

The Digital Transformation of the Banking Industry in the Era of Big Data

Linghan Li^{1,a,*}

¹*School of Data Science, Zhejiang University of Finance & Economics, Hangzhou, 310018, China
a. hanhan.lli319@zufe.edu.cn*

**corresponding author*

Abstract: Big data analytics has become an instrumental tool for digital transformation in the banking industry. By leveraging massive volumes of data, banks can gain valuable insights to optimize operations, reduce risks, and improve customer experience. For risk management, big data techniques enable banks to detect fraud and money laundering activities more accurately. In customer relationship management, big data analytics allows banks to better understand customer needs, provide personalized services, and enhance loyalty. Furthermore, big data can inform investment decisions by identifying new opportunities and mitigating risks. While big data brings significant opportunities, it also presents challenges in data governance, privacy, and security that require prudent management. Technical and business model innovations must align to fully realize the potential of big data. Banks should invest in big data infrastructure, promote a data-driven culture, and pursue strategic partnerships. Regulators and policymakers should establish flexible guidelines to encourage big data adoption while protecting consumer privacy. By harnessing big data responsibly, banks can transform into truly customer-centric digital organizations. Overall, big data is redefining the banking industry, and continuous digital transformation is imperative for banks to thrive in the new data-driven era.

Keywords: big data, bank, digital transformation

1. Introduction

In today's era, with the continuous popularization of internet technology and the rapid changes in user needs, the traditional banking business model and customer experience can no longer meet market demands. With the rise of emerging businesses such as mobile payment, e-commerce, and P2P online lending [1], users expect more convenient, secure, and fast financial services. At the same time, regulatory authorities have put forward higher requirements and standards for bank risk management, customer information security, and other aspects, intensifying the urgency and necessity of bank digital transformation; the rapid development of emerging technologies such as blockchain and artificial intelligence has made banks face the urgent need for digital transformation. In addition, the progress and maturity of big data technology provide the banking industry with unprecedented opportunities and challenges. With the help of big data technology, banks can achieve comprehensive, personalized customer service through data mining and analysis techniques, improve risk management and decision-making levels, create the ultimate user experience, and win market competitive advantages. Therefore, bank digital transformation has become a reality that banks have

to face and an important means to promote the sustainable development of the banking industry. Only by continuously promoting digital transformation can banks maintain a leading position in market competition and further enhance their core competitiveness.

As digital transformation deepens, the banking industry is facing huge changes and challenges. Under such circumstances, the emergence of big data technology provides new ideas and opportunities for the financial industry. Big data technology can help banks better understand customer needs, identify potential risks, improve operational efficiency, and so on, thereby enhancing customer experience and service quality to meet the development needs of the financial market.

In the past few years, more and more academic research and business practices have involved the application and innovation of big data in the banking industry. The necessity of the transformation of commercial banks under the conditions of digital transformation of economic relations has become a hot issue [2]. Modern information technology's role in the banking industry is growing day by day, rapidly entering the digital world, where the innovative model of big data technology provides an excellent opportunity for banks to showcase valuable new products, especially by combining their existing services with new digital features [3]. Naimi-Sadigh et al. [4] studied how the disruption, implementation, and completion of the digital transformation process of Iranian banks (Maskan Bank) affected the development of remote banking services. To assess the impact of these assumptions, a survey was conducted on customers of Tashkent branch, a joint-stock commercial bank with foreign capital, and the survey results were analyzed using the econometric model created by the author [5].

This article aims to study the application and development trend of big data in the banking industry in the era of big data, explore the application of big data technology in bank risk management, customer relationship management, investment decision-making, and other aspects, analyze the advantages and challenges of big data technology in the banking industry, and propose corresponding countermeasures and suggestions for future development prospects, providing valuable reference value for further promoting the digital transformation of the banking industry.

2. The Current Situation of Bank Transformation in the Era of Big Data

Bank transformation has become the key to marketing competitive advantage in the era of big data. Significant progress has been made in upgrading digital infrastructure, improving business digitization, and advancing data management digitization. In the future, digital transformation will be a necessary path for the development of the banking industry.

2.1. Digital Upgrade of Basic Infrastructure

With the continuous development of information technology, according to the "Global Digital Overview 2022", the number of global social media users has exceeded 4.62 billion, accounting for 58.4% of the total global population. In the financial field, it has been highly integrated with the Internet. Therefore, the digital upgrade of basic infrastructure has become a necessary step for banking transformation. This includes the digital upgrade of network equipment, information security, storage, and other infrastructure. By implementing information construction, digital management of business processes can be achieved, which in turn improves business execution efficiency. In addition, the upgrade of network facilities can achieve comprehensive coverage of online business, improve service efficiency, and enable banks to achieve online transactions, remote appointments, intelligent inquiries and other functions. The improvement of security facilities can better achieve the goals of risk prevention, security, and fraud prevention [1].

2.2. Digital Upgrade of Business

Banks have continuously improved business process efficiency and customer service quality through digital means. The rapid development of mobile banking, online payments, e-commerce platforms, and other businesses has provided customers with more convenient financial services. Digital technology allows for the innovation and promotion of new products, which improves market competitiveness and meets customer needs. For instance, digital banking products in China, Alipay and UnionPay QuickPass, have brought more convenient service experiences to customers.

Meanwhile, Customer relationship management and loan management businesses have also been further optimized. In terms of customer relationship management, big data technology is widely used to establish a customer relationship management system, achieve digital management of customer information, improve customer service, and increase customer satisfaction, promoting business volume and customer retention rate [6]. In terms of loan management, the comprehensive digital upgrade of such businesses optimizes cumbersome manual review procedures, improves the accuracy and efficiency of loan qualification, customer experience, and greatly reduces business costs [7].

2.3. Digital Upgrade of Data Management

The introduction and application of big data technology have put forward higher requirements for bank data management. Massive data involved in banking businesses need to be managed and analyzed through technologies such as big data, utilizing data to achieve business upgrades and innovations. Through data collection and processing technology, banks can build a complete data system, achieve data visualization and analysis, help banks have a deep understanding of customer needs and market changes, promote business innovation and development. The digital upgrade of data management can achieve more accurate risk management and highly protect user data privacy and security.

3. Analysis of the Impact of Big Data on the Transformation and Upgrading of Banking Business

In the era of big data, traditional commercial banks are gradually eroded by the impact of internet finance, which is mainly manifested in the following three aspects: the decline in the share of residents' savings deposits [6]; the reduction in the dependence of residents and small and micro enterprises on commercial bank loans; the imbalance of commercial bank loan structure and the prominent pressure, with the proportion of medium and long-term loans far exceeding short-term loans [8]. Through the above-mentioned impact manifestations, it can be seen that under the impact of internet finance, commercial banks are losing their customers, funds, and businesses. From the perspective of big data, the influencing factors mainly include the following four aspects.

3.1. Big Data Platform Construction

Banks need to build big data platforms to manage and analyze various types of data more effectively. Big data platforms can provide banks with refined services and convenient transaction processes, such as the MapReduce model of Hadoop platform, which can run complex computing models on distributed systems, greatly improving data computing efficiency and reducing transaction time and hardware costs [9]. By integrating and analyzing various types of data, banks can achieve personalized customization, risk control and portfolio optimization. In the construction of big data platforms, banks need to consider the following aspects:

1. Data collection. Building a comprehensive data collection network, including various external and internal data, such as transaction data and user behavior data, integrating these data and processing them to ensure the accuracy and consistency of the data.

2. Data warehouse. Banks combine data warehouses with big data technology to store, manage, and process all data, ensuring data security and confidentiality to support business operations and development [6].

3. Data mining. Using data mining technology to deeply mine customer needs and behavior patterns, quickly discover valuable information in the data, improve marketing effectiveness, and promote product promotion.

4. Data visualization. Implementing data visualization and analysis through data visualization technology, making it easy for business departments to quickly understand data information and business conditions.

3.2. Decision-making Model Transformation

Traditional decision-making models mostly use empirical judgments, which cannot effectively solve complex problems. Big data analysis plays a crucial role in helping banks to make decisions. The banking industry needs to change its decision-making model with the help of big data technology to achieve data-driven intelligent decision-making. By analyzing massive amounts of data, banks can predict market trends, estimate risks and returns, and develop more scientific and reasonable management strategies. The widespread application of data mining and artificial intelligence technologies can be used for precision marketing, analyzing customer behavior data and network behavior data, conducting personalized marketing promotions, launching different products according to different user needs, and improving based on user feedback data. At the same time, it also plays a significant role in timeliness prediction. Using big data technology, banks can make more accurate financial forecasts, market risk assessments, etc., to grasp future market trends and develop corresponding decision-making plans. In intelligent investment, banks can predict stock prices with the help of artificial intelligence technology, assist investment decisions, and achieve stable performance and risk control [6].

In the transformation of decision-making models, banks need to pay attention to potential problems in the process. First, banks need to comprehensively collect and process various types of data, including corporate financial statements, market data, customer behavior data, etc., and ensure the high quality and usability of data through data cleaning, processing, and processing. Second, in data modeling and analysis, banks need to use various data mining, machine learning, and artificial intelligence technologies to perform deep learning and modeling on the data to discover the rules and valuable information behind the data. Third, for intelligent decision-making, banks need to apply the results of data analysis and mining to business decision-making and continuously optimize and improve decision-making models [10].

3.3. Innovation in Risk Management

The financial industry is essentially a risk management business, and big data technology can greatly enhance the risk management capabilities of financial institutions. Credit risk accounts for a large proportion of the internal economic capital of commercial banks, ranging from 70% to 90% [8]. By analyzing data, banks can obtain more useful information, estimate risks, and develop scientific risk management strategies. For example, banks can use big data technology to build models for credit rating and loan qualification review of borrowers. Therefore, the application of big data technology can help banks achieve more refined risk management and provide protection for business operations. This is specifically manifested in the following aspects:

1. Data-based credit evaluation. Through the analysis and processing of big data, banks collect various types of risk-related data, including customer credit reports, financial statements, etc., verify and review these data to ensure the authenticity and reliability of the data, and more accurately assess customer risk levels, improving loan approval efficiency and accuracy.

2. Real-time monitoring. Using big data technology, banks can monitor market risks, transaction risks, etc., in real-time, grasp business conditions in a timely manner, and avoid potential risks.

3. Early warning system. Banks can establish risk early warning systems based on big data analysis to monitor and manage potential risks. By analyzing historical data and current data, banks can predict possible future risks, take preventive measures, and effectively reduce losses caused by risks.

4. Fraud detection. Big data technology can help banks identify potential fraudulent activities by analyzing transaction patterns and customer behaviors. This can effectively reduce losses caused by fraud and improve the security of financial transactions [11].

3.4. Improvement of Customer Service Quality

With the advent of big data technology, banks have the opportunity to deeply mine and analyze customer behavior, which can lead to a better understanding of customer needs and improved customer satisfaction. Personalized marketing efforts can be achieved by leveraging historical behavior data and online transaction information, which can help banks to accurately push relevant products and services, thereby enhancing customer stickiness and loyalty. To achieve this, banks need to collect various types of customer behavior data and integrate them into comprehensive customer profiles that can be used to establish a clear and complete information archive. By using various data mining and machine learning techniques, customer profiles can be deeply analyzed and explored, which can reveal potential needs and opportunities [6].

Through in-depth analysis of customer data, banks can gain insights into customer preferences and needs, which can help them to promote products that accurately meet their needs. By analyzing consumer characteristics and customer behavior through big data, personalized recommendations for customers can be achieved, and products and services can be optimized, leading to increased customer satisfaction and loyalty. This can ultimately enhance brand value and competitiveness. Additionally, banks can leverage risk warnings to identify high-risk customers in a timely manner, and conduct risk warning and avoidance strategies to mitigate potential losses [1].

4. Transformation Suggestions for the Banking Industry in the Big Data Era

4.1. Enhance the Core Processing Capability of Big Data Technology

The foundation of big data lies in platform construction and information integration capability. Given the massive, diverse, and sparsely valued characteristics of big data, commercial banks need to transform traditional data warehousing technology and establish large-scale, unstructured, distributed, and streaming computing big data warehouses [9]. This transformation will enable commercial banks to strengthen the establishment of data standards and governance of data quality.

4.2. Increase Financial Innovation Efforts

Driven by high-tech such as cloud computing, biometric identification, hardware intelligence, and mobile internet, the future application of big data in banking business will go beyond business analysis and decision-making. Instead, it will include high integration in business, management, technology, and other aspects. Therefore, commercial banks need to continuously improve their business processes, reduce operating costs, and enhance customer experience through big data innovation [1].

4.3. Strengthen Big Data Security Management

Big data has changed the risk characteristics of data security, requiring not only new management methods but also the inclusion of a comprehensive risk management system for unified monitoring and management. To ensure the security of big data, commercial banks need to adjust their big data structures, strengthen industry self-regulation, and improve their own big data security level through regulatory services [8]. They also need to enhance customers' awareness of data security and actively communicate with them to strengthen data security and data usage.

4.4. Enrich Information Sources and Application Methods

With the rise of social networks, social media such as microblogs and forums have become new data sources for commercial banks. Currently, commercial banks primarily use structured data in big data applications, while the application of semi-structured and unstructured data such as network videos and voice are still in its infancy. However, the analysis of these types of data is crucial for sentiment monitoring, risk management, and customer behavior extraction [12]. Therefore, the establishment of unstructured data is an important goal for the banking industry to enhance its business capabilities.

4.5. Compliance with Business Development Needs and Market Rules

In the current era of big data, there has been a significant surge in the application of big data across various industries, including the banking sector, which is actively developing big data strategies and conducting research and development on big data technology. The application of big data has the potential to bring significant economic benefits to commercial banks. However, constructing a big data ecosystem is a long-term process, and choosing strategies or technologies that are not suitable for one's own development conditions may have adverse effects on the industry. Therefore, it is essential to use big data technology in a manner that aligns with one's own business development needs and market rules, and to identify opportunities and application scenarios that are appropriate for one's own situation [11].

5. Conclusion

This article presents a comprehensive analysis of the impact and current status of big data technology on the transformation of the banking industry and proposes a series of recommendations to help banks meet the challenges of digital transformation. The findings suggest that big data technology will become the core driving force for the transformation and upgrading of bank businesses in the future.

As big data technology continues to develop and mature, banks can leverage it to achieve more refined services and convenient transaction processes, leading to the launch of higher-quality products and services that enhance customer satisfaction and loyalty. Furthermore, the application of big data technology opens up new opportunities for banks to achieve higher levels of development and broader development space, such as expanding into the fintech field and promoting the construction of smart cities.

However, the practical application of big data technology in banking also brings new challenges and risks. Banks need to continuously face these challenges and establish sound management systems and protection mechanisms to ensure the sustainable development of banking business transformation. To achieve digital transformation and improve business efficiency, banks should take active measures to strengthen the construction of technology innovation, talent introduction, and risk management.

In conclusion, with the in-depth application of big data technology, the transformation of banking business has become an inevitable trend in the digital age. The findings of this study emphasize the significance of big data technology as the primary driving force for the transformation and upgrading

of bank businesses, leading the banking industry towards higher levels of development and broader development space.

References

- [1] Yang, Z.: *Research on the Future Transformation Paths of Commercial Banks in the Internet Finance*. *Trade Fair Economy*, 2, 110-112 (2023).
- [2] Krasnikolakis, I., Tsarbopoulos, M., Eng, TY.: *Are incumbent banks bygones in the face digital transformation?* *Journal of General Management*, 1, 60-69 (2020).
- [3] Xia, L.: *Artificial Intelligence: A New Engine for Promoting Bank Transformation*. *Times Finance*, 11, 43-44 (2020).
- [4] Naimi-Sadigh, A., Asgari, T., Rabiei, M.: *Digital transformation in the value chain disruption of banking services*. *Journal of the Knowledge Economy*, 13, 1212-1242 (2022).
- [5] Mamadiyarov, Z.: *Analysis of factors affecting remote banking services in the process of bank transformation in uzbekistan*. *Financial and Credit Activity Problems of Theory and Practice*, 1(36), 14-26 (2021).
- [6] Zengan, G., Minchao, L., Guike, Z.: *Opportunities, Challenges and Strategies of Bank Digital Transformation in Post COVID-19 Era*. *Modern Management Science*, 3, 103-112 (2021).
- [7] Yening, Z., Shuo, W.: *The Impact Mechanism of FinTech on Digital transformation of Commercial Banks: An Empirical Study Based on the mesomeric effect Model*. *Wuhan Finance*, 11, 30-40 (2021).
- [8] Lin, L., Shaohui, C.: *Research on credit-risk economic capital management of commercial banks in China*. *Qinghai Social Sciences*, 3, 119-127 (2021).
- [9] Tao, L.: *Innovative Practice of Distributed Database of Shenzhen Rural Commercial Bank*. *FinTech Time*, 30(5), 25-27 (2022).
- [10] Kurmanova, D.A., Galimardanov, A.R., Sultangareev, D.R.: *Digital transformation of the russian commercial bank*. *Bulletin USPTU Science education economy Series economy*, 1(35), 49-61 (2021).
- [11] Babel, B., Gius, D., Gräwert, A., Lüders, E., Natale, A., Nilsson, B., & Schneider, S.: *Capital management: Banking's new imperative*. *McKinsey Working Papers on Risk*, 38 (2012).
- [12] Hassani H., Huang X., Sliva E.: *Digitalisation and big data mining in banking*. *Big Data and Cognitive Computing*, 2(3), 1-13 (2018).