

Challenges and Limitations of Traditional Financial Auditing in the Big Data Environment

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Abstract: Driven by the digital wave, big data technology has profoundly transformed enterprise operation models, with massive amounts of structured, semi-structured, and unstructured data emerging continuously. As a long-standing economic supervision activity, traditional financial auditing faces severe challenges in data acquisition and processing, auditing methods and technologies, auditor capabilities, and audit risk control. This paper explores the limitations of traditional financial auditing in the big data environment through literature research, case analysis, and comparative analysis. The study finds that traditional auditing methods struggle to meet the demands of the big data era in terms of data processing speed, audit accuracy, and risk control. To address these challenges, this paper proposes recommendations such as promoting auditing technology innovation, strengthening auditor training, improving auditing standards and norms, and establishing a data security management system. These measures aim to drive the transformation and upgrading of traditional financial auditing, enhance the quality and efficiency of auditing work, and better enable auditing to play its important role in maintaining market economic order and protecting investors' rights and interests.

Keywords: Traditional financial auditing, Big data environment, Auditing methods and technologies, Auditing risks.

1. Introduction

In the context of the global digital wave, big data technology is reshaping the operational models of various industries with unprecedented intensity, and the financial sector is no exception [1]. Enterprises' business activities generate massive amounts of structured, semi-structured, and unstructured data, which not only include traditional financial transaction information but also cover multi-dimensional content such as customer behavior, market dynamics, and supply chain flows [2, 3].

Traditional financial auditing, as a long-standing economic supervision activity, has a development history closely linked to the economic environment. In the industrial economy era, enterprise business models were relatively simple, and financial data mainly existed in the form of paper documents and simple electronic spreadsheets [3]. With limited data volume and single structure, traditional auditing methods such as detailed auditing and sampling auditing could well achieve auditing objectives [4]. However, with the arrival of the big data era, the explosive growth of data and the sharp increase in complexity have put traditional financial auditing to severe tests in many aspects [5].

An in-depth exploration of the challenges and limitations faced by traditional financial auditing in the big data environment not only helps improve the auditing theoretical system but, more importantly, can provide practical improvement directions for auditing practice. This will enhance the quality and efficiency of auditing work and better enable auditing to play its important role in maintaining market economic order and protecting investors' rights and interests.

2. Theoretical Foundations and Research Methods

2.1. Traditional Financial Auditing

The theoretical system of traditional financial auditing has been gradually constructed and improved through long-term auditing practice [2-4]. The theory of fiduciary economic responsibility is the cornerstone for the existence and development of traditional financial auditing. In the modern enterprise system, the separation of ownership and management rights prevents stakeholders such as shareholders and creditors from directly participating in enterprise management. They need auditors to supervise and evaluate the performance of economic responsibilities by managers to safeguard their legitimate rights and interests.

Audit risk theory is an important guide for traditional financial auditing work. Audit risk consists of inherent risk, control risk, and detection risk. During the auditing process, auditors need to determine an acceptable level of audit risk through understanding and evaluating the audited entity, and design and implement audit procedures accordingly to control detection risk within an acceptable range.

In addition, traditional financial auditing adheres to basic principles such as independence, objectivity, and impartiality, which ensure the quality and credibility of auditing work.

2.2. Application Principles of Big Data Analysis Technology in Auditing

The 4V characteristics of big data profoundly reveal its essential differences from traditional data. Volume refers to the scale of data reaching PB or even EB levels, far exceeding the processing capacity of traditional data processing tools [5, 6]. Velocity emphasizes the extremely fast speed of data generation and processing, requiring real-time or near-real-time analysis and response. Variety indicates a wide range of data types, including structured data (e.g., tabular data in

databases), semi-structured data (e.g., XML, JSON files), and unstructured data (e.g., text, images, audio, video). Value means that big data contains huge commercial and social value, which needs to be mined through professional technologies and methods.

Big data processing and analysis theories focus on data, emphasizing the extraction of valuable information and knowledge from massive data. Data mining technology can discover hidden patterns and correlations in data; machine learning algorithms can predict and judge future trends through learning and training on data; distributed computing frameworks (e.g., Hadoop, Spark) provide strong technical support for processing massive data.

2.3. Research Methods

This study combines literature research, case analysis, and comparative analysis to analyze the challenges and limitations of traditional financial auditing in the big data environment.

(1) Literature research: By reviewing domestic and foreign literature on traditional financial auditing and the application of big data technology in auditing, this study sorts out existing research results, understands the research status and development trends, and provides theoretical support for this paper.

(2) Case analysis: Selecting some enterprises with representative applications of big data, this study analyzes the

problems encountered in their financial auditing processes and the application of traditional financial auditing methods, summarizing the specific challenges faced by traditional financial auditing.

