploration of how blockchain technology can transform cross-border trade financing. Our findings demonstrate that blockchain-based models, through the creation of a shared, tamper-proof ledger, can fundamentally streamline workflows, reduce the need for manual verification, and establish systemic trust among trading partners, banks, and other stakeholders. Although traditional models are hampered by trust deficits stemming from information silos and asymmetries, the blockchain approach shows clear potential to address these core pain points by making trade processes substantially transparent, automated, and auditable.

Thus, this study offers an extensive, context-specific understanding of the mechanisms through which blockchain can create value in SME trade financing, going beyond theoretical advantages to determine the dynamics of real-world applications. However, as a qualitative study with a limited sample size, our findings are intended for analytical, rather than statistical, generalization. Future research should build upon this exploratory foundation by conducting large-scale quantitative surveys and data analyses to measure the precise impact of blockchain-based models on financing costs and efficiency across the industry, thereby validating the patterns observed in this study.

Author Contributions

Yun Li and Yangzi Zhang designed the study; all authors conducted the study; Yangzi Zhang and Yun Li collected and analyzed the data. Yangzi Zhang and Yun Li participated in drafting the manuscript, and all authors contributed to critical revision of the manuscript for important intellectual content. All authors gave final approval of the version to be published. All authors participated fully in the work, took public responsibility

for appropriate portions of the content, and agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or completeness of any part of the work were appropriately investigated and resolved.

Conflict of Interest

The authors declare no conflict of interest.

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Ethics Approval and Consent to Participate

This survey was conducted in compliance with [Ethics Committee of Henan Institute of Economics And Trade] (HN/JINGMAO-141). Participants were informed of the study's purpose and data usage prior to participation, and responses were collected anonymously. No personally identifiable information was stored.

Availability of Data and Materials

The datasets used and/or analysed during the current study were available from the corresponding author on reasonable request.

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Not applicable.

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