Applied Artificial Intelligence Research

INNOVIAIR

When Algorithms Push Firms to Cheat: AI, Blockchain, and Financing in China

Ming Fu[a,*]

[a]Guangzhou Institute of Science and Technology, Guangzhou, Guangdong 510540, China

ARTICLEINFO

Keywords:
SMEs
Financing Constraints
Artificial Intelligence
Blockchain
Governance Synergy
Dual-Threshold Mechanism

ABSTRACT

As pillars of China's economy, SMEs(Small and Medium-sized Enterprises) face persistent financing frictions. To address these challenges, the government promotes digital finance tools such as artificial intelligence (AI) and blockchain. AI enables rapid risk assessment and improves efficiency but often imposes rigid standards that overlook SME conditions, creating algorithmic pressures and incentives for data manipulation. Blockchain enhances governance through immutable, transparent records but raises compliance costs and adaptation burdens. Drawing on interviews with SME owners, managers, and financial intermediaries, this study applies grounded theory to analyze how AI and blockchain jointly reconfigure financing governance in China. Findings reveal that algorithmic rigidity and blockchain transparency interact, generating systemic tension while compelling institutional adaptation from firms. This dynamic converges into a state of governance synergy, wherein the technologies' complementary functions are institutionalized, ultimately producing a dual-threshold financing mechanism. Under this mechanism, firms must sequentially pass AI-driven credit screening and blockchain-based data verification. This research advances digital governance theory by framing technology as an active institutional shaper and contributes to SME finance literature by elucidating the paradigm shift from relationship-based to protocol-based financing logic.

1. Introduction

As SMEs are the bedrock of the Chinese economy, they create jobs, drive local development, and encourage competition. However, SMEs still experience longstanding financing challenges. Traditional finance institutions treat SMEs as risky borrowers due to their weak collateral, volatile cash flows, and lack of credit history. As a result, credit rationing occurs systematically, and SMEs have limited access to external finance. The problem is not only global, but it is more pronounced in China because China's growth strategy depends significantly on SMEs for industrial upgrading and regional equity[1].

Given these structural constraints, the Chinese government encourages digital finance to expand credit access. New technologies can improve risk assessment, reduce fraud, and increase lending opportunities. Artificial intelligence (AI) serves as the primary method for risk control. AI offers speed and consistency because it takes less time to process loan applications. Further, it is rigid because the system often uses fixed indicators and cannot consider firm-specific situations. Many SMEs consequently experience loan rejection due to technical standards that do not reflect their true performance. Some scholars warn that algorithmic systems replicate bias, ignore contextual information, and generate perverse incentives for firms to manipulate data[2]. Although AI regulation improves efficiency in lending decisions, it also triggers questions of fairness and accountability. These questions reveal underlying institutional frictions. In recent years, scholars in finance and information systems have found that AI improves efficiency at the expense of human judgment and firm-specific judgment in credit evaluation[3].

Blockchain has been promoted as an additional governance route. Its immutable, transparent, and traceable records will lower fraud and improve the willingness to lend and borrow[4]. Credit data standardization and smart contract enforcement are anticipated to improve compliance and lessen opportunism. Nevertheless, there are also significant costs associated with blockchain adoption. Digital reporting, compliance adaptation, and regulatory compliance place a heavier financial burden on SMEs. Recent international work also finds that although blockchain improves transparency, it may give rise to new governance tensions and conflicts, and even strengthen

* Corresponding author.
E-mail address: 15796734137@163.com.
https://doi.org/10.65455/d2tq5y61
Received 19 January 2026; Received in revised form 20 January 2026; Accepted 28 January 2026; Available online 20 March 2026

inequality between firms with different levels of digital capability[5].

Taken together, AI and blockchain constitute a dual governance system. AI speeds up the credit assessment process, whereas blockchain ensures record keeping integrity. The overall impact is improved oversight, but also an increased pressure on SMEs. SMEs must comply with more stringent standards as regulators become more reliant on digital infrastructure. This double control gives rise to a paradox: although digital technologies expand access in principle, they also constrain firms through algorithmic rigidity and compliance costs. To date, most scholarship has examined AI and blockchain separately, often focusing on technical performance or single governance outcomes. Fewer studies have examined how the joint use of AI blockchain reconfigures financing practices and governance logic for firms, SMEs in particular.

This gap is particularly salient in China where digital finance is used not only as an instrument to facilitate credit inclusion but also as a tool for regulatory control. Existing research lacks a coherent explanation to how the dual technological pressures give rise to SMEs' adaptive strategies and reconfigure the institutional logic of financing. This study fills the gap by exploring how AI risk control and blockchain governance exert combined pressures to give rise to governance synergy and a dual-threshold financing mechanism in China. Based on grounded theory approach informed by interviews with SME owners, financial managers, and industry intermediaries, this study develops a conceptual model that explains how algorithmic rigidity, blockchain transparency, systemic tension, and institutional adaptation collectively reconfigure financing governance.

2.Review

2.1.SME financing constraints and digital challenges

Small and medium-sized enterprises (SMEs) are widely recognized as engines of economic development, employment, and innovation, especially in emerging markets. Yet, they consistently face severe financing constraints. According to the World Bank, nearly 65 million firms in developing economies experience unmet financing needs, totaling over $5.2 trillion annually. In China, SMEs account for over 60% of GDP and 80% of employment, yet they often struggle to secure formal credit due to perceived risk and limited transparency.

