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Financial Risk Management Based on Big Data Technology

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Abstract: In the past decade, the financial industry has shown a trend of rapid development, with traditional financial institution models gradually being replaced by a coexistence of traditional and various emerging financial forms. As the operating models in the financial industry undergo corresponding changes, the types and quantity of risks that may exist within the industry continue to increase. The complexity of financial risks is gradually becoming more pronounced, with factors such as changes in laws and regulations, lack of credit assessment, and data loss or leaks in internet financial trading platforms potentially leading directly to financial risks. Employing traditional work models and methods for financial risk management often makes it difficult to achieve the desired risk control outcomes. Currently, big data technology has been widely utilized in the insurance, banking, and other sectors of the financial industry. Major financial institutions continuously innovate the traditional methods of analyzing and processing data information by leveraging big data, transforming the way financial data exists in the industry. Only by actively adapting to the trends of the times and flexibly applying big data technology to practices such as credit assessment and risk alerting can financial risk management innovation be comprehensively promoted, resulting in effective control of complex financial risks. Based on this, this paper analyzes the changes and characteristics of financial risk management in the era of big data, discusses the important role and specific applications of big data technology in the field of financial risk management and proposes relevant strategies for enhancing financial risk management in the big data environment, aiming to advance the progress of financial risk management in the era of big data.

Keywords: Big Data Technology, Financial Risk Management, Risk Assessment, Risk Prevention, Technology Application.

1. Introduction

Currently, the scope of development in the financial industry is becoming increasingly broad, with a gradual increase in the number of customers and continuous advancement in financial innovation. Various forms of finance are rapidly emerging, rendering traditional financial risk management models inadequate to meet the current development needs of the industry. With the market changing rapidly, the financial industry must keep pace with the times, making effective use of data technology crucial. For instance, big data technology can efficiently process large volumes of data. In the financial sector, massive amounts of data are generated daily, such as customer transactions, market trends, and credit ratings. Processing and analyzing such data is crucial for risk management. Big

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data, as a distributed storage and computing method, can disperse vast amounts of information across various computing nodes, significantly enhancing data processing efficiency. Additionally, big data technology can provide more accurate data analysis results for financial risk management. Through analyzing and mining large datasets, we can uncover patterns and trends hidden within the data, enabling better prediction of future market trends and risk situations, and the corresponding development of risk control strategies.

Many scholars have conducted research on financial risk management in the context of big data. Paola Cerchiello and Paolo Giudici present the first systemic financial risk model based on big data, and show that such a model can shed further light on the interrelationships between financial institutions[1]. Hangjun Zhou et al. develops a big data mining approach of PSO-based BP neural network for financial risk management with IoT[2]. Min Zhang points out that it is necessary to integrate big data and Internet of Things technology to establish an effective financial risk assessment mechanism and discuss the application research of fiscal and taxation big data in enterprises risk management[3]. Wei Ran and Yao Sheng introduces the method of identifying financial risk in the background of big data by classifying the methods of financial risk identification and designing the factor model[4]. Yue Huabo et al. study enterprise Financial Risk Management (FRM) through Big Data Mining (BDM) and explore effective FRM solutions by introducing information fusion technology[5]. Jung Kwangmin et al. proposes a dynamic process of portfolio risk measurement to address potential information loss and finds that the use of financial big data improves small portfolio risk analysis[6]. Qiyu Liang explores financial risk prediction methods based on big data technology from aspects such as credit risk analysis, and then explored financial risk prevention strategies supported by big data technology from aspects such as risk prevention awareness[7]. Qiang Du obtain the financial risk prediction feature sequence in the context of big data based on the use of recurrent neural networks and LSTM deep neural networks[8].

It is foreseeable that the application of big data technology will have a profound impact on financial risk management. Therefore, enterprises, governments, and other entities need to continuously explore innovation, adjust strategies flexibly, and adapt to the financial risk management practices required in the era of big data.

2. Characteristics of Financial Risk Management in the Era of Big Data

2.1. Impact on Traditional Analytical Methods

In traditional enterprise financial management processes, due to the challenges in data collection and the lack of advanced data analysis techniques, data analysis has often been based on sampling tests, resulting in partial and incomplete results that fail to cover the entirety of the data. With the introduction of big data technology, comprehensive research can be conducted on the collection, organization, and analysis of financial data, leveraging the correlations within big data to produce more comprehensive analysis results and enhance the efficiency of analytical work. The application of big data technology has become a inevitable trend in financial risk management.