(3) Comparative analysis: By comparing traditional financial auditing methods with auditing methods in the big data environment, this study analyzes differences in audit scope, audit efficiency, audit accuracy, etc., and clarifies the limitations of traditional financial auditing.

3. Results

3.1. Challenges of Traditional Financial Auditing in Data Acquisition and Processing

In the big data environment, enterprise data exhibits characteristics of multi-source and heterogeneity. Traditional financial auditing usually relies on financial data provided by the audited entity, mainly from the enterprise's financial information systems such as ERP systems. However, in the big data era, enterprises' business activities are closely connected with the external environment, generating data that includes not only internal financial data but also transaction data with suppliers, customers, and partners, as well as external data such as user reviews and transaction records on social media and e-commerce platforms.

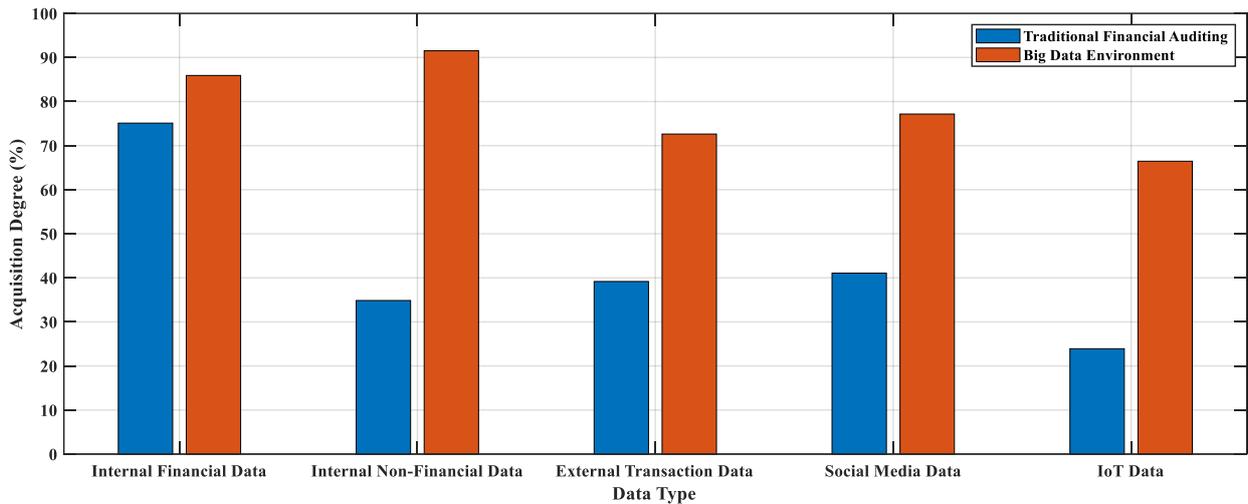


Figure 1. Comparison of Data Acquisition Scope

Traditional financial auditing has obvious limitations in data acquisition channels, making it difficult to obtain these widely distributed external data and unstructured data. Figure 1 (Comparison of Data Acquisition Scope between Traditional Financial Auditing and Big Data Environment) clearly shows this difference. It can be seen from the figure that the data acquisition scope of traditional financial auditing is like a narrow circle, including only the core financial data within the enterprise; while the data acquisition scope in the big data environment is like a huge network, covering multiple data sources inside and outside the enterprise. This significant difference in data acquisition scope prevents traditional financial auditing from fully understanding the enterprise's operating conditions and financial risks.

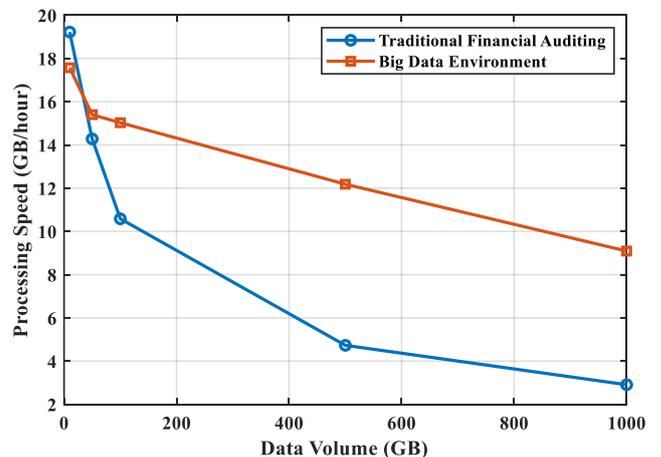


Figure 2. Comparison of Data Processing Speed

In terms of data processing, the software and tools used in

traditional financial auditing are mainly designed for structured data, with limited processing capacity. When facing massive and heterogeneous data, traditional methods often find themselves helpless. Figure 2 (Comparison of Data Processing Speed between Traditional Financial Auditing and Big Data Environment) presents, in the form of a line chart, the changes in data processing speed of the two auditing methods as data volume increases. The processing speed curve of traditional financial auditing drops sharply with the increase in data volume, becoming very slow when data volume reaches a certain scale; while the processing speed curve of auditing based on big data technology is relatively flat, maintaining high processing efficiency in the case of massive data. This fully illustrates that traditional financial auditing cannot meet the needs of the big data environment in terms of data processing speed.