Classic economic theory highlights information asymmetry as the core barrier to SME finance. Banks and other lenders have less credible data sheets on SMEs than on large firms, leading to higher perceived default probabilities and lower credit access[1,6]. The financial growth cycle model also shows how young firms have to depend on informal sources before they can be credentialed on the basis of reputation or assets[7]. In the European context, it is noteworthy that persistent institutional bottlenecks and the bank-dominated credit system continue to impede SME financing[8].

However, new studies show that digital financial technologies are helping to mitigate these bottlenecks. In China, firms such as Ant Group and JD Finance have opened up alternative credit access based on transaction information, online ratings, and behavioural metrics[9]. Digital inclusive finance has also proven valuable in serving special needs in specific regions and among non-state-owned SMEs[10,11]. However, these gains are tempered by digital literacy gaps and concerns over data security. Recent evidence also shows that government financial aid, when combined with digital tools, significantly improves SME survival rates during crises[12]. The structural transformation driven by digital technologies has reshaped the entry dynamics and governance frameworks of firms, especially SMEs, in ways that require them to adapt continuously to evolving technological environments[13].

2.2.Artificial intelligence in financial risk control

Artificial Intelligence (AI) has become a cornerstone of digital credit assessment, allowing financial institutions to process vast datasets—including invoices, tax reports, utility bills, and social media footprints—to build predictive credit models[14,15]. These AI systems significantly reduce loan processing time and improve prediction accuracy.

Despite these advantages, AI introduces new complexities. Most systems rely on static indicators that often overlook SME-specific nuances, such as seasonal cash flows or informal labor. This results in “algorithmic rigidity” where context-blind automation hurts firms that cannot meet normalized data expectations. In turn, SMEs may “game” input criteria to meet algorithmic thresholds, even if only performatively, with no corresponding changes in their operations.

In addition, AI models are often called “black boxes” opaque about how they arrive at their decisions[10]. This hurts stakeholder trust and causes concern about AI fairness, especially when SMEs are denied credit without explanation. Hence, there is growing support for Explainable AI, or Explainable Artificial Intelligence (XAI), which renders algorithmic decision-making transparent and accountable[16,17].

Governments and regulators are catching up to these problems. China is developing AI governance policies to ensure fairness and compel compliance with changing data privacy regulations[18]. Government policy will be essential to the long-term health of AI in finance.

2.3.Blockchain and the promise of transparency

Blockchain technology offers significant benefits in addressing data authenticity and integrity in financial systems. Through immutable ledgers and timestamped records, blockchain prevents tampering and provides transparent audit trails for financial transactions[19].

In the context of SME financing, blockchain helps lenders verify documents such as tax filings, purchase orders, and supply chain transactions. Studies show it reduces fraud, enhances creditworthiness, and streamlines compliance audits[20]. However, the technology also presents challenges. SMEs often face high adoption costs and limited technical expertise. Additionally, blockchain raises privacy concerns, as

sensitive operational data may become visible to regulators or ecosystem participants[21].

In China, blockchain is heavily policy-driven. National initiatives encourage its use in taxation, customs, and procurement to promote transparency and combat corruption[22]. Integration with state-backed platforms like the Digital Tax System has led to partial automation of compliance. While this formalizes SME operations, it also imposes significant adaptation burdens.

Emerging literature explores blockchain's synergy with AI, particularly in data provenance, real-time validation, and smart contract automation[23]. These hybrid models are still nascent but present promising governance architectures.

2.4.Governance synergy and institutional adaptation

Few studies have examined how AI and blockchain interact as a joint governance mechanism. Together, they form a dual system: AI accelerates credit evaluation, while blockchain secures the integrity of the underlying data. This dual control mechanism reflects a new form of digital governance that imposes both efficiency and compliance pressures on SMEs.

Firms are responding. Some firms choose to invest in their IT or compliance officers; others choose to outsource data structuring and reporting. These responses demonstrate an institutional adaptation process where compliance is seen not as a trap but an opportunity for capability enhancement[9].

The institutionalization depicted here builds on Berger and Udell's[7] model but digitalizes it. Digital SMEs are shifting from informal to formal, rules-based accountability mechanisms, often forced by formal government requirements and platform entanglement. The digital state infrastructure supported by the Chinese government has embedded compliance into ordinary business life[24].

Remarkably, some digitally entangled SMEs use this compliance to create competitive credentials, such as securing faster credit and joining upper-tier supply chains. These new "compliance capabilities" are distinguishing firms that are less likely to be affected from those that are more vulnerable in digital SME markets.

2.5.Toward a dual-threshold financing mechanism

With the convergence of AI and blockchain, the process of SME financing is undergoing a structural change: the emergence of dual-threshold financing. That is, SMEs first need to pass the AI-based credit check, which screens digital footprints, behavioral signals, and transaction information , before they need to be blockchain verified for data authenticity and state compliance[14,25].

SMEs face the new protocol in place of relationship lending. It enhances transparency and accountability, but also raises new risks of exclusion for SMEs without digitized information or facing algorithmic biases. Interestingly, the dual-thresholds are not purely technological, but reflect two layers of governance filters by market and state actors.

Field evidence shows that firms that successfully overcome the dual-constraints face better credit terms, have better reputational capital, and also lower monitoring costs[26,27]. However, the system also generates tension. Firms must continuously adapt to evolving digital standards, manage cross-platform interoperability, and mitigate risks of over-compliance.

This financing mechanism reflects China's broader policy agenda of integrating technology and regulation to promote systemic trust. While similar models are emerging globally, particularly in trade finance, China provides a unique case where policy-led digital governance shapes market behavior directly.

