Analysis of Problems and Countermeasures in the Application of Big Data Technology in Finance

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Abstract: With the increasing degree of informatization in the financial industry, customer demand and market environment are becoming increasingly complex, and big data technology applications in the financial sector are now a major factor driving the industry's growth. Based on this, the article analyzes the problems and countermeasures in the application of big data technology in finance. The application of big data technology in the financial field faces four problems, namely, data quality problems, data privacy and security problems, data silos and collaboration challenges, data analysis and use restrictions, and this article obtains four countermeasures through discussion. The countermeasures are as follows, improving data quality, enhancing data privacy protection, connecting data silos and reducing data analysis and utilization limitations. In addition to offering solutions to some of the issues encountered in its implementation, the study presented in this article serves as a reference for the use of big data technologies in the financial sector.

1 INTRODUCTION

From a macro perspective, big data technology has become a key driver of economic, social, technological and even global development. It has not only improved the efficiency and effectiveness of various fields but is also profoundly changing the way human society operates. Therefore, the advancement of modern society will inevitably need the understanding and application of big data technology. Big data technology has numerous applications. Table 1 shows the applications of big data technologies in specific areas.

In particular, the special characteristics of the use of big data technology in the financial sector is that it accentuates the high accuracy and performance of the data in real time, risk management and compliance of the data, and privacy and data security.

Nowadays, there have been a number of studies that have analyzed in depth the application of big data technologies in finance. To meet the challenges of data quality and processing efficiency, financial institutions should fundamentally optimize their data processing processes (Zhang & Liu, 2024). Additionally, enterprises can establish big data platforms for data sharing (Zhou, 2024; Zhu, 2023). At the same time, in the quantitative investment process, machine learning algorithms in big data technology can be utilized to construct machine learning models with computer support (Guo, 2024). In terms of asset allocation, asset allocation founded on big data technologies is establishing a set of customer-centric intelligent asset allocation system by analyzing customers' investment behavior and financial situation (Zhao, 2024). However, the application of big data analytics in the financial sector still faces four problems, issues with data quality, issues with data safety and confidentiality, data silos and collaboration challenges, data analysis and use restrictions, so this study analyzes these issues in depth and proposes responses accordingly.

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Table 1: Applications of big data technologies.

Field	Big Data Applications	Key influence
financial	Risk management, precision marketing, credit scoring, anti-fraud monitoring	Enhanced risk control, increased customer conversion, reduced bad debt risk
healthcare	Disease prediction, personalized treatment, healthcare resource optimization	Improved healthcare efficiency, personalized treatment plans, reduced healthcare costs
government	Smart city development, public safety management, resource allocation	Improved city management efficiency, enhanced public safety, optimized resource allocation
energy	Smart grids, energy demand forecasting, renewable energy management	Increased energy efficiency, reduced waste, promoted green energy
education	Personalized learning paths, educational resource optimization, academic research data analysis	Improved teaching effectiveness, equitable distribution of educational resources, accelerated research progress

2 PROBLEMS

2.1 Data Quality Issues

Because financial data is often collected from a variety of sources, it may contain inconsistencies, redundancies, or incomplete errors. Data quality directly affects the accuracy of big data analyses. (Xiao, 2024). Studies on big data technology's application in the finance sector. Firstly, the financial sector involves multiple data sources such as market data, trading data and customer data, and these different data can lead to inconsistencies in data quality. Second, each type of data is affected to varying degrees, with market data being affected by market fluctuations and trading activities, while customer data is subject to quality uncertainty due to irregularities in information entry or inaccuracies in the information provided by customers. Third, financial institutions may be affected by factors such as network fluctuations and system failures when collecting data, all of which may lead to inconsistencies in the data collection process. Finally, due to the dynamic nature of financial markets, delays in data transmission and processing can result in an inability to ensure real-time availability, for example, in a rapidly fluctuating market environment, where delays in transmission and processing times can result in the unavailability of data at critical moments, thereby affecting the ability of financial institutions to respond to market conditions.