3.2. Limitations of Traditional Financial Auditing in Auditing Methods and Technologies

Traditional financial auditing takes sampling auditing as the core method, whose basic principle is to select a certain number of samples from the population for auditing and then infer the situation of the population based on the audit results of the samples. This method is effective when the data volume is small and the data distribution is relatively uniform. However, in the big data environment, enterprises' business data is complex and changeable, with strong correlations between data. The use of sampling auditing may lead to samples failing to fully represent the population, thereby increasing audit risks.

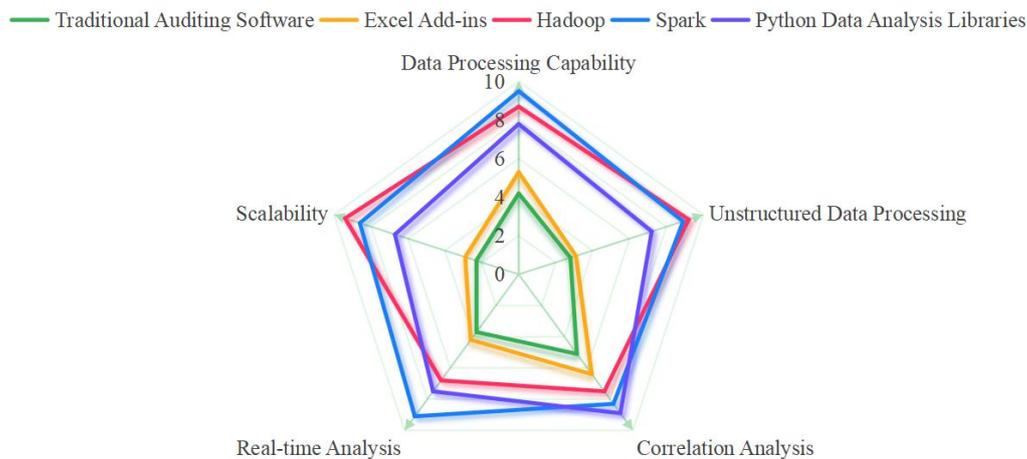


Figure 3. Suitability of Different Auditing Techniques in Big Data Environment

The technologies and tools used in traditional financial auditing are relatively outdated, unable to effectively process and analyze big data. Traditional auditing software is mainly used for simple verification and calculation of financial data, lacking the ability to process unstructured data and mine correlations between data. Figure 3 (Suitability of Different Auditing Techniques in Big Data Environment) shows the applicability of different auditing technologies in the form of a radar chart. Traditional auditing software scores low in data processing capability, unstructured data processing, and correlation analysis, while big data analysis tools such as Hadoop and Spark score high in these aspects, further highlighting the limitations of traditional auditing technologies.

3.3. The Inadequacies of Traditional Financial Auditing in Terms of Auditors' Capabilities

Auditors are the main body of auditing work, and their capability level directly affects the quality and efficiency of auditing work. In the traditional financial auditing environment, auditors mainly need to have solid financial

accounting knowledge, auditing theories and methods, and rich practical experience. However, in the big data environment, these capabilities are far from sufficient.

The big data environment requires auditors to have a diversified knowledge structure and skills. They need to be proficient not only in professional knowledge of financial auditing but also in big data processing technologies (such as distributed computing frameworks like Hadoop and Spark), data mining algorithms, programming languages (such as Python and SQL), and machine learning. Figure 4 (Changes in Required Auditor Capabilities: Traditional vs. Big Data Environments) shows this change in capability requirements in the form of a stacked bar chart. In the traditional environment, financial accounting knowledge and auditing skills account for more than 80% of the composition of auditors' capabilities; in the big data environment, the proportion of financial accounting knowledge and auditing skills drops to about 50%, while the proportion of new capabilities such as data mining, programming, and machine learning reaches about 50%. However, at present, traditional financial auditors generally have a low level of mastery in these new capabilities, unable to meet the needs of auditing work in the big data environment.