While existing studies offer insights into SME finance, AI risk modeling, and blockchain transparency, most treat these technologies separately. There is limited understanding of how AI and blockchain interact to form integrated governance systems that redefine compliance, financing logic, and institutional behavior in SMEs. Moreover, few studies examine how SMEs strategically respond to these dual pressures. How do they convert compliance costs into organizational capabilities? How does digital governance formalize formerly informal sectors? These questions remain underexplored, particularly in policy-intensive contexts like China.

This study addresses these gaps by investigating how AI and blockchain jointly produce governance synergy and establish a dual-threshold financing mechanism, using China's SME sector as an empirical case.

3.Research design and method

3.1.Research methods

Grounded Theory was first introduced by Anselm Strauss and Barney Glaser from Columbia University in 1967. It is a research method that helps scholars understand and explain social phenomena in depth[28]. The main purpose of this approach is to extract meaningful concepts from daily experiences and social practices. These concepts are then used to build new theoretical frameworks.

This method starts with data collection based on specific research questions. The process is inductive and bottom-up. Researchers apply three steps: open coding, axial coding, and selective coding. These steps help transform raw data into concepts and categories[29]. Data are constantly compared, summarized, and classified. Theory and data interact throughout the process. This cycle leads to the creation of new theories that capture the core meaning of the phenomenon, as shown in Figure 1.

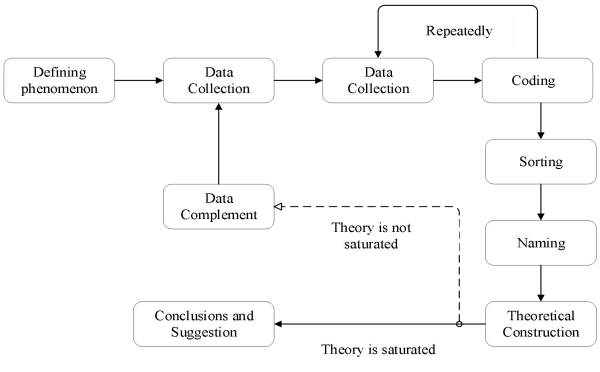

Fig 1. Flow chart of grounded theory

Grounded Theory provides a systematic way to do qualitative research. Earlier qualitative studies often relied too much on personal experience and training. This approach instead offers a clear process. It guides the researcher in thinking, analyzing data, and developing theory. It is different from quantitative research. Quantitative studies usually start with hypotheses and depend more on researcher judgment. Grounded Theory avoids this problem because it does not rely on preconceived ideas[30]. Data collection and data analysis happen at the same time. The method builds theory directly from the coding of raw data. It does not depend only on logic or prior assumptions.

3.2.Sample selection and data collection

This study used purposive sampling to gather data from Chinese small and medium-sized enterprises (SMEs). Purposive sampling is often applied in qualitative research because it allows researchers to select cases that provide the most relevant and rich information. The firms in this study had direct experience with AI-based risk control and blockchain governance in financing. The sample included businesses from manufacturing, trade, and services. Specifically, 30 SMEs were selected: 12 from manufacturing, 10 from trade, and 8 from service industries. This distribution helped capture both shared patterns and sector-specific practices.

The main data came from semi-structured interviews, which are effective in grounded theory studies for eliciting detailed insights from participants. In total, 30 in-depth interviews were conducted. The respondents included 12 firm owners, 10 financial managers, and 8 industry intermediaries. Each interview lasted 60 to 90 minutes. The interviews focused on AI review mechanisms, blockchain applications, financing fraud, and compliance strategies. Respondents were encouraged to share personal experiences and to describe concrete cases of algorithmic pressure, blockchain verification, and adaptation under regulatory constraints.

The study also collected supplementary materials. These included company documents, industry guidelines, and policy reports. Such triangulation enhanced the robustness of the analysis by validating findings from multiple sources. Data collection and coding took place at the same time, consistent with grounded theory principles. After 27 interviews, no new substantive categories emerged. Three additional interviews were conducted to confirm theoretical saturation. This ensured the completeness and reliability of the data set[31].

3.3.Research process

3.3.1.Open coding

The main purpose of open coding is to transform raw data and phenomena into concepts. First, the interview transcripts were coded and marked line by line to generate preliminary concepts and identify conceptual categories. To minimize the influence of researcher bias on coding quality, the original words of the respondents were used as much as possible to extract initial concepts. During the open coding phase, a total of 810 original statements and their corresponding initial concepts were obtained. Because there was a high degree of overlap among the original statements, reclassification and consolidation were conducted to categorize the initial concepts. In addition, initial concepts with low frequencies were removed, and only those that appeared more than three times were retained. As a result, 63 initial concepts and 17 categories were obtained, as shown in Table 1.

