Proceedings of the 3rd International Conference on Management Research and Economic Development
DOI: 10.54254/2754-1169/177/2025.22433

Research on the Application of Big Data Technology in Enterprise Financial Risk Management

Shunjie Guan

Guangdong University of Technology, Guangzhou, China
1435316412@qq.com

Abstract: In the context of global economic integration and digital transformation, the financial industry is facing an increasingly complex and changeable risk environment. With its powerful data processing and analysis capabilities, big data technology provides a new solution for enterprise financial risk management. This paper provides an in-depth analysis of the application of big data technology in enterprise financial risk management. However, big data technology also faces many challenges, such as data security and privacy protection, data quality and reliability, technology and talent bottlenecks, and laws, regulations and supervision. To address these challenges, this paper puts forward corresponding coping strategies, including strengthening technical means and management measures to ensure data security and privacy, optimizing data processing process to improve data quality, increasing investment in technology research and development and talent training and introduction, and improving laws and regulations and innovating regulatory mode. This study holds important theoretical and practical guiding significance for enterprises to effectively use big data technology to improve the level of financial risk management, and provides a useful reference for the stable development of the financial industry.

Keywords: big data technology, financial risk, data security, risk management

1. Introduction

In the wave of global economic integration and digital transformation, the financial industry is undergoing profound changes. With the rapid development of the financial market and the endless emergence of financial innovation, enterprises encounter both opportunities and increasingly complex diversified financial risks [1]. These risks not only pose a threat to the financial situation and operating stability of the enterprise but also may have a chain reaction on the stability of the entire financial market. Therefore, effective financial risk management has become the key to the steady development of enterprises in the financial field [2].

With the rapid development of information technology, big data technology has emerged as a transformative tool and has been widely used in the financial field. With its powerful data processing ability and analysis and mining ability, big data technology offers a new perspective and method for enterprise financial risk management. It integrates massive, multi-source and heterogeneous data inside and outside the enterprise, and reveal the potential laws and trends of risks through in-depth analysis and mining of these data, enhancing enterprises' ability to accurately identify, assess, and mitigate financial risks.

DOI: 10.54254/2754-1169/177/2025.22433

2. The application of big data technology in enterprise financial risk management

2.1. Credit risk management

Credit risk is an important part of enterprise financial risk, which refers to the possibility that the enterprise will suffer losses due to the failure of the borrower or counterparty to perform the obligations agreed in the contract. In the traditional credit risk management, enterprises mainly rely on limited information such as the borrower's financial statements and credit records for evaluation, which often suffer from incomplete information and poor timeliness. The application of big data technology can integrate multi-source data, provide enterprises with more comprehensive and accurate credit risk assessment, and realize real-time credit monitoring and early warning [3].

2.1.1. Credit risk assessment

Although traditional credit risk assessment methods, such as credit score card and expert judgment method, can evaluate credit risk to a certain extent, they have obvious limitations. Credit score card is primarily based on historical data and specific index system, making them less adaptable to dynamic market conditions and the diverse characteristics of borrowers. The law of expert judgment depends on the subjective experience of experts, rendering them susceptible to human factors, increasing the subjectivity and uncertainty of the evaluation results.

The emergence of big data technology introduces new ideas and methods for credit risk assessment. Through the integration of multi-source data, including internal financial data, transaction data, customer information, as well as external macroeconomic data, industry data, social media data, etc., a more comprehensive and accurate credit risk assessment model can be built. These data reflect the credit status of borrowers from multiple dimensions, such as repayment ability, repayment willingness and business stability. This enhances the precision and reliability of credit risk evaluation.

2.1.2. Real-time credit monitoring

In credit risk management, conducting a one-time credit risk assessment is insufficient. It is also necessary to monitor the credit status of borrowers in real time, finding out potential risks in time and issue early warning. The traditional credit monitoring method primarily relies on regular financial statement analysis and manual investigation. This method suffers from information lag and low efficiency, making it difficult to find the changes of credit risk in time [4].

With the help of big data technology, enterprises can realize the real-time monitoring of customers credit status. Through the real-time connection with various data sources, such as banking systems, e-commerce platforms, social media, etc., customers can obtain the latest transaction information, capital flow situation, public opinion information, etc. Using real-time data analytics, these data are processed and analyzed in real time. Once abnormal changes are found in the customers credit status, such as overdue repayment, tight capital chain, negative public opinion, etc., the system can timely send early warning signals to remind enterprises to take corresponding risk control measures.

2.2. Market risk management

Market risk refers to the potential financial losses enterprises may incur due to adverse fluctuations in market prices, including interest rates, exchange rates, stock prices, and commodity prices. In the complex and changeable financial market environment, effective market risk management is crucial for the financial stability and sustainable development of enterprises. With its powerful data processing and analysis capabilities, big data technology has brought new opportunities for risk

DOI: 10.54254/2754-1169/177/2025.22433

management in the enterprise market, enabling enterprises to more accurately identify risk factors, monitor risk status in real time and predict risk trends.

2.2.1. Identification of market risk factors

Market risk factor refers to the various factors that affect the price fluctuation of the financial market, and then cause the market risk. These factors are diverse and interrelated, making it challenging for traditional risk identification and assessment methods to comprehensively capture and analyze them. The advent of big data technology has provided a strong support for solving this difficult problem. By integrating vast amounts of internal and external data, enterprises can identify the market risk factors more comprehensively and employ advanced data analysis technology to build an accurate risk assessment model.

Big data technology has unique advantages in identifying market risk factors. Companies can collect data from multiple channels, including financial market transaction data, macroeconomic indicators, industry reports, and social media analytics. Financial market trading data can directly reflect the fluctuation of market price, such as the closing price and trading volume of stocks, the contract price of futures, and the open position volume, etc. These data are the basis for identifying market risks. Macroeconomic data, such as gross domestic product (GDP), inflation rate, interest rates, and exchange rates, have a profound impact on financial markets. For example, rising interest rates may lead to lower bond prices, and fluctuations in exchange rates may affect the foreign exchange earnings of multinational companies.

Industry data can help enterprises understand the development trend and competition situation of the industry they are in. The depression of the industry may lead to the decline in the sales revenue of enterprises and the squeeze of market share. While social media data may not appear directly linked to financial markets, a large amount of public sentiment and market expectations also have an significant impact on market risks. For example, negative reviews of a company on social media could spark panic among investors, sending the company share price down [5].

2.2.2. Real-time market risk monitoring

In market risk management, real-time monitoring of risk status and accurate prediction of risk trends are essential for enterprises to implement effective risk control measures promptly. With its powerful data processing ability and real-time analysis technology, big data technology enables real-time monitoring and accurate prediction of market risks, providing enterprises with timely and accurate risk information. This allows them to respond proactively to the complexities of the ever-changing financial market.

Take the securities market as an example, the securities market is a highly complex and sensitive market, with frequent market price fluctuations and many influencing factors. Big data technology plays an important role in the market risk monitoring and prediction in the securities market. Through real-time collection and analysis of huge amounts of securities market data, including stock prices, volume, capital flow, macroeconomic data, company's financial data, industry dynamic data and social media public opinion data, enterprises can real-time grasp the changes of the market, timely discover the potential risk factors, and predict the movements of the market risk.

In terms of real-time market risk monitoring, big data technology can realize the real-time collection and processing of securities market data. Enterprises can establish real-time data connections with stock exchanges and financial data providers to obtain the latest trading data of the securities market. Utilizing distributed computing technology and real-time data processing framework, such as Apache Flink, Kafka, etc., enterprises can quickly process and analyze these massive real-time data. By setting a series of risk monitoring indicators, such as the volatility of stock

DOI: 10.54254/2754-1169/177/2025.22433

price, abnormal changes of trading volume, sudden change of capital flow, etc., the risk situation of the securities market is monitored in real time. Once the risk index is found to exceed the preset threshold, the system can immediately issue an early warning signal to remind the enterprise to take corresponding risk control measures.

2.3. Operational risk management

Operational risk is the risk of loss due to imperfect or faulty internal procedures, personnel, systems, or external events. In corporate financial activities, operational risks widely exist in various business links, such as transaction execution, clearing and settlement, account management, and internal control. The application of big data technology has brought new ideas and methods for enterprise operational risk management, which can help enterprises to more effectively identify, evaluate, monitor and warn operational risks, thus reducing operational risk losses.

2.3.1. Operational risk identification

The identification of operational risk is the foundation of operational risk management. Traditional operational risk monitoring primarily relies on periodic reports and manual inspections, which are insufficient for real-time risk detection and early warning. These methods has problems such as information lag and limited coverage and often fail to comprehensively and accurately identify potential operational risks. Big data technology can integrate the internal and external multi-source data of an enterprise, uncover hidden risk factors through data analysis and mining techniques, and achieve more precise risk identification and assessment. The first step involves integrating multi-source data. Enterprises collect transaction data, customer information data and employee operation log data generated by the internal business system of the enterprise, and introduce the external industry data, regulatory data and public opinion data. These diverse data cover all aspects of enterprise operations and provide a rich source of information for operational risk identification.

Next, the data cleaning and preprocessing were performed. Given that raw data often contain issues such as missing values, duplications, and errors, enterprises utilize the data cleaning technology to process the data, remove the invalid data, fill the missing value, correct the wrong data, and ensure the accuracy and integrity of the data. Following this, the characteristic variables associated with operational risk were extracted from the preprocessed data by using data mining and analysis techniques.

2.3.2. Operation risk monitoring

Operational risk monitoring mainly relies on regular report and manual inspection, which are insufficient for real-time risk detection and early warning. These conventional methods often fail to find the early signs of risk events in time. Big data technology can collect and analyze massive data in real time, through the establishment of risk monitoring indicators and early warning model, realize real-time monitoring and early warning of operational risks, and provide support for enterprises to take risk control measures in time.

In terms of real-time monitoring, the system collects transaction data, market data and system operation data of the securities trading system in real time, as well as operation behavior data of employees and transaction behavior data of customers, etc. Using real-time data analysis technology, these data are processed and analyzed in real-time. By setting a series of operational risk monitoring indicators, such as the response time of the trading system, the error rate of trading orders, and abnormal transaction frequency, the change of operational risk can be monitored in real time. If any of these indicators exceed predefined thresholds, the system immediately triggers an early warning signal, enabling enterprises to take prompt corrective actions.

DOI: 10.54254/2754-1169/177/2025.22433

3. Challenges and countermeasures for the application of big data technology

3.1. Data security

The growing prevalence of cyberattacks poses a significant threat to enterprise information systems, with hackers invading the information systems of enterprises through various means and steal sensitive data. Common cyber attacks include malware, phishing, and DDoS attacks. For example, in the WannaCry ransomware incident in 2017, a large number of computer systems of enterprises and institutions around the world were attacked, and the encrypted data faced the risk of ransom payment. Financial institutions were particularly vulnerable, with customer information, transaction records, and other vital data at risk.

Beyond cyber threats, security risks in the process of data storage and transmission can not be ignored. Enterprise database may be lost due to inadequate physical security measures, such as server theft, fire, flood and other natural disasters. During data transfer, the data may be intercepted and tampered with if no effective encryption measures are taken. Some criminals set up listening devices on the network transmission line to obtain sensitive data transmitted by enterprises, using them for illegal purposes. The violation of internal personnel is also a major threat to data security. Internal employees of the enterprise may lead to data security incidents due to negligence, intentional leakage and other reasons. For example, estoring sensitive files in unsecured locations or sharing account credentials can create vulnerabilities that threaten organizational data integrity. To address these challenges, enterprises need to adopt a series of effective protection measures. At the technical level, the application of data encryption technology should be strengthened. Data encryption is the process of converting raw data into ciphertext, and only authorized personnel with the correct key can decrypt and access the data. In the process of data transmission, SSL/TLS and other encryption protocol are adopted to ensure the security of data in network transmission. In terms of data storage, sensitive data should be encrypted by using AES, RSA and other encryption algorithms to encrypt the data in the database processing. At the management level, enterprises should formulate perfect data security and privacy protection systems. Clarify the norms and processes of data collection, storage, use, transmission and sharing, to ensure that there are rules to follow in all aspects of data processing. Employee training on data security best practices is essential to enhance awareness and adherence to security protocols. Additionally, regular audits and security assessments should be conducted to identify and address potential vulnerabilities proactively.

3.2. Data quality

The impact of data quality on risk management is multifaceted and profound. Inaccurate data can bias risk assessment and mislead enterprises to making decisions. In the credit risk management, if the customers income data is wrongly recorded, it may lead to the miscalculation of the customers repayment ability. If low-income customers are overestimated, banks may give them loans beyond their actual ability to repay, increasing the risk of default. If the customer fails to pay on time, the bank will face a loss of funds, and the credit risks transform into actual losses. This kind of risk assessment bias caused by inaccurate data may lead to a chain reaction in the whole financial system and affect the stability of the financial market.

In order to improve data quality, companies need to adopt a series of effective methods. In the data collection stage, the data requirements should be clarified, and a scientific and reasonable collection plan should be formulated. Determine the type, scope and accuracy of data to be collected according to the objectives and requirements of risk management. While collecting customer credit data, we should not only pay attention to the basic information and financial status of customers, but also collect their credit history, repayment records and other relevant information. At the same time,

DOI: 10.54254/2754-1169/177/2025.22433

reliable data sources should be selected to ensure the authenticity and reliability of the data. For external data, data providers should be strictly screened and evaluated, and data suppliers with good reputation and professional ability should be selected.

3.3. The technical bottleneck

At the technical level, the complexity and diversity of big data processing technology have brought great challenges to enterprises. The processing of big data involves data collection, storage, cleaning, analysis, mining and other links, and each link needs the corresponding technical support. In the data collection stage, it is necessary to obtain data from a variety of different data sources, including structured data, semi-structured data and unstructured data, which requires enterprises to have efficient data collection technologies and tools. In terms of data storage, due to the huge scale of big data, the traditional relational database is difficult to meet the storage requirements, so distributed storage technologies, such as Hadoop distributed File System (HDFS), are needed. However, the application of these new technologies requires enterprises to have a certain technical strength and experience, otherwise prone to unstable data storage, low reading and writing performance and other problems.

In order to solve the technical problems, enterprises can take a series of targeted measures, , such as increasing investments in big data research and development. Integrating advanced data processing technologies and tools can enhance efficiency and reliability. Establishing dedicated research and development teams and fostering collaborations with academic institutions can also be beneficial. For example, a financial institution partnering with a leading university to establish a big data joint laboratory can facilitate the development of innovative risk management solutions. Such collaborations enable enterprises to leverage cutting-edge academic research for practical applications while benefiting from access to expert knowledge and talent development opportunities, ultimately fostering a mutually beneficial ecosystem.

3.4. Laws and regulations

With the rapid development of big data technology, new financial business models and products are constantly emerging, such as Internet finance, digital currency, intelligent investment and consulting, etc. However, the relevant laws and regulations have failed to keep up with the development of technology and business. Taking digital currency as an example, digital currencies such as Bitcoin and Ethereum have been widely used and traded around the world, but most countries and regions have not yet formulated perfect laws and regulations on digital currency regulation. As a result, many chaos exist in the digital currency market, such as market manipulation, money laundering, illegal fund-raising and other frequent risk events. Due to the lack of clear legal norms, regulators face many difficulties in supervising the digital currency market, which makes it difficult to effectively crack down on illegal activities and protect the legitimate rights and interests of investors.

The government should pay close attention to the application and development trend of big data technology in the financial field, formulate and revise relevant laws and regulations in a timely manner, and clarify the legal status, regulatory rules, responsibilities and obligations of big data financial business. For digital currency, special laws and regulations should be issued as soon as possible to regulate the issuance, trading, supervision and other aspects of digital currency, and clarify the nature, trading rules and investor protection measures of digital currency. At the same time, we will strengthen legislation on emerging financial services such as Internet finance and intelligent investment consulting to fill in the legal gaps and provide a strong legal basis for financial supervision.

DOI: 10.54254/2754-1169/177/2025.22433

4. Conclusion

In the process of digital transformation of the financial industry, the application of big data technology in enterprise financial risk management has become an unstoppable trend. This study deeply analyzes the specific application of big data technology in credit risk, market risk and operational risk management, and shows its significant advantages in improving the efficiency and accuracy of risk management.

Looking ahead, with the continuous development and innovation of big data technology, its application in enterprise financial risk management will be more thorough and extensive. Enterprises should actively respond to the challenges, leverage the advantages of big data technology, and constantly improve the level of financial risk management. Meanwhile, the government and regulatory agencies should create a good policy environment and regulatory atmosphere, promote the healthy application of big data technology in financial risk management, and jointly promote the stable development of the financial industry. The widespread adoption of big data in this domain holds great promise, offering new momentum for the sustainable development of the financial industry.

References

[1] *Tian X, Tian Z Y, Khatib S F A, et al.Machine learning in internet financial risk management: A systematic literature review[J]. PLoS ONE, 2024, 19(4). DOI:10.1371/journal.pone.0300195.*

[2] *Gao Z. Application of Internet of Things and Block-chain Technology in Improving Supply Chain Financial Risk Management System[J]. IETE journal of research, 2023, 69(10): 6878-6887.*

[3] *Liu J, Ge Z, Wang Y. Role of environmental, social, and governance rating data in predicting financial risk and risk management[J]. Corporate Social Responsibility & Environmental Management, 2024, 31(1).*

[4] *Kismawadi E R, Aditchere J, Libeesh P C. Integration of Artificial Intelligence Technology in Islamic Financial Risk Management for Sustainable Development[J]. Springer, Cham, 2024.*

[5] *Wang S. The Application of Artificial Intelligence-Based Risk Management Models in Financial Markets[J]. Open Journal of Social Sciences, 2024, 12(11): 11.*