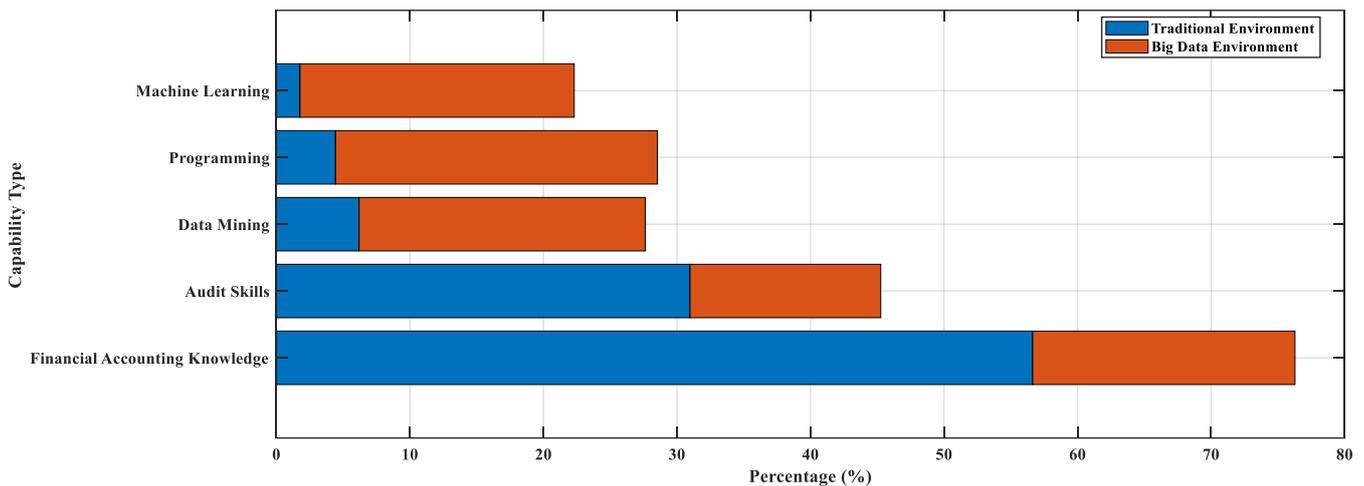


Figure 4. Changes in Required Auditor Capabilities: Traditional vs Big Data Environments

3.4. Challenges of Traditional Financial Auditing in Audit Risk Control

In the big data environment, the sources of audit risks are more complex and diverse, making traditional audit risk control methods difficult to respond effectively. On the one hand, it is difficult to ensure the authenticity and integrity of data. In the big data environment, data sources are extensive, and the process of data generation and transmission is complex, prone to problems such as data tampering and data loss. Traditional auditing methods mainly confirm the authenticity and integrity of data through inspection of paper documents and simple verification of electronic data, which are significantly less effective when facing massive and heterogeneous data.

On the other hand, data security faces severe threats. Big data contains a large amount of enterprise trade secrets and personal privacy information, which are vulnerable to security risks such as hacker attacks and data leakage during storage, transmission, and processing. Once data security issues arise, they will not only affect the normal conduct of auditing work but also may bring huge losses to enterprises. Traditional financial auditing lacks effective technologies and means in data security management, unable to comprehensively identify and evaluate data security risks.

In addition, the acquisition and evaluation of audit evidence in the big data environment have become more difficult. Traditional audit evidence mainly exists in the form of paper documents and contracts, whose authenticity and reliability are relatively easy to verify. In the big data environment, however, audit evidence exists more in the form of electronic data, which is easy to modify without leaving traces, posing great challenges to the acquisition and evaluation of audit evidence.

4. Conclusions

Through in-depth analysis of the performance of traditional financial auditing in the big data environment, this study draws the following clear conclusions: At the level of data acquisition and processing, traditional financial auditing is limited by its inherent data collection channels and processing tools, unable to cover the extensive data sources in the big data environment, and its processing speed is far from meeting the needs of massive data processing. In terms of auditing methods and technologies, the accuracy of sampling auditing in the big data environment decreases significantly,

and traditional auditing technologies and tools have poor adaptability to big data, struggling to cope with complex data processing and analysis tasks. In terms of auditor capabilities, the knowledge structure and skill system of traditional financial auditors can no longer adapt to the requirements of the big data environment, with obvious shortcomings in emerging capabilities such as data mining and programming. In terms of audit risk control, traditional methods cannot effectively respond to new risks brought by data authenticity, integrity, and security in the big data environment, and the acquisition and evaluation of audit evidence also face many difficulties.

To effectively address the above challenges and limitations and promote the transformation and upgrading of traditional financial auditing, measures need to be taken from multiple aspects. First, vigorously promote the innovation of auditing technologies, actively introduce big data analysis tools and technologies such as Hadoop, Spark, and Python data analysis libraries, establish audit information systems adapted to the big data environment, and improve the capