Risk Management and Analysis of Commercial Banks Under Digital Background

Yuqi Gao

Institute of Economics, Guangdong University of Foreign Studies South China Business College, Guangzhou 510000, China
2240434116@e.gwng.edu.cn

Abstract. In recent years, as technology is developing fast in the digital stage, commercial banks are also adapting by transformation. The introduction of the new technologies such as big information analysis, machine learning (ML) and artificial intelligence (AI) have changed the way the financial services has been existing provided and also has provided new challenges and opportunities for the analysis and management of the risk of the banks. Given this reality, banks need to revisit the paradigm of risk management and then act swiftly to mirror dynamic markets. Due to digital transformation pushes, banks are extensively navigating big data in order to optimize credit decision-making processes and ensure effective action against market volatility. Moreover, operational risk, credit risk, market risk and a series of other risks is becoming increasingly prominent, have become an indispensable part of bank sound operation. With the aid of automated technologies and other tools for digitalization, commercial banks have enhanced the risk management quality compared to previous traditional approaches. With the growing digitalization, banks must keep pacing with the evolving technology and knowledge systems to maintain a competitive stance and address new-age threats.

Keywords: Commercial bank, Digitalization, Big data, Risk management, Information security.

1 Introduction

In today's era of speed digitization development, the mobile and online financial services, the application of big data, the import of AI and ML technology, and the improvement of blockchain have deeply changed the way commercial banks mode of operation. The proliferation of mobile platforms and online service allow clients to manage their finances whenever and wherever possible, while the application of big data and advanced algorithms increases the precision of risk evaluation and service customization. However, with the rapid development of digitalization, internet security issue has also become increasingly severe. Commercial banks are faced with unprecedented opportunities and challenges, which not only bring a lot of risks, but also give birth to unprecedented opportunities.

© The Author(s) 2025
M. M. Husin (ed.), *Proceedings of the 2025 International Conference on Financial Risk and Investment Management (ICFRIM 2025)*, Advances in Economics, Business and Management Research 333,
https://doi.org/10.2991/978-94-6463-748-9_72

On the one hand, data security and privacy protection, shortage of professionals and technology investment, intensifying competition, model risk and algorithmic prejudice and the third-party risk and other problems all of them put forward higher requirements for stabilization operation of banks. On the other hand, digitalization also provides banks with opportunities of increasing customer experience and quality of service, optimizing efficiency of operation, increasing risk management ability, expanding market shares, innovating financial products and service, in many other ways. In order to drive this wave of transformation successfully, commercial banks must grasp the new opportunities given by the era and deal with the attendant risks effectively to ensure competitiveness and sustainable development in a rapidly changing market environment.

Therefore, it is important of practical significance to discuss the risk management of commercial banks under the background of digitalization. The existing research mainly focus on management and development, new types risk management and digital transformation strategy of commercial banks under the background of digitalization. Haibo Zhang's article mainly reveals that digital finances has brought new business opportunities and service space to commercial banks, but also prominent the low informationization degree, the challenges of datafication management ability inadequate capability, and through promote information construction level and promote datafication management to deal with these problems [1]. Jimin Tian's research focuses on new type risk, for example, information technology (IT) risk and climate financial risk, emphasizes the importance of completing comprehensive risk management system, proposes the method of strengthening the identification and assessment of new type risk and formulating pertinence prevention and control measure, reflects the tendency of financing institution constantly continuous renewal risk management strategy to adapt new risk modal [2]. Xingtao Wang's article analyzes the new requirements put forward by the rapid development of information technology on the business model and service mode of commercial banks, showing that banks are actively using emerging technology like artificial intelligence and blockchain to lift efficiency, cost reduction and satisfy increasingly diversified customer demand [3]. With the increasing uncertainty in the global economic environment and the advancement of technology, bank organizations are paying more attention on digital transformation and its impact and new types of risks. However, there are still some insufficiencies and gaps in the current research. There are less discussions about the specific implementation for specific regions or small banks. For some complex and unpredictable risk types, there is a lack of mature and effective assessment tools and solutions, such as, chain reactions triggered by extreme weather events. Most of the current literature focuses on strategic planning of macroscopic level, but not much on micro-level factors, such as, grass-roots staff training. All these provide the direction of further research in the future. This article through thorough analysis the changes in risk characteristics brought digital transformation for commercial banks, evaluating the effectiveness of the current risk management framework and exploring risk management strategies that adapt the demands of the new era. This paper will explore a comprehensive risk management system framework for commercial banks which is effectively applicable to the digital age, which should be able to identify new sources of risk, assess risk levels, develop

prevention and control measures, and establish monitoring mechanisms to ensure that commercial banks can operate robustly in a rapidly changing digital environment.

