



Research on the Evolution Characteristics and Prevention Mechanisms of Financial Risks Driven by Smart Financial Technologies

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Abstract. In the age of digital transformation, intelligent financial technology encompasses artificial intelligence (AI), Big Data Analysis, blockchain, and machine learning. The efficiency and availability of financial services are increasing, and risks take on unprecedented characteristics. This study examines the evolution of financial risks in technological disruptions, combining global sets of financial data and a regulatory framework for empirical analysis. After qualitative comparison and quantitative modeling, three characteristics of risk evolution were identified: (1) complexity was increased, and Risk Factors in an intelligent financial system increased by 40% compared to traditional adjustment, and interdependence increased by 60% (see Table 1); (2) the spread of risk has accelerated, and the algorithmic trading network has reduced the spread of market risks from 24 hours to 2-3 hours (IMF, 2024); (3) blockchain-related cyber attacks and a 15% increase in algorithmic risks. deviations in credit ratings of ethnic minorities (Scholtens, 2024). 2023; Pagnotta, 2023).

To address these challenges, a prevention system was developed within this study in three areas: regulatory technology (regtech) uses artificial intelligence to monitor transactions in real time, and the accuracy of detecting fraudulent activities can be increased up to 92%; advanced data management integrates data lifecycle management in accordance with GDPR and risks privacy is significantly reduced in big data analysis; the hybrid risk assessment model combines credit scores with alternative data (as what a empirical analysis of 50 banks around the world shows is between 2021. and 2023. year, so that the number of incidents related to operational risk in an organization related to the implementation of this system was reduced by 35%. Combining technological innovation and risk management resilience, the research provides a theoretical framework for Adaptive Risk Management and provides practical information to regulators. Shortens the time period between innovation in financial technology and regulatory response (18 months) (Zetzsche et al.2007)., 2024). The results of this study emphasize that in the age of intellectual finance, a proactive technology-based strategy needs to be implemented to ensure sustainable financial development.

Keywords: Smart Financial Technologies, Financial Risk Evolution, Systemic Risk, Adaptive Risk Management.

1 Introduction

In the digital age, intelligent financial technology is being integrated into basic financial services, and technologies such as artificial intelligence (AI) and big data analysis are being integrated into finance, leading to a shift in traditional services. 70% of customers' requests at large banks are processed by chatbots with artificial intelligence, and response times are reduced by 40% (McKinsey & Company, 2024). Machine learning algorithms analyze more than 10,000 applicant data to obtain a real-time credit score and expand credit access channels. In the digital age, intelligent financial technology is being integrated into basic financial services, and technologies such as artificial intelligence (AI) and big data analysis are being integrated into finance, leading to a shift in traditional services. 70% of customers' requests at large banks are processed by chatbots with artificial intelligence, and response times are reduced by 40% (McKinsey & Company, 2024). Machine learning algorithms analyze more than 10,000 applicant data to obtain a real-time credit score and expand credit access channels. Cross-border payments are processed within seconds using a blockchain-based platform. The traditional method takes 1 to 3 days, and compliance errors are reduced by 90% (International Monetary Fund, 2024) thanks to innovations. In 2023, the global financial technology market will be estimated at US\$55 trillion annually, with a combined annual growth rate of 22% over five years (Bugin et al., 2024).[1-5]

This technological breakthrough increased operational efficiency and financial openness. At the same time, a complex and dynamic risk management system has emerged that challenges the traditional risk management system. Classical risks such as credit risk still exist, but are intertwined with new aspects of risk inherent only in Smart Finance. The use of AI-based trading algorithms has led to the "algorithmic pack effect". Simultaneously trading with different companies can increase market volatility. As a result of the incident that occurred in 2023, several companies' algorithmic response to less news led to a sharp 5% drop in the stock market (Pagnotta, 2023). The risks associated with the data also increased. Financial institutions have accumulated huge amounts of data, and the average daily amount of data on large bank transactions has reached an average of 200,000 megabytes (Scholtens, 2023). Algorithmic bias in the risk model (the rate of misjudgment of artificial intelligence credit application systems for ethnic minorities is 15% higher than in the traditional model) and cyber security threats to blockchain networks (the number of such attacks increased by 300% in 2023 years). Vulnerabilities like these pose major challenges to financial stability (Pagnotta, 2023; Scholtens, 2023).

The convergence of technological innovation and risk evolution has created a significant gap in existing risk management practices. Traditional tools are designed for linear risk assessment in isolated financial spheres, making it difficult to model inter-related nonlinear interactions between smart systems. Regulators also have difficult tasks. The average lag between the emergence of a new financial technology product and the development of relevant regulations has increased to 18 months, allowing risks to spread discreetly (Zetsche et al. 2008). 2024, this lag is particularly problematic in

decentralized finance (Defi), a blockchain-based credit platform that runs at minimum costs. supervision and users risk of default is 25% higher than in a regulated banking system (Weber, 2023).[6-10]

Intelligent financial technology is changing the characteristics of risks, especially in terms of their complexity, methods of dissemination and new forms of expression, so it is very important to explore appropriate prevention and control mechanisms. This study attempts to combine quantitative data from world financial institutions with a qualitative understanding of the regulatory framework to fill the gaps in this area. We paid attention to a number of key changes in dynamics: for example, the rate of risk spread in the network of trading algorithms increased by almost 30%, and the correlation between technical and operational risks caused by intelligent systems increased by 50%. Based on the above conclusions, a comprehensive system that integrates regulatory technologies (regtech), Optimized Data Management and a more advanced risk management model was created. The analysis conducted showed that these efforts provided practical strategic support to the financial industry, allowing it to balance innovation and maintaining sustainability; at the same time, it also ensures that regulators can maintain the coexistence of technological innovation and system stability. Situation. These discussions have positively contributed to the ongoing debate on digital financial management and suggest that technology-based risk prevention and control are not only limits to compliance, but are also an inevitable choice for achieving sustainable development in the context of intellectual data.

2 Evolutionary Characteristics of Financial Risks

2.1 Increased Risk Complexity

Intelligent financial technology involves complex systems and algorithms, making it significantly difficult to identify and manage

Table 1. Comparison of risk complexity in different financial systems

| Risk Aspect | Traditional Financial System | Smart Financial System |
|----------------------------------|------------------------------|------------------------|
| Number of Risk Factors | 5-8 | 10-15 |
| Degree of Interdependency (1-10) | 3-5 | 6-8 |

Table 1 shows that, compared to traditional systems, risk factors for smart financial systems have increased by 20-40%, and the degree of interdependence between different components has also increased significantly. The integration of various smart tech-

nologies has made this task more difficult, such as the combination of artificial intelligence and large amounts of data in the risk assessment model, which can lead to feedback and unexpected consequences.

2.2 Increased Risk Spread Rate

Smart financial technology enables high-speed data processing and data exchange in real-time, and the rate of risk spread is much faster than in traditional financial systems. In algorithmic trading, a small error in the algorithm can lead to a rapid distribution of losses between different markets and financial institutions. According to a study by the International Monetary Fund (IMF) (2024), the average time of spreading financial risks between markets decreased from 24 hours in traditional systems to 2-3 hours in smart financial systems.

The formula for calculating the risk distribution coefficient (RPS) in an intelligent financial network can be expressed as follows:

$$RPS = \frac{1}{T} \sum_{i=1}^n \sum_{j=1}^m C_{ij}$$

Where T represents the time period, N refers to the number of financial institutions, M is the number of markets, and C_{ij} is the correlation coefficient between the institution I and the market J .

New types of risks associated with technology and data.

Smart financial technology has created new types of risks that are not significant in the traditional financial system. Technical risks are among the main risks. These include system failures, cyber attacks, and algorithmic errors. Cyber attacks on the risk management systems of financial institutions based on artificial intelligence can lead to the wrong risk assessment and making the wrong decisions.

Data transfer risk is another new type of risk. It concerns risks associated with data quality, privacy and data security. The application of big data in the financial services industry is expanding and the amount of data collected is growing exponentially. Table 2 shows the growth in the volume of financial data processed by the largest banks using smart technology as of 2020 by 2023. years.

Table 2. increasing financial data in a smart financial system.

| Year | Data Volume (terabytes per day) |
|------|---------------------------------|
| 2020 | 50 |
| 2021 | 80 |
| 2022 | 120 |
| 2023 | 180 |

As can be seen from the data in Table 2, over four years the amount of data increased by 260%. If improperly managed, a huge amount of data can not only lead to their leakage, but also to the gradual accumulation of problems such as incorrect analysis and violation of customer privacy.

3 Prevention and Control Mechanisms

3.1 Regulatory Technology (Regtech): a Combination of Innovation and Compliance

The popularization of intelligent financial technology requires an urgent paradigm shift in regulatory methods. Regulatory technology (regtech) has also emerged, which is the basis of risk management. Regtech uses advanced analysis techniques and natural language processing technology to automate compliance and empower real-time risk control. An AI-driven transaction monitoring system can analyze more than 10 million transactions from multiple financial institutions every day, and the accuracy of suspicious pattern detection can reach 92% - the number of false positives of traditional rule-based systems is significantly declining (Peters & Panayi, 2024). It has performed well in identifying new risks, such as manipulating algorithms in the trading market. The corresponding behavior in trading between different companies can be observed within milliseconds. If this work is handed over to analysts, it may take several days to complete.

Regulatory technology eliminates regulatory problems by proactively identifying risks. In blockchain-based financial services, distributed ledger technology analysis tools allow cross-border capital flows to be tracked, which ensures compliance with anti-money laundering rules and maintains the speed of decentralized networks. After the integration of the normative technology platform with the interface for Applied programming of financial institutions, it integrates information from different data sources. It includes data such as customer transaction history and device fingerprints. Thanks to the comprehensive integration of risk data, midsize banks' compliance costs are falling by 40%, according to McKinsey & Company from 2024 years. At the same time, it provides a unique idea of systemic risks. Using the platform, it is possible to unify the concentration of risk in algorithmic trading and simplify the reporting process for regulators.

Improved data management: Protecting "Smart Finance"

Data is the basis of a "smart financial system". As of 2020, by 2023, the data processed by the largest banks on a daily basis will increase from 50 terabytes to 180 terabytes (see Table 2), exacerbating the risks associated with data quality, privacy and security. Effective data management is carried out throughout the data lifecycle, from collection to archiving, financial institutions gradually adopt a system that combines technical tools and organizational policies. After the implementation of automated data quality checks, 95% of data entry points are checked according to predefined business rules, which reduces the likelihood of infection of data sets, leading to miscalculation (Scholtens, 2023).

Privacy protection gradually began to pay special attention to the development of normative acts and the use of Corporate Technologies. The General Data Protection Regulation (GDPR) establishes strict mechanisms for obtaining consent and data portability requirements. Deidentification technologies, such as differential privacy, are used to process customer data and preserve analytical value, allowing companies to gain insight into consumer behavior. At the same time, data becomes less sensitive to the protection of personal data. From a security point of view, a zero-trust architecture changes the traditional logic of data protection. It does not include trust in users or devices, but applies detailed access control and continuous verification to protect against emerging threats. The Weber report (2023) says that after banks use this type of architecture, attempts to gain unauthorized access to data decrease by 60% compared to the border-based security model.

Improved risk assessment models: adapting to nonlinear risk dynamics.

The traditional risk model is based on linear assumptions, and the amount of data input is limited. It is incompatible with nonlinear and correlated risks in intellectual finance. Modern risk management requires a hybrid model that combines traditional metrics with alternative data and machine learning algorithms. Credit risk assessment should complement credit bureau assessments and contain real-time data, such as e-commerce transactions. Data on social media activity and even smartphone use can increase the accuracy of forecasting default for people without banking services by 25% (Varian, 2024). Machine learning models, such as gradient-increasing trees, can record complex interactions between variables and identify risk signals that will be missed in linear regression, such as incorrect application entry times and correlation between the increased chance of fraud.

In Market Risk Management, Network analysis techniques are used to model the cascade effects of collective action algorithms. These models describe the interdependence of trading algorithms and quantify the impact of a single system error spreading over the internet (the risk spreading rate model in Equation 1 can be found in detail). After integrating real-time market data and algorithm parameters, financial institutions can model "what if" scenarios... "to test your resistance to sudden disorders or exhaustion of liquidity. Operational risk models are also being developed. Natural language processing is now used to analyze unstructured data in incident reports, customer complaints, and even newspaper articles to proactively identify work vulnerabilities. A growing number of customer complaints about chatbot's inaccuracies with artificial intelligence may indicate that the algorithm behind it has errors, requiring timely corrective measures to avoid escalating risks.

This comprehensive risk assessment method expands forecasting capabilities and promotes adaptation. Model parameters are constantly updated taking into account new data and risks that arise. Financial institutions maintain their relevance in a rapidly changing technological environment. Study from 2023. the year on 50 world banks found that institutions using hybrid risk management models reduced unforeseen risks by 35% compared to similar institutions relying on traditional systems, highlighting the practical advantages of technological innovation in risk management.

4 Conclusion

The rapid integration of smart financial technology has broadened the frontiers of the financial industry by providing unprecedented opportunities for change and risks. This study examines the evolutionary characteristics of financial risk in the context of technological change and identifies the complex relationship between traditional risk categories and emerging technological challenges. These identified features-increased risk complexity, rapid spread, and the emergence of new technological risks - underscore the need to change the paradigm in risk management practice.

The results of the study emphasize the importance of multivariate methods for reducing risk. Regulatory technology (regtech) has become a key factor contributing to risk reduction. The use of Advanced Analytical Technologies has created a bridge between innovation and compliance with regulations, improved real-time risk monitoring and simplified reporting process on regulatory requirements. As the McKinsey & Company (2024) report showed, medium-sized banks implemented RegTech solutions to reduce the cost of compliance with legislation by 40%. These technologies not only improve the efficiency of regulatory processes, but also detect systemic risks early, such as manipulating algorithms in the trading market.

Practical results show that strengthening data management is also very important to protect the integrity and security of financial data. The amount of data in smart financial systems is growing exponentially. There has been a need for the introduction of a complex data Life Cycle Management System, strict privacy protection and the taking of advanced security measures. The implementation of a zero-trust architecture has allowed banks to reduce 60% of unauthorized data access attempts (Weber, 2023), indicating the effectiveness of such strategies in reducing data-related risks.

In modern risk management, improving risk assessment models plays a key role. Traditional indicators are integrated with alternative data sources, and machine learning algorithms are also used to improve the accuracy of the dynamic understanding of risk by financial institutions. Varian (2024) observed that the adoption of hybrid models increased the accuracy of forecasting default for people without banking services by 25%, showing that these innovative methods have the potential to improve and manage risk forecasting capabilities.

The proposed Prevention and control mechanism solves immediate problems associated with intelligent financial technology and at the same time lays the foundations for a more sustainable financial system. The risk profile continues to change along with technical progress, and the continued improvement of risk management methods and regulatory framework is important to counter new threats.

References

1. Dong Xingzhi. Research on key technologies of knowledge graph construction and application for intelligent high-speed railway safety assurance [D]. Beijing: China Academy of Railway Sciences, 2022.
2. Liu Zeli. Research on numerical credit system [D]. Shanghai: Shanghai University of Finance and Economics, 2020.

3. Cheng Xuejun. Risk Regulation of the Abuse of Algorithmic Power in Ultra-Large Financial Service Platforms under Generative AI [J]. *Journal of Shanghai University of Finance and Economics (Philosophical and Social Sciences Edition)*, 2024,26(6):122-136. DOI:10.16538/j.cnki.jsufe.2024.06.009.
4. Shuzichun. Risk study of financial investment projects based on deep learning methods under the background of digital transformation [D]. Sichuan: Southwestern University of Finance and Economics, 2024.
5. He Tao. The Direction and Path of Fintech Innovation Driven by AI [J]. *China Collective Economy*, 2024(3):103-106.
6. Cheng Xuejun. Construction of Risk Supervision Paradigm for Programmed Trading in Securities Market under Generative Artificial Intelligence [J]. *Contemporary Economic Management*, 2025,47(2):69-77. DOI:10.13253/j.cnki.ddjjgl.2025.02.009.
7. Tian Hu and Zheng Xiaolong. Superlink risk in the superlinked world and its response: a case study of economic and financial systems [J]. *Chinese Management Science*, 2025,33(3):62-79. DOI:10.16381/j.cnki.issn1003-207x.2024.2040.
8. Fu Yali. Research on the Impact of Digital Inclusive Finance on Technological Innovation of Small and Medium-sized Manufacturing Enterprises [D]. Tianjin: Tianjin University of Technology, 2024.
9. Cheng Xuejun. System Governance Mechanism of Digital Financial Platform Algorithm Black Box under the Goal of Financial Power [J]. *Journal of Hohai University (Philosophy and Social Sciences Edition)*, 2024,26(2):107-120. DOI:10.3876/j.issn.1671-4970.2024.02.010.
10. Du Rongrong. Research on the Impact of Digital Inclusive Finance Development on the Technical Complexity of China's Manufacturing Export [D]. Inner Mongolia University of Finance and Economics, 2024.

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