Table 1. Analysis of open coding

Primary Source Statements	Conceptualization	Generalization
"The loan system requires me to upload bank statements, but the actual turnover is not enough." "AI review only looks at numbers, not the real situation." "Indicators are too rigid and don't match actual business conditions."	Algorithm rigidity, excessive indicators, forcing firms to falsify	I. Algorithmic Pressure in Risk Control
"If we don't submit complete tax data, the system directly rejects us." "AI automatically denies loans when invoice anomalies are detected." "Lack of flexibility blocks many SMEs." "Algorithmic review has no human judgment."	Data compliance rigidity, rigid review, lack of flexibility	II. Rigidity of AI Review
"Peers are all faking bank statements; if I don't, I can't get a loan." "Fabrication has become an unspoken rule." "The stricter the system, the more we find ways to circumvent it." "Some even study how to trick AI review."	Adaptive cheating, collective fabrication, system gaming	III. Financing Fraud as a Hidden Rule
"We bought a package of fake invoices, ready within minutes." "Agencies help produce fake materials, charging high fees." "There is a complete industry chain serving financial fraud."	Third-party involvement, gray industry chain, fraudulent services	IV. Intermediary Chains of Fraud
"After the blockchain invoicing system went online, fake invoices were no longer usable." "Once data is on-chain, it cannot be changed." "Fake records are easily exposed on-chain." "Financial records must be standardized to pass loan reviews."	Blockchain anti-counterfeiting, immutability, financial standardization	V. Blockchain Anti-Counterfeiting Mechanism
"Banks directly access on-chain data; we don't need to submit it again." "High transparency eliminates many opportunities for fraud." "Blockchain makes loan reviews faster and safer." "Small firms can no longer exploit loopholes."	Data transparency, information sharing, reduced fraud opportunities	VI. Blockchain-Enhanced Transparency
"AI risk control emphasizes efficiency but ignores SMEs' practical difficulties." "Blockchain emphasizes compliance but raises costs." "The combination constrains firms but also increases burdens." "We feel squeezed from both sides."	Efficiency–compliance tension, increased costs, dual constraints	VII. Tension Between Algorithm and Blockchain
"Blockchain requires us to be compliant, but it also pushes us to formalize gradually." "In the long run, it's beneficial." "Although difficult at first, it forces us to be more transparent."	Positive governance effects, long-term compliance, incentivized formalization	VIII. Positive Governance of Blockchain

"AI only looks at data, not seasonal market fluctuations." "Blockchain is also a cold technology." "Technology has no warmth, lacks human judgment." "When problems occur, no one can explain."	Technological coldness, lack of flexibility, absence of human touch	IX. Cold Effects of Technology
"We began to learn financial compliance actively." "Firms hired specialists for on-chain reporting." "Digital governance actually improved our capabilities." "Compliance costs turned into learning costs."	Capacity building, institutional learning, organizational adaptation	X. SME Adaptation
"Government requires fintech firms to connect with blockchain systems." "Policies push banks to use on-chain data." "Compliance gradually becomes institutionalized." "Noncompliant firms face greater pressure." "Regulation has become normalized."	Policy-driven, institutional embedding, mandatory enforcement	XI. Policy Embedding and Institutionalization
"AI review is faster than manual checks." "Blockchain reduces room for human manipulation." "Overall financing processes are more efficient."	Faster review, reduced human intervention, efficiency gains	XII. Technological Efficiency Gains
"Some firms feel full data transparency is unsafe." "On-chain information is entirely controlled by regulators." "There are concerns about business privacy leakage." "Sometimes even client data gets exposed."	Privacy concerns, data security, trust dilemma	XIII. Data Privacy and Trust
"Fraud may succeed in the short term, but once traced the consequences are severe." "Blockchain raises the long-term cost of noncompliance." "Many are turning to compliance." "The risks of noncompliance outweigh the benefits."	Rising violation costs, long-term deterrence, compliance trend	XIV. Compliance and Deterrence
"Banks now rely on dual AI + blockchain systems." "Platform interconnection reduces loopholes." "A new governance ecology is forming." "Cross-institutional data sharing is smoother."	Technological synergy, complementary governance, upgraded financing ecology	XV. Technological Synergy in Governance
"When applying for loans, we first try to meet algorithmic indicators." "Then we make sure on-chain data is correct." "Financing logic has become dual compliance with algorithm and blockchain." "This is an entirely new financing process."	Dual thresholds, algorithm–blockchain sequencing, new financing logic	XVI. New Financing Logic
"We first prepare data to meet AI indicators, then adjust accounts to satisfy blockchain verification." "The financing process is no longer a single step but two sequential gates." "This sequential compliance path has become normalized in our financing practices."	Sequential compliance, dual-gate mechanism, institutionalized process	XVII. Sequential Compliance Path

Table 1 presents a synthesized structure of the open and axial codes derived from the grounded theory process. These codes are not raw data fragments but conceptual categories formed through iterative comparison, constant coding, and theoretical sampling. Each entry reflects deeper patterns identified across interviews and serves as the foundation for the core categories. The following narrative further elaborates on the relationships among these codes and demonstrates how they contribute to the construction of the emergent theoretical model.

3.3.2.Axial coding

The logical relationship between categories is identified from four aspects: condition, vein, action strategy, and result. In the open coding stage, the corresponding sub-categories (concept classification) are preliminarily generalized. In the axial coding phase, these dimensions are further aggregated and analyzed. Finally, 6 main categories are extracted from 17 sub-categories, as shown in Table 2.

Table 2. Axial Coding Analysis

Main Category	Corresponding Open Codes	Category Connotation
Algorithmic Pressure	I. Algorithmic Pressure in Risk Control; II. Rigidity of AI Review; III. Financing Fraud as a Hidden Rule; IV. Intermediary Chains of Fraud	Rigid algorithmic standards in risk control push SMEs toward falsification; hidden rules and intermediaries emerge as adaptive responses.
Blockchain Transparency	V. Blockchain Anti-Counterfeiting Mechanism; VI. Blockchain-Enhanced Transparency; VIII. Positive Governance of Blockchain; XIV. Compliance and Deterrence	Blockchain's immutability and transparency curb falsification, raise violation costs, and foster compliance and financial standardization.
Systemic Tension	VII. Tension Between Algorithm and Blockchain; IX. Cold Effects of Technology; XIII. Data Privacy and Trust	The interaction of AI and blockchain creates dual constraints—efficiency vs. compliance, technological coldness, and persistent privacy concerns.
Institutional Adaptation	X. SME Adaptation; XI. Policy Embedding and Institutionalization; XII. Technological Efficiency Gains	SMEs adapt through compliance learning; policies institutionalize blockchain practices; efficiency gains reshape financing processes.
Governance Synergy *(bridge category)*	XV. Technological Synergy in Governance	Serves as the convergence point of algorithmic pressure, blockchain transparency, systemic tension, and

		institutional adaptation. It embodies the collaborative integration of technology, institutions, and governance, channeling these influences toward a new financing outcome.
Dual-Threshold Financing Mechanism	XVI. New Financing Logic; XVII. Sequential Compliance Path	The final outcome: financing becomes structured by two sequential gates—algorithmic review and blockchain verification—forming a compliance-oriented dual-threshold mechanism.

3.3.3.Selective coding and theoretical model

In the axial coding phase, researchers further discovered that the categories interact through several typical relational structures. Algorithmic Pressure, Blockchain Transparency, Systemic Tension, and Institutional Adaptation are all closely related to Governance Synergy. From this, Governance Synergy was identified as a bridge category. Additionally, the factor directly leading to the Dual-Threshold Financing Mechanism is Governance Synergy, while the other categories influence this outcome through their interaction with it. Governance Synergy thus serves as the central linkage that integrates technology, institutions, and governance. The researcher integrated the relevant data into a comprehensive theoretical model.

Table 3. Classification of Typical Relational Structures

Typical Relational Structure	Connotation of Relational Structure	Statement Text (Part of Examples)
Algorithmic Pressure→ Governance Synergy	Rigid AI risk control standards generate pressure and drive fraudulent attempts, but when interacting with blockchain mechanisms, this pressure becomes embedded in the governance framework.	"Loan review indicators are too rigid, so we had to fabricate invoices to pass."
Blockchain Transparency→ Governance Synergy	The immutability and traceability of blockchain create strong compliance constraints, providing the foundation for collaborative governance.	"Once invoices are on-chain, we have no choice but to standardize accounting."
Systemic Tension→ Governance Synergy	The dual constraints of AI and blockchain (efficiency vs. compliance, privacy concerns, technological coldness) necessitate collaborative governance mechanisms to balance tensions.	"The system is efficient, but it feels cold and ignores our real difficulties."
Institutional Adaptation→ Governance Synergy	Policy embedding and organizational adaptation push firms toward gradual compliance and create conditions for governance synergy.	"Banks now require blockchain-verified data, so we had to reorganize our reporting processes."
Governance Synergy →Dual-Threshold Financing Mechanism	The complementary integration of algorithmic review and blockchain transparency generates a "dual-threshold, sequential compliance" financing logic.	"We must first meet algorithmic criteria and then ensure on-chain data is clean—this has become the new financing process."

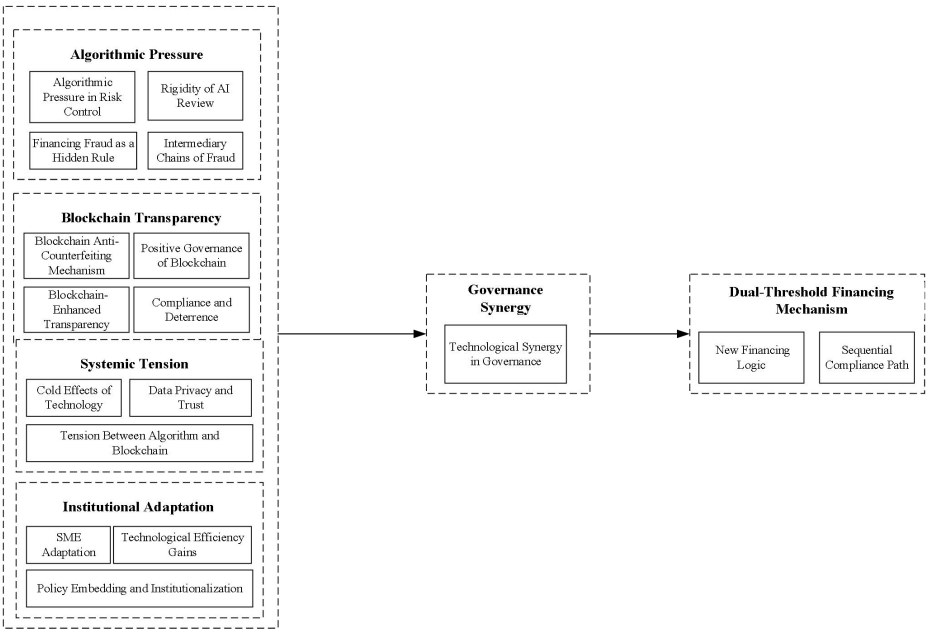

Fig 2. The influencing factors of the formation of the dual-threshold financing mechanism under governance synergy

Thus, we have constructed a model of the factors influencing the formation of the dual-threshold financing mechanism under governance synergy, as shown in Figure 2.

3.3.4.Theoretical saturation

When additional interviews no longer generated new concepts or categories—indicating that theoretical saturation had been achieved—further data collection was concluded. To evaluate the robustness of the conceptual framework, a comparative coding analysis was conducted on several subsequent interviews beyond the initial set. A saturation check revealed no additional categories or new relational structures, confirming that theoretical saturation had been achieved—a concept increasingly debated in qualitative research for its utility and clarity[32]. Consequently, it was determined that expanding the sample was unnecessary. The findings confirm that the theoretical model of dual-threshold financing has reached saturation and can be regarded as stable and complete[31].

4.Research analysis and results

The grounded theory analysis identified five typical relational structures. Each reflects a close linkage between categories and shows how AI risk control and blockchain governance jointly shape SME financing practices. These structures explain the pathway through which fragmented pressures are transformed into the dual-threshold financing mechanism.

4.1.Algorithmic pressure and governance synergy

Algorithmic pressure is the first factor that influences SME behavior. Firm interviews also show that AI-based risk control system only takes into account rigid information such as tax records or bank transaction histories, completely ignoring firm's seasonal income or informal employees. Faced with algorithmic pressure, SMEs tend to engage in intentional falsification even with the assistance of fraud agencies.

Scholarship such as "static algorithmic thresholds" in SME credit scoring corroborates our findings. For example, JD Finance reportedly employs more than 30,000 risk indicators and 500 AI models to score SME creditworthiness. While this raises efficiency, it also means that firms with rigid information — such as structured digital records — face challenges[33]. Furthermore, AI-based systems have been shown to institutionalize data manipulation among smaller firms under financial pressure[34].

Yet, algorithmic rigidity facilitates the emergence of governance synergy when combined with blockchain systems. Rather than encouraging unchecked deception, rigid standards begin to enforce order and transparency when institutionalized within a broader compliance infrastructure[35]. In short, AI pressure — while harsh — serves a governance function when coupled with accountability mechanisms.

4.2.Blockchain transparency and governance synergy

Blockchain contributes by increasing data integrity and compliance visibility. Respondents noted that once records like invoices or transaction logs are placed "on-chain" they are no longer alterable. Several interviewees stated that this has deterred them from using fabricated materials altogether, as they fear being permanently flagged by lenders or regulators.

This aligns with empirical research on blockchain's immutability and real-time traceability. JD.com's blockchain-enabled supply chain finance platform has significantly reduced credit fraud and transaction lag by providing lenders with immediate access to verified data[36]. Blockchain also removes discretion in document interpretation, further reinforcing governance synergy between platforms, lenders, and regulators[37].

Lockchain's impact is not only technical but also cultural. Respondents described how transparency compelled them to internalize new standards of reporting. Scholars similarly note that blockchain can enforce long-term compliance by increasing the reputational and legal costs of non-conformance[20]. Moreover, the integration of blockchain with AI technologies has been shown to enhance regulatory compliance by improving both transparency and operational efficiency in governance systems[38].

4.3.Systemic tension and governance synergy

While AI and blockchain each contribute positively to transparency and efficiency, their integration creates systemic tension. Respondents described being "squeezed from both sides" where AI prioritizes speed and data minimalism, while blockchain emphasizes exhaustive transparency and permanent accountability. This duality imposes contradictory demands, leaving SMEs overwhelmed.

This tension is supported by literature showing that both technologies lack human sensitivity. AI systems rarely offer explanations for loan rejections, while blockchain's transparency often exposes sensitive business information[34]. The result is what one respondent called "technological coldness"—efficiency without empathy.

Despite this friction, tension also creates the space for governance innovation. As digital systems mature, scholars argue for "balanced digital oversight" where the strengths of AI (efficiency, prediction) are used to streamline processes while the strengths of blockchain (integrity, trust) secure compliance[39]. The synergy lies in using systemic tension to refine protocols that are both robust and adaptable.

4.4.Institutional adaptation and governance synergy

Under dual technological pressure, SMEs are not passive recipients — they adapt. Interviews revealed that many firms began hiring compliance consultants, implementing digital accounting systems, and restructuring internal governance to better interface with AI and blockchain infrastructures.

These organizational adaptations reflect what scholars call "compliance capability building." Rather than viewing compliance as a sunk cost, firms increasingly treat it as a

competitive asset. Recent findings show that digitally compliant SMEs receive preferential loan terms and access to higher-value supply chains[9]. Similarly, AI-driven early warning models allow firms to proactively manage financial risks, reducing default probabilities[40].

On the policy side, state mandates are accelerating this process. Government-led integration of AI and blockchain into platforms such as the National Tax System has normalized dual compliance expectations[41]. This institutional embedding represents a paradigm shift—from informal credit access to formalized, technology-driven financial ecosystems.

4.5.Governance synergy and the dual-threshold financing mechanism

Governance synergy acts as the integrative force connecting all previous elements. Respondents frequently described their financing process as a "two-step gate": first passing AI-based risk evaluations, then satisfying blockchain-based compliance checks. "This is the new financing logic" one respondent summarized. "We must meet both criteria—algorithm and blockchain."

This dual-threshold model is increasingly prevalent. Studies show that integrated AI + blockchain platforms outperform traditional systems in both fraud detection and credit scoring[42]. In JD.com's case, blockchain-based finance was shown to reduce processing time, while AI models predicted default risks in real time[36].

More importantly, the dual-threshold system redefines the logic of SME finance. Instead of relying on personal relationships or offline documentation, firms must align with digital standards and platform protocols. This has regulatory implications: not only are firms required to comply, but platforms themselves become extensions of the regulatory state[43].

5.Conclusion and implications

5.1.Conclusions

This study, employing grounded theory, systematically examines how AI risk control and blockchain governance jointly reshape SME financing in China. The core conclusions first elucidate the dynamic formation path of the "dual-threshold financing mechanism." This mechanism is not a mere overlay of technologies but stems from a systematic process of governance reconfiguration. The initial "technology-institution" dual pressure — namely, the data manipulation incentives induced by algorithmic rigidity and the compliance constraints reinforced by blockchain transparency—interacts to generate systemic tensions such as efficiency-compliance conflicts. These tensions compel firms to undertake institutional adaptation, including capacity building and process restructuring. Driven by policy embedding, the aforementioned pressures, tensions, and adaptive behaviors ultimately converge and crystallize into governance synergy, signifying the evolution of technology from independent tools into a complementary and integrated governance system. This synergy, in turn, gives rise to the novel "dual-threshold financing mechanism," wherein firms must sequentially pass the "algorithmic credit screening" and "blockchain data verification" thresholds, fundamentally transforming financing logic from "relationship-based" to "protocol-based."

Second, this study makes distinct contributions to relevant theories. For digital governance theory, it moves beyond the view of technology as neutral, demonstrating how AI and blockchain act as active "institutional shapers" whose interaction and synergistic effects can catalyze new governance structures. For institutional theory, it reveals the proactive adaptability of firms under strong techno-institutional pressures, specifically how they convert "compliance costs" into "compliance capabilities," thereby enriching research on organizational responses within institutional complexity. For SME finance theory, it clarifies the structural shift in financing logic driven by digitization—from reliance on soft information in relationship-based lending to dependence on hard data and technical protocols in dual-threshold financing — providing a framework for understanding the profound impact of digital finance in emerging markets.

Finally, this study engages with and extends contemporary scholarly discourse. The findings corroborate the risk that algorithms may incentivize data manipulation[10], while also aligning with the positive role of blockchain in enhancing transparency[36]. Furthermore, the "governance synergy" effect revealed here and the resulting sequential financing thresholds resonate with emerging directions exploring the integration and optimization of AI and blockchain[35]. This highlights the necessity of developing more adaptive regulatory technologies that can mitigate algorithmic rigidity and protect corporate privacy while pursuing efficiency.

5.2.Policy implications

The findings offer critical implications for various stakeholders. For policymakers, it is crucial to prudently assess the "rigidity" side-effects of AI risk models, promote the development of explainable AI, and retain necessary channels for human review to reduce distortive incentives for SMEs. When advancing blockchain-based data transparency, a robust data privacy protection framework must be implemented simultaneously to maintain SME trust. Differentiated technical compliance support policies should also be designed to assist SMEs with weak digital capabilities, preventing technological empowerment from turning into technological exclusion. For financial institutions, the perspective should extend beyond using blockchain solely for risk monitoring to actively explore innovative financial products based on on-chain credible data. While leveraging AI for efficient approval, flexible handling mechanisms for "algorithmic edge cases" should be established to avoid credit mismatch. For SMEs themselves, digital compliance should be viewed as a long-term strategic investment. Proactively enhancing financial digitization and data governance capabilities can transform compliance into core capital for accessing superior financial resources and supply chain advantages. For technology providers, efforts should focus on developing "Reg Tech" solutions that enable AI and

blockchain not only to supervise but also to provide enterprises with compliance diagnostics, risk warnings, and process optimization support, thereby balancing “oversight” with “empowerment.”

References

[1] BECK T, DEMIRGUC-KUNT A. Small and medium-size enterprises: Access to finance as a growth constraint. Journal of Banking & Finance, 2006, 30(11): 2931 – 2943.

[2] CHEN H, ZHANG M, ZENG J, et al. Artificial intelligence and corporate risk-taking: Evidence from China. China Journal of Accounting Research, 2024, 17(3):100372-100372.

[3] FUSTER A, GOLDSMITH-PINKHAM P, RAMADORAI T, et al. Predictably unequal? The effects of machine learning on credit markets. The Journal of Finance, 2022, 77(1): 5 – 47.

[4] TAPSCOTT D, TAPSCOTT A. Blockchain revolution: How the technology behind bitcoin is changing money, business, and the world. New York: Portfolio, 2016.

[5] CATALINI C, GANS J S. Some simple economics of the blockchain. Communications of the ACM, 2019, 63(7): 80 – 90.

[6] STIGLITZ J E, WEISS A. Credit rationing with imperfect information. American Economic Review, 1981, 71(3): 393 – 410.

[7] BERGER A N, UDELL G F. The economics of small business finance: The roles of private equity and debt markets in the financial growth cycle. Journal of Banking & Finance, 1998, 22(6-8): 613 – 673.

[8] CRESSY R, OLOFSSON C. European SME Financing: An Overview. Small Business Economics, 1997, 9(2): 87 – 96.

[9] YANG J, ZHANG Y, GONG J, et al. How does fintech development affect financing constraints of SMEs? Evidence from China. ECONOMICS, 2024, 12(3): 210 – 230.

[10] CHEN Z. Digital inclusive financial popularization and China's SME financing constraints//Comenius University in Bratislava.Proceedings of the 8th International Conference on Economic Management and Green Development（part8）.Zhongnan University of Economics and Law, 2024:563-572.

[11] SUN R, SHANG Q, ZU A, et al. How does digital finance affect financing constraints of SMEs? Evidence from China. Applied Economics, 2026, 58(2):363-381.

[12] AUDRETSCH D B, ARONICA M, BELITSKI M, et al. The impact of government financial aid and digital tools on firm survival during the COVID-19 pandemic. Small Business Economics, 2025, 65(3): 813 – 836.

[13] SAVONA M, ARCHIBUGI D. The evolution of the ICT industry and the entry of new firms. Research Policy, 2006, 35(5): 661 – 674.

[14] WAH B. Revolutionizing SME financing: AI and FinTech for transparency, efficiency and inclusion. Journal of Southwest Jiaotong University, 2025, 60(2): 1 – 12.

[15] KOÇAR K. AI-based decision making in finance sector. Next Generation Journal for The Young Researchers, 2024, 8(1).

[16] THOOM S R. Lessons from AI in finance: Governance and compliance in practice. International Journal of Science and Research Archive, 2025, 14(01): 1387 – 1395.

[17] CELSI R, ZOMAYA A. Perspectives on managing AI ethics in the digital age. Information, 2025, 16(4): 318.

[18] WANG M. AI technologies in modern taxation: Applications, challenges, and strategic directions. International Journal of Finance and Investment, 2024, 1(1):42-46..

[19] ADEWALE T T, OLORUNYOMI T D, ODONKOR T N. Blockchain-enhanced financial transparency: A conceptual approach to reporting and compliance. International Journal of Frontiers in Science and Technology Research, 2022, 2(1): 11 – 21.

[20] MOEIN ELAHI NEZHAD, SHIMA RASHIDIAN, CONSIGLIA BOTTA. Revolutionizing trade finance: leveraging the power of blockchain and AI in electronic letters of credit. Uniform Law Review, 2024, 29(1): 87 – 115.

[21] YUSUF S O, ABUBAKAR J E, OCRAN G, et al. Exploring the impact of AI-driven and blockchain-enabled tax filing systems on SMEs in the era of technological innovation: A review of benefits, challenges, and adoption barriers. World Journal of Advanced Research and Reviews, 2024, 23(3).

[22] KULOTHUNGAN V. A blockchain-enabled approach to cross-border compliance and trust//2024 IEEE 6th International Conference on Trust, Privacy and Security in Intelligent Systems, and Applications (TPS-ISA). Washington D.C., USA: IEEE, 2024: 446 – 454.

[23] PRAJAPATI C. AI and blockchain integration in finance. International Journal of Innovative Science and Research Technology, 2025, 10(3): 2537 – 2538.

[24] KOZENKOV A, KAUT Y. Digital financial monitoring in public administration. Economic Space, 2025, 200:289-296.

[25] KONG H, LUO F. Research on the Threshold Effect of Financing Constraints on the Innovation Efficiency of High-Tech Manufacturing Firms//Proceedings of the 2024 5th International Conference on Big Data Economy and Information Management. 2024: 735 – 742.

[26] JIA H, ZHANG M. Financing constraints, major business performance, and return on financial assets. Finance Research Letters, 2024, 66: 105653.

[27] ODEYEMI O, et al. Integrating AI and blockchain for financial services security. Finance & Accounting Research Journal, 2024, 6(3).

[28] PULLA V. An Introduction to the Grounded Theory Approach in Social Research. International Journal of Social Work and Human Services Practice, 2016, 4(75-81).

[29] WOLFSWINKEL J F, FURTMUELLER E, WILDEROM C P. Using grounded theory as a method for rigorously reviewing literature. European Journal of Information Systems, 2013, 22(1): 45 – 55.

[30] GIOIA D A, CORLEY K G, HAMILTON A L. Seeking Qualitative Rigor in Inductive Research: Notes on the Gioia Methodology. Organizational Research Methods, 2012, 16(1): 15 – 31.

[31] COYNE I T. Sampling in qualitative research: Purposeful and theoretical sampling; merging or clear boundaries?. Journal of Advanced Nursing, 1997, 26(3): 623 – 630.

[32] BRAUN V, CLARKE V. To saturate or not to saturate? Questioning data saturation as a useful concept for thematic analysis and sample-size rationales. Qualitative Research in Sport, Exercise and Health, 2021, 13(2): 201 – 216.

[33] SOOD M. The power of AI to transform the global SME credit landscape// AI for Finance. Hoboken, USA: Wiley, 2020: 52 – 53.

[34] YE X, YAN Y, LI J, et al. Privacy and personal data risk governance for generative artificial intelligence: A Chinese perspective. Telecommunications Policy, 2024, 48(2): 102851.

[35] ZHANG Z. Combining blockchain and AI to optimize the intelligent risk control mechanism in decentralized finance. Journal of Industrial Engineering and Applied Science, 2025, 13(2): 446 – 447.

[36] LI CHAO. The Exploring Blockchain and Supply Chain Finance by JD.com to Overcome SME Financing Challenges in China. International Journal of Education and Humanities, 2024, 4(3): 309 – 315.

[37] CUI H. Blockchain technology and its application research in supply chain financial risk control//2021 International Conference on Computer, Blockchain and Financial Development (CBFD). Nanjing, China: IEEE, 2021: 401 – 404.

[38] AHMED M F, KHAN M R A A, ISLAM M R, et al. AI and Blockchain for Regulatory Compliance: Enhancing Transparency and Efficiency in Governance. Journal of Artificial Intelligence General Science (JAIGS), 2024, 7(01): 278 – 290.

[39] MAAMARI B E. Between innovation and oversight: A cross-regional study of AI risk management frameworks in the EU, U.S., UK, and China. arXiv, 2025: arXiv:2503.05773.

[40] GUI Y. Enterprise Accounting Risk Early Warning Model Based on Artificial Intelligence System Economics//2023 IEEE International Conference on Integrated Circuits and Communication Systems (ICICACS). Raichur, India: IEEE, 2023: 1 – 5.

[41] WANG D, ZHANG W. Intelligent finance in China’s financial market//Financial Mathematics and Fintech. Singapore: Springer, 2021: 157 – 172.

[42] GAO G, WANG H, GAO P. Establishing a credit risk evaluation system for SMEs using the soft voting fusion model. Risks, 2021, 9(11): 202.

[43] ADDULA R S, MEDURI K, et al. AI and blockchain in finance: Opportunities and challenges for the banking sector. International Journal of Advanced Research in Computer and Communication Engineering (IJARCCE), 2024, 13(2):184-190.