2.2 Data Privacy and Security Concerns

Financial data contains a large amount of sensitive information about individuals and businesses.
Information may be exchanged wirelessly between people, computers, and the surrounding environment thanks to widely used large data transfer technologies as wireless sensor and actuator networks (Zhang, 2020). While this improves the convenience and efficiency of data collection, it also increases the risk of data breaches. For example, in 2017, Equifax, one of the main three American credit reporting companies, suffered a serious data leak. Hackers exploited an unpatched cyber vulnerability in Equifax to illegally access the company's database. About 147 million American consumers' personal information, including Social Security numbers, dates of birth, addresses, and driver's license numbers, were compromised in the hack. This example underscores data security's significance and privacy to the banking industry, especially when dealing with large amounts of sensitive data. Data breaches can not only cause significant harm to individuals, but also pose serious financial and reputational risks to financial institutions.

2.3 Data Silos and Collaboration Challenges

The data in different parts of the financial institution is usually closed, so that there are many data silos, limiting the effect of big data application.

For example, the risk management department has its own risk data, while the marketing department has independent customer data, which leads to the inability to share data between departments, hindering the establishment of an overall data view and affecting the comprehensive analysis of the overall business. Different departments use different data standards, making it necessary to spend a lot of effort on standardization in the data integration process. Standardization involves consistency in data naming, units, formats, etc. Inconsistency leads to confusion in data integration, and the lack of standardization increases the difficulty of integration, leading to misleading conclusions in the analysis

process. At the same time, financial institutions rely on multiple third-party data providers, and different providers use different data formats, which complicates the integration of data from different providers, further increasing the difficulty of integration and creating challenges for financial institutions to utilize third-party data.

2.4 Data Analysis and Utilization Limitation

In the big data era, some enterprises encounter certain problems in data analysis and utilization (Qiu, 2024). These issues are primarily evident in the following two areas. Firstly, although most enterprises have accumulated a huge amount of data, they have not been able to explore the intrinsic value of these data in depth. This is mainly due to the general lack of professional big data analysis team, especially the lack of data scientists and engineers who master advanced technologies such as data mining and machine learning. Secondly, there is also a significant lack of data infrastructure construction in enterprises, such as the lack of data warehouses and data middleware. This lack of infrastructure makes it difficult for in-house data teams to take on the complex tasks of data integration, storage, processing, and model building. This not only limits the depth and breadth of big data analytics and applications, but also affects an organization's ability to make data-based decisions and the possibility of guiding business strategy based on data insights.

3 SOLUTIONS

3.1 Increase the Data Quality

Data quality will be improved through the implementation of a reliable data governance framework, including steps such as data cleansing, data standardization, and data integration. Meanwhile, the development of technology utilizing artificial intelligence to automate the identification and repair of errors in data is also a way to enhance data quality. Between the industry with the formation of data self-contained system, from within the financial industry, to be in accordance with the content of the data of banks, securities, insurance, etc., effectively solving the problem of non-uniformity of the standard specification. If you want to effectively use big data to carry out analysis work, then it is essential to make sure the standardization of data recording methods and methods, but also need to develop the content of the specification is closely related to the protection of data quality. By comprehensively considering the different ways of recording data, mastering various types of accounting processing methods, and starting from within financial institutions, within the industry, and between industries, it gradually realizes the basic goals of data openness and sharing, and promotes the establishment of a platform for sharing basic data on comprehensive statistics in the financial industry (Chang, 2024).

Companies can use machine learning algorithms to automatically identify and fix errors in data, especially effective when dealing with large-scale data. Companies can also use AI models to predict possible data quality issues and take steps to prevent them in advance.

3.2 Strengthen Data Privacy Protection

Financial institutions can strengthen data privacy and security through a variety of measures such as data encryption, patching network vulnerabilities, and blockchain technology to prevent data leakage and misuse and ensure compliance in a strict legal and regulatory environment, while improving customer trust and corporate reputation.

Enterprises need to save accounting information and establish a more complete confidentiality system and authorize it. More advanced network key technology can be utilized for encryption, so that the security of accounting information has been improved. At the same time, enterprises can strengthen the protection of computer hardware and software for recording accounting information, and effectively implement the confidentiality of information.

By patching network vulnerabilities, the unscrupulous elements can be prevented from attempting to steal company data and information through illegal means. At the same time, by installing patches in a timely manner, conducting regular vulnerability scans, and strengthening access control and encryption measures, the security of the system can be enhanced, thus effectively protecting data privacy and preventing the leakage of sensitive data

Blockchain technology protects data privacy through mechanisms such as decentralization, encryption and hashing, anonymity, tamper-proof ledgers, smart contracts and selective disclosure. It enables users to conduct secure transactions and share data without revealing their personal identity, while ensuring data integrity and control and reducing the risk of privacy breaches.

3.3 Bridge the Data Silos

Data silos can be bridged through the establishment of a unified data platform, the use of data warehouses and data lakes, and the use of integration techniques and tools. These measures can help to consolidate dispersed data resources and facilitate the flow of data across different departments and systems, thereby improving data availability and the efficiency of business decision-making.

Enterprises can establish a unified data-sharing policy framework, clarify the data-sharing standards for each department's business area, promote data openness and integration, avoid information silos, and promote the full utilization of data resources by all parties. A data lake has been constructed to store data from different data sources in their original form, forming a centralized and scalable data storage architecture, which facilitates flexible data extraction by various business sectors as needed and improves data availability. At the same time, enterprises can also develop unified data standards to reduce the difficulty of data integration, improve data interoperability between different systems, standardize data naming, format, units and other aspects of the standard, simplify the process of data integration, to ensure that the data can be in the smooth flow between different systems.

Another way to address this issue is to consolidate these data silos using integration techniques and tools. There are a variety of frameworks and tools for data integration. Integrating these data silos is a costly and time-consuming process, but big data integration is focused because of its long-term benefits (Peter, 2019).

3.4 Decrease Data Analysis and Utilization Limitation

Businesses that develop talent should focus on their employees' computer skills training, so that the financial management work and big data combined to help enterprises quickly make the right decisions, thus prompting leaders to fully recognize the importance of financial work, to enhance the environment that supports the growth of the enterprise's plans. In addition, businesses, educational institutions, and universities can cooperate with each other, the enterprise appointed professional financial management personnel to colleges and universities for further study, you can also hire outstanding graduates of universities to form a more professional team. During the course of management team, enterprises should try to enrich some Internet professionals, only in this way can make the combination between financial management and big data more closely, so that the enterprise to get more quality services.

While data warehouses are mainly used to integrate and store structured historical data to support reporting and decision analysis, a data middle office is a more flexible architecture that integrates structured and unstructured data, supports real-time processing and diversified data applications, and helps companies break down data silos to promote data sharing and business innovation. By adding data warehouse and data center, in-enterprise data teams can take on the complex task of integrating, storing, processing, and modeling data, as well as delving into the value inherent in that data.

4 CONCLUSIONS

The financial business is becoming more and more information-driven, which has complicated the market and client demands. As a result, big data technology is being used in the financial sector, which is helping to drive the industry's growth. Based on this, the paper examines the issues and solutions pertaining to the application of big data technologies in the financial industry. Four issues arise when using big data technologies in the financial sector: issues with data quality; issues with data safety and privacy; issues with data silos and collaboration; and issues with data analysis and use limits. This article discusses these issues and provides four solutions. The following countermeasures include lowering data analysis and utilization restrictions, linking data silos, strengthening data privacy protection, and improving data quality. In addition to offering solutions to some of the issues encountered in its implementation, the study presented in this article serves as a reference for the use of big data technologies in the financial sector.

The future research direction related to this thesis is the deep integration of Artificial Intelligence and Big Data in finance. The deep integration of Big Data and Artificial Intelligence has a broad research prospect in the field of finance, especially in the areas of intelligent investment advisor, financial risk management, anti-fraud system, personalised service for customers, high-frequency trading and quantitative investment, as well as financial product innovation. Enterprises can significantly improve the efficiency of financial decision-making, the accuracy of risk management and the personalised level of customer service by combining the rich information

of big data with the powerful analytical capabilities of AI, thus promoting the further development of fintech.

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