2.2. Increasing Variety of Financial Risk Forms

With the widespread application of big data technology, financial institutions are facing significantly increased potential financial risks, leading to the formation of various new forms of financial risks. For example, with a broader coverage of accessible financial data, financial institutions often encounter technological risks. If the application of big data analytic technology is not executed properly, it may not only fail to effectively utilize vast financial data but also lead to issues of biased risk assessment results. Furthermore, when financial institutions collect, aggregate, and organize various financial data through big data platforms, privacy risks are magnified. In the event of a

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financial data breach, where customer privacy information is accessed by unauthorized individuals, both customers and financial institutions themselves may incur substantial economic losses.

2.3. Increasing Significance of Financial Data

In traditional financial risk management models, financial institutions prioritize the collection and analysis of financial data, but the content of the data is relatively limited. For example, tasks such as risk identification and risk assessment still rely to some extent on the subjective experience of the staff. However, with the advent of the big data era and the widespread application of big data technology, the role that financial data can play has become increasingly critical. Whether it is the identification of potential financial risk types or the selection of risk management strategies, financial data analysis results are essential reference points.

3. The Crucial Role of Big Data in Financial Risk Management

3.1. Comprehensive Acquisition of Financial Data

In the traditional financial risk management model, financial institutions face limitations in accessing financial data, leading to inefficiencies in data collection. This often results in inadequate timeliness and comprehensiveness of financial data, making it challenging to provide significant assistance in credit evaluation, risk monitoring, and other related tasks. Taking the example of loan operations, when a borrower applies for a loan, financial institutions may struggle to gather specific data related to the borrower's financial transactions, tax payments, etc. This hinders accurate risk assessment and the implementation of targeted financial risk management measures.

Effective utilization of big data technology can fundamentally transform this situation in financial risk management. By establishing data-sharing platforms with customs, tax authorities, law enforcement agencies, other enterprises, or financial institutions, various information systems can be efficiently interconnected. Leveraging this platform for automated and intelligent financial data collection and organization allows for detailed financial data pertaining to customer financial transactions, goods circulation, liabilities, business operations, third-party platform payments, and other aspects to be obtained, ensuring the comprehensiveness of financial data.

Upon acquiring comprehensive and detailed financial data, financial institutions can not only establish a sophisticated credit rating system by creating individual customer profiles but also utilize big data analytics to accurately evaluate customer credit ratings. Furthermore, they can make reasonable predictions on the probability of customer default behavior, potential operational risks for corporate clients, and other aspects to support subsequent quantitative analysis and management of financial risks.

3.2. Accurate Assessment of Financial Risks

Financial risks inherently possess complex and diverse characteristics, as well as a high degree of uncertainty. Even risks of the same type with similar causal factors can vary significantly in impact, scope of losses, and probability of occurrence based on factors such as timing and the specific financial institution involved. This variability presents significant challenges in identifying and measuring financial risks. Leveraging big data technology effectively in financial risk management allows for the utilization of its advantages in handling vast amounts of data. By integrating data from various sources such as customer information, market data, and current regulations, and employing specialized risk assessment models for comprehensive analysis, accurate risk identification and measurement can be achieved. This approach helps determine the types of potential financial risks,

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their severity, likelihood of occurrence, scope of losses, and other relevant information, thereby supporting the selection of strategies and tools for financial risk management.

3.3. Establishing Standardized Risk Assessment Frameworks

From the perspective of financial institutions, decision-making in traditional financial risk management is subjective, and financial risks themselves are highly complex. Therefore, there is often a lack of standardized criteria in the risk assessment process. Taking credit operations as an example, even within the same financial institution processing a credit application for a client, differences in the approving personnel can lead to varying final approval outcomes, significantly impacting the accuracy of risk assessment. The effective application of big data technology in financial risk management can address the shortcomings of traditional models, assisting financial institutions in developing specialized risk assessment models tailored to their specific circumstances. This involves establishing corresponding professional software tools and information systems for financial risk assessment to replace manual risk assessment by management personnel. When conducting credit risk assessments using these professional software tools and information systems, regardless of changes in approving personnel within the financial institution, the evaluation must heavily rely on the recommendations provided by the software and system. As a result, significant discrepancies in the final assessment outcomes are less likely to occur, ensuring the standardization of risk assessment criteria.

3.4. Effectively Mitigating Substantive Financial Risks

In traditional financial risk management models, many financial institutions collect, organize, and record customer information comprehensively. However, they often face challenges in effectively utilizing this information in conjunction with practical business operations such as credit approval. Applying big data technology in financial risk management enables the automatic integration of data on corporate client operational status, customer transaction information, third-party platform payment data, and more using big data systems. Leveraging this data, simulations can be conducted to predict the future development of potential financial risks. If the probability or severity of a certain type of financial risk exceeds predefined thresholds, the system can automatically issue warnings and provide recommendations such as freezing collateral, proactive withdrawal, or mandatory loan repayment. By acting on the warning messages and recommendations from the risk alert system, financial institutions can promptly identify potential financial risks, implement appropriate risk mitigation and control measures, thereby significantly reducing substantive risks.

4. Specific Applications of Big Data in Financial Risk Management

4.1. Establishing a Scientific and Comprehensive Risk Prevention System

Under the impact of diversified factors, the number of types of financial risks is continuously increasing. These risks not only include external-oriented risks such as credit risk and market risk, but also internal-oriented risks such as operational risk and liquidity risk. The existence of diversified financial risks brings corresponding adverse effects to the smooth and effective implementation of financial activities. The increasing number of types of financial risks significantly raises the difficulty of financial risk regulation. In the context of effective application of big data analysis and mining technologies, combined with the relevant calculation methods proposed for different types of financial risks in the Basel Accords, financial risk management personnel can better establish a scientific, rational, and comprehensive financial risk prevention system. Through the calculation,

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identification, and regulation of financial risks, supervisors can robustly monitor aspects such as the occurrence rate and damage rate of financial risks.

4.2. Establishing a Comprehensive Customer Profile Database

For financial enterprises, customer default behavior often serves as a significant source of various financial risks. To reduce the likelihood of customer default behavior and effectively control the adverse impact it poses on financial risks, a comprehensive and systematic analysis of customer behavior is essential. By enhancing the understanding of customers for financial enterprises and related institutions, it becomes possible to prevent frequent defaulting customers from entering into financial agreements with financial enterprises and institutions, thereby controlling financial risks at the source and reducing the probability of risk occurrence. Furthermore, leveraging effective utilization of customer credit analysis reports enables financial enterprises to develop efficient risk mitigation measures, achieve meticulous work, and effectively optimize financial risk management goals. Simultaneously, amidst the continuous development in the financial industry, there is a trend towards increasing complexity in the credit environment. Given that information disclosure on many corporate websites often exhibits significant lagging characteristics, financial enterprises and related institutions struggle to have timely and comprehensive insights into the current financial status of corporate clients. Particularly with the increasing variety of credit models in the domestic financial industry, the growing number of financial behaviors among corporate clients escalates the challenges in financial risk management. Through the effective utilization of big data analytics and mining technologies by relevant institutions and enterprises, supported by robust big data capabilities, data on past behaviors, occurrence times of behaviors, and social relationships of corporate clients can be rapidly collected and organized. By presenting this information graphically, financial enterprises and related institutions can better understand the past financial status of corporate clients, analyze the likelihood of customer default behavior occurrence, anticipate potential operational risks for enterprises, and aid in formulating optimized financial risk management measures. This contributes to meeting the evolving needs of financial risk management in the industry.

4.3. Meeting Risk Management Needs for Emerging Financial Service Models

In the continuously evolving financial industry, emerging financial service models such as P2P lending and online small unsecured loans have been emerging and widely adopted. In light of the emergence and broad application of these new financial service models, it is crucial to focus on enhancing the corresponding financial risk management practices. Leveraging the effective application of modern scientific technology such as big data analytics by relevant personnel can provide robust data support. This not only aids in facilitating the active transformation of credit management models and related concepts within financial institutions but also contributes to the adaptation of financial risk management to accommodate the existence and development of new financial management models.

5. Strategies for Enhancing Financial Risk Management in the Big Data Era

5.1. Accelerating the Development of Big Data Platforms

Many financial institutions can leverage big data platforms to extensively collect various financial data to ensure comprehensive financial coverage. However, there are many deficiencies in the construction of big data platforms. To transform this current state of financial risk management and achieve effective utilization of big data technology, it is necessary for relevant financial institutions to continue accelerating the construction of big data platforms. They should integrate their business

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realities and financial data requirements, continuously expand financial data collection channels, and connect various data collection channels to strengthen the information sharing capabilities of big data platforms. For example, in the investigation of data related to corporate clients, collaboration with internet e-commerce platforms and new media platforms can be strengthened to comprehensively collect information on corporate clients' product production and sales situations, management preferences, and other information. This ensures that credit ratings and financial risk assessments for corporate clients have more objective data support. In the investigation of data related to individual clients, entry can be made through the internet finance sector, conducting data collection activities targeting the large user base of third-party payment platforms and social networks to ensure the comprehensiveness and objectivity of financial risk assessment results.

5.2. Optimizing the Application of Customer Data

For financial institutions, while financial risk management relies on a large amount of financial data as its foundation, its core objective is not simply data collection and organization. Rather, it involves conducting comprehensive scientific analysis of financial data and effectively applying it to tasks such as risk identification, risk measurement, selection of risk management strategies, and risk mitigation. This ensures better control of various financial risks. Therefore, in the era of big data, to effectively apply big data technology in financial risk management, financial institutions must also adhere to the fundamental principle of customer-centricity. They should promptly establish a comprehensive customer risk management system and focus on aspects such as data storage and organization, data analysis, integration of analysis results, and application of analysis results. By developing relevant system modules, financial institutions can ensure the wide and effective application of financial data for customers. For instance, in data analysis, leveraging the internal structural characteristics of the current customer base and their relationship with various financial risks, the development of customer classification functions within the customer risk management system can be undertaken. This enables the system to integrate data information for each customer, automatically classify and grade them based on this data, and identify common potential financial risks for different types and levels of customers to enhance the specificity of financial risk management. In terms of applying data analysis results, functionalities such as customer credit limit management, customer issue analysis, display of customer transaction habits, and transaction optimization recommendations can be developed based on the actual requirements of financial risk management and other business operations. These features provide support for tasks such as handling customer credit transactions and preemptively avoiding potential financial risks.

5.3. Strengthening Data Security Management

In financial risk management based on big data technology, financial institutions are able to achieve comprehensive collection and effective utilization of various financial data. However, they also face significant data security issues. The consequences of accidental loss or unauthorized disclosure of financial data collected in the past can be severe. To prevent such occurrences and mitigate the negative impacts of applying big data technology, it is essential to strengthen data security management and ensure comprehensive protection of financial data. For example, in cases where customer-related data directly impacts their financial security, a mechanism for graded protection of customer data should be established. This involves determining the confidentiality level of customer data types and implementing database access control and data encryption methods to provide specialized protection for highly confidential customer data and prevent data leakage incidents. Additionally, in situations where financial risk management requires high data comprehensiveness, establishing a robust system for off-site data backup is necessary. Regular off-site backup of acquired

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financial data helps prevent unexpected incidents such as database system hardware failures or network attacks, ensuring prompt recovery of financial data in case of accidental loss.

6. Conclusion

In conclusion, it is manifest that the emergence of the big data era has not only brought about substantial alterations to financial risk management but also revolutionized diverse aspects of business operations. Besides comprehending the role of big data in financial risk management, financial institutions must also give priority to exploiting its potential for customer insights and market trends. By leveraging advanced analytics and machine learning algorithms, enterprises can acquire a more profound understanding of customer behavior, preferences, and requirements. This empowers them to customize their products and services more effectively while mitigating risks associated with market fluctuations. Furthermore, in the contemporary interconnected digital terrain, ensuring robust data security measures is of paramount importance. Financial institutions need to invest in cutting-edge cybersecurity protocols to safeguard sensitive information from cyber threats and breaches. Moreover, constructing scalable big data platforms that can handle vast volumes of diverse data sources is indispensable for extracting actionable insights. This entails integrating structured and unstructured data from internal systems as well as external sources such as social media feeds or industry reports. By doing so, financial institutions can enhance their decision-making processes by obtaining a comprehensive view of market dynamics and proactively identifying potential risks. In conclusion, embracing big data technologies offers an opportunity for financial institutions to fortify their risk management capabilities while remaining competitive in an increasingly dynamic marketplace. Through strategic investments in technology infrastructure, talent development, and the ethical use of customer data, organizations can navigate uncertainties more effectively while delivering greater value to stakeholders.

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