2 Digital Risks Faced by Commercial Banks

2.1 Operational Risks

Operational risk is the risk of loss from inadequate or failed internal processes, people and systems or from external events. These risks often take the form of systemic problems, data theft, cyber attacks and insufficient maintenance of technology updates that could result in the shutting down of banking services or the compromise of client data." To meet these challenges effectively, financial institutions need to establish a powerful cyber defense system and conduct regular technology maintenance and upgrades to maintain business continuity as well as data confidentiality. As the digitization of banking business deepens, new threats such as network intrusion, ransomware, phishing attack are rampant day by day, which poses a serious threat to the information security of banking industry. According to Cisco Systems (CISCO) 2022 State of Security Report, global financial industry has suffered irreversible effects, and the number of financial industry security incidents has increased by nearly 30% in only one year [4]. Hackers continue to covet critical information assets. The high dependence on information technology in the banking business will cause any unplanned interruption to be directly reflected in the user experience, such as obstacles in online payment and limited mobile banking function, leading to user loss and revenue decline. Automation tools are meant to enhance efficiency, but bad design or implementation can add to operational risk, whether through overly complex human-computer interfaces that can result in human error, or algorithms pushed into production without adequate testing.

Moreover, potential security risks are also caused by third-party service providers and cloud computing solution providers, and once these partners have problems, it will naturally impact the stable operation of the entire banking system. Even minor service outages and data breaches can damage customer trust quickly while ruining a brand's good image for all time. For the main reasons of the large repair cost of each security incident, it is not only the direct repair cost and customer compensation, but also the impact of reputation damage leading to loss of market share [5]. With more stringent laws and regulation, banks must continue to invest in technology and operational processes to comply with the latest regulatory requirement.

2.2 Credit Risk

Credit exposure presents a more complex face in the digital transformation. Traditional credit authorization methods have too many problems to deal with disposing online transactions and digital accounts. Therefore, bank institutions urgently need to innovate assessment mechanisms, using big data analysis and artificial intelligence technology, in order to more accurately estimate the repayment ability of borrowers, thus reducing the possibility of default. With thorough application of big data technology, the credit files of individuals and business users are becoming more detailed and multi-

dimensional, but this also brings new challenges of data protection. How to ensure the effective collection, storage and use of personal data under the premise of complying with relevant legal provisions has become a core issue that needs to be solved in the banking industry. Although the popularity of machine learning algorithms in the credit decision-making process has significantly improved the processing speed, its "black box" feature, that is, the opacity of the internal operation of the algorithm, may lead to bias or unfair credit policies and damage the legitimate rights and interests of consumers [5]. The convenience of digital service platforms has attracted a large number of financial fraud activities, including but not limited to identity theft, fictitious identities, and forged loan requests, which undoubtedly puts higher requirements on banks' anti-fraud capabilities. In addition, the rise of new financial instruments such as cryptocurrencies and peer-to-peer (P2P) loans has opened up diversified investment channels for investors, but it has also made the market more volatile and increased the complexity of credit evaluation.

As credit risk intensifies, traditional credit scoring models may no longer valid, generating the rising proportion of non-performing loan, cutting down profitability and capital base of banks directly. Frequent negative reports and data breaches undermine public trust in the financial system in the long run. In order to comply with increasingly stringent regulations, financial institutions need to increase investment on manpower and technology, which has a negative impact on their financial situation.

2.3 Market Risk

With the close integration of financial markets with Internet technology, market volatility and the speed of price changes have increased. This requires banks not only to have keen market insight, but also to be able to adjust their strategies quickly to respond to rapidly changing market conditions. In addition, strengthening the construction of risk management system and speeding up the reaction speed to market dynamics has also become an indispensable task for banks. For example, the price of a crypto asset like Bitcoin can go up and down by hundreds or even thousands of dollars in a very short period of time, creating huge money management and asset allocation challenges for the relevant financial institutions. In recent years, the proportion of high-frequency trading has continued to grow, coupled with the dominance of machine learning and quantitative strategies in the market, and even small price movements can be rapidly amplified, further increasing market instability.

A trending post on social media platforms such as Twitter and Reddit can trigger volatility in global markets within seconds, especially in the stock and foreign exchange markets. Changes in economic indicators and monetary policies between countries can also spread rapidly through financial networks, resulting in simultaneous fluctuations in asset prices in different regions, increasing the probability of cross-border risk transmission. This market turmoil is directly related to the value of assets held by banks, especially in the emerging markets and high-tech sectors, and may lead to pressure on capital adequacy ratios. When asset prices fall sharply, banks often struggle to liquidate assets quickly, especially in illiquid markets, exacerbating the liquidity squeeze. Sharp swings in asset values can also cause panic among depositors, leading to a run on the bank and threatening the long-term creditworthiness of the bank.

2.4 Legal Compliance Risk

Regulatory frameworks for digital financial services vary significantly across countries and regions and are frequently updated, creating additional challenges for the operations of multinational banks. In order to ensure the legality and compliance of business activities, banks need to closely track changes in relevant laws and regulations, and timely adjust their business processes and product content to avoid penalties for violations. For example, the European Union's General Data Protection Regulation (GDPR) sets very strict rules on the processing of personal information, and violators can be subject to significant financial penalties [6]. With digital technology making data more vulnerable to unauthorized access, banks risk losing customer trust in addition to legal consequences in the event of a breach. The anonymous nature and price volatility of cryptocurrencies make it difficult for banks to deal with anti-money laundering (AML) and preventing the financing of terrorism (CFT). Although payment service directive 2 (PSD2) like regulations have promoted the development of open banking, they have also put forward higher requirements for the security and privacy protection of data exchange [7]. While smart contract technology is expected to improve transaction efficiency, there are still many problems at the level of legal interpretation and enforcement, especially when it comes to international transactions.

3 Risk Management Strategy

3.1 Strengthen Information Security Construction

Commercial banks can deploy advanced firewalls and intrusion detection systems and integrate the latest network security devices and technologies, such as next-generation firewalls (NGFW), deep packet detection (DPI) technology, and intrusion detection/prevention systems (IDS/IPS), to form a solid protection network that can effectively defend against network threats such as malware and hackers. Multi-factor authentication (MFA) can be implemented within the bank, for example, beyond the traditional authentication method, the use of biometrics, one-time passwords, smart cards and other verification means, greatly enhance the security of the account, effectively prevent unauthorized access. At the same time, banks can use Advanced Encryption Standard (AES) encryption, combined with Secure Socket Layer/Transport Layer security (SSL/TLS) protocols, to fully encrypt data at rest and in transit to ensure that data can remain private even if intercepted. At the same time, bank staff should adhere to the principle of least authority and precisely define the data access rights of each post, so as to reduce the exposure of sensitive information [8]. The banking system should clearly identify the classification of different types of data and configure security measures according to different levels of sensitivity. Bank management should regularly carry out safety education and training for all employees to improve their safety awareness and personal protection capabilities, with the aim of building the first line of human defense. Banks need to set up professional crisis management teams, which should be able to quickly identify and respond to emergencies, effectively control the development of the situation and reduce losses [7].

Building an unswerving information security system is not only the need of protecting the interests of customers, but also an effective measure to maintain the reputation of banks and social stability. Integrating different defender strategies with the new-age technology, banks can protect themselves from getting disenfranchised in the wave of burgeoning digitalization and create a firm footing for the enduring and healthy development of the industry.

3.2 Improve Risk Assessment Capabilities

Under the background of digital transformation, commercial banks are facing new challenges and opportunities. For financial institutions, it is crucial to enhance the risk assessment ability, which not only affects the effective allocation of capital, but also directly concerning bank's entirety operational stability and long-term competitiveness. Through application of big data platform, collecting sorting and analyzing a large amount of information form internal and external sources, including market dynamics, economic barometer and industry tendency, and combining with artificial intelligence algorithms for going deep into analysis, big data models can help banks reveal hidden dependency and pattern, thereby assisting more accurate forecast and decision-making.

In order to make the ability to resist risks stronger, banks should strengthen scenario simulation and stress testing, establish a virtual environment to simulate extreme but possible situations, such as interest rate changes, a sharp increase in credit default rates, so as to assess the risk tolerance of banks under these situations, and optimize risk management strategies accordingly. Banks can establish comprehensive credit rating models based on big data, take multiple dimensions, such as financial statement analysis, credit history, industry status and business status, into account, build a comprehensive credit portrait, make more accurate assessments of borrowers' willingness and repayment ability [9].

Daily monitoring of credit changes is one of the key measures for coordination to prevent credit risks [9]. Timely adjustments of loan limits and loan conditions can be made, thus preventing losses caused by sudden emergence of credit risks, which can be achieved by monitoring the dynamic changes of data in real-time data update mechanism. It is also necessary to ensure that there is enough liquidity in the operation of the bank, by establishing a reasonable liquidity ratio and buffer mechanism, so that the bank has enough liquidity to cover short-term liabilities, and reserve certain scale funds to cope with sudden funding needs. Meanwhile, the model based on the past record is applied to the future cash flow in and out to plan daily operation and strategy of the bank, to prevent shortage in liquidity.

Standardised processes and internal controls are critical for that as well. The banking system needs to establish effective operational norms to minimize human errors, and to reinforce in the inspection and supervision to ensure that all activities are legal and compliant [8]. The main elements in creating a positive corporate culture are pre- and daily work on risk awareness and compliance by the bank employees. Supervisors need to be welcoming of early reporting of potential risks and actively cooperate with their personnel to run a sustainable operational environment. Furthermore, banks should establish professional departments to pay close attention to changes in the legal environment and carry out compliance review to ensure that business activities comply

with the latest regulatory requirements, thus avoiding the risk of legal disputes and fine. Operating cross border for instance requires understanding local laws and regulations at length and analyzing the additional risk associated with political and economic uncertainty. To ensure sound development, commercial banks need to update their ability to assess and manage the risks they face on an ongoing basis in the global and digital environment. This is not only an essential approach to uncertainty, but also an important way to shape the core competitive advantage. Through the extensive use of data intelligence, improved management and a moderate compliance attitude, commercial banks can seize opportunities in a rapidly changing market and achieve sustainable development goals.

4 Concrete Practice of Digital Risk Management

When it comes to risk identification, commercial banks should fully utilize advanced technologies such as big data and artificial intelligence, to achieve sensitive capture of new risks. Agricultural Bank of China established a digital credit management platform with internal and external data resources integrated, has realized the entire process of credit risk management. Meanwhile, both a whole bank unified credit risk early warning and monitoring "Beacon Fire platform" is set up to realize automatic monitoring of the whole caliber credit business, and central release and processing for all kinds of early warning information [10]. Furthermore, the Agricultural Bank of China Hebei Branch developed a digital intelligent risk control platform independently, which achieved the integrated processing of all kinds of data, the internal mechanism construction of information disclosure and statistical reporting, integration and management of various IT vendors and reformative software applications, corporation data integration and strengthened supervision of records to improve office efficiency and continued to gather public information for database building and risk data modeling, thus helping to transform the establishment of internal and external fraud prevention and dangers elimination model, eventually reducing risk cost [11].

For risk assessment, commercial banks should continuously optimize their methods and techniques to ensure that the assessment results are forward-looking and accurate. On the one hand, it is necessary to deeply analyze the causes, occurrence probability, transmission mechanism and possible consequences of risks, improve the technical means of identification and evaluation, and explore the methods of optimizing evaluation and measurement. On the other hand, it should also actively cooperate with universities and scientific research institutions to carry out professional research, learn the latest research results and excellent practical experience, and play a synergistic role in the industry [7]. On this basis, banks need to formulate perfect risk system policies and procedures based on their actual conditions, continuously optimize the risk management system framework system, clarify the responsibilities of each link, organically combine with the three lines of defense, and form an orderly, coordinated and unified comprehensive risk management framework [11].

Risk control is the key link to prevent and resolve financial risks. Commercial banks must take targeted measures to deal with different types of risks. In view of IT risks, it

is necessary to strengthen the control of safe production and operation, improve the information security protection ability and the proactive prevention level of network information security. For climate-related financial risks, it is necessary to strengthen policy guidance, integrate climate factors into the management process of other individual risks, and establish a collaborative management mechanism across risk types and business lines. In terms of model risk, a sound model management mechanism should be established, including development, verification, exit, to ensure that the model maintains good performance [2]. In addition, the Hebei Branch of Agricultural Bank of China breaks traditional barriers by carrying out internal control inspection, responsibility audit and due diligence supervision and other projects as a whole, and carries out verification and analysis from the perspective of full risk, thus possessing the ability to discover potential risks [11].

Robust reporting on risk not only supports internal decision making, but also external investor confidence. Thus, commercial banks should focus on the quality of information disclosure, disclose climate risk and other related information in regular publicity reports, enhance brand image, conduct exchanges with domestic and foreign counterparts, and integrate into the international climate discourse system [2]. In addition, Agricultural Bank of China Hebei Branch has also judged the actual needs under the digital transformation background, reduced the number of on-site inspection items and saved a lot of costs, and it should be different from traditional audit, when providing the service in the form of digital, it can also carry out a variety of related monitoring models maintain and optimize, all of this is conducive to improve risk reporting efficiency and quality [11]. Moreover, China Construction Bank initiated the "Blue Core Project" to improve its independent risk control ability, fill the gaps in the investment and trading business system, and ensure uniform identification, prevention and management of risk early warning and disposal process [10].

5 Conclusion

Under the background of digitalization, the risk management and analysis of commercial banks has shifted from the traditional experience-based model to a new approach that relies more on data and technology. By using big data, introducing machine learning algorithms and artificial intelligence technologies, banks can more accurately predict risks, improve anti-fraud capabilities, and effectively respond to market volatility. Digital transformation is forcing banks to re-examine internal management and operational processes to ensure legal and compliant operations. The results show that the application of digital transformation and platform improves the efficiency of risk management and reduces its operating cost.

This paper expounds the important impact of digital technology on risk management of commercial banks. It changes the traditional way of risk assessment and makes risk identification more accurate. The introduction of big data by banks improves information transparency and helps banks and regulators build a more robust financial system. Research shows that with the deepening of digitalization, banks need to

constantly update their technology and knowledge system to adapt to the rapidly changing market environment and technological progress.

In the future, commercial banks should continue to deepen the digital process, and there may be some new development trends in risk management. For example, banks will leverage advanced technologies such as AI and ML to automate risk monitoring and early warning systems, further improving the accuracy of risk predictions. But as cross-border business grows, banks will also strengthen international cooperation, working with other banks to develop global risk management standards and frameworks. The most important thing is to pay attention to digital ethics, and banks should ensure that new technology applications comply with new laws and regulations to protect customers' private data security.

References

1. Zhang, H.B.: Research on management and development dilemma of rural commercial banks and Countermeasures under the background of digital finance. Expo Economy, 21, 97-100 (2024)
2. Tian, J.M.: Research on new risk management of commercial banks: New situation, new challenge and new method. Journal of Agricultural Banking 5, 4-8(2024)
3. Wang, X.T.: Commercial bank under the background of the new era of digital transformation strategy research. Journal of Finance 28, 48-50 (2024)
4. CISCI. Security Status Report. 2022 December 7, 2022. https://www.cisco.com/c/zh_cn/products/security/security-reports.html, last accessed 2024/12/1
5. Chen, Y.J.: Discussion on strengthening risk management and prevention and control of rural commercial banks. Township Enterprise Review, 21, 5-7(2024)
6. Tian, Y.J.: Personal Information protection in Government data opening: EU experience and enlightenment: Reflections based on EU General Data Protection Regulation. Journal of Yibin College 08, 1-8(2024)
7. Hou, J., Wan, M.Y., Ning, W.: Thinking and practice of business R&D integration in the context of strong overseas supervision: An exploration based on EU PSD2 supervision project. China Financial Computer 11, 67-72 (2019)
8. Song, H.S.: Research on Internal control methods and risk prevention Paths of commercial banks. Investment and Cooperation 10, 30-32 (2024)
9. Li, Y.H.: Guard against and dissolve the financial risk in commercial bank strategy analysis. Circulation of the National Economy 21, 171-174 (2024)
10. Luo, X.M., Huang, Y.J., Li, Y.B.: Study the construction of risk control system under the background of digital intelligence. Journal of Agricultural Bank 5, 9-14 (2024)
11. Mi, X.F., Shi, Y.: Operational risk prevention and control strategies and practices of commercial banks in the context of digital transformation: A case study of Agricultural Bank of China Hebei Branch. Agricultural Bank Journal 3, 47-49 (2024)

Open Access This chapter is licensed under the terms of the Creative Commons Attribution-NonCommercial 4.0 International License (http://creativecommons.org/licenses/by-nc/4.0/), which permits any noncommercial use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license and indicate if changes were made.

The images or other third party material in this chapter are included in the chapter's Creative Commons license, unless indicated otherwise in a credit line to the material. If material is not included in the chapter's Creative Commons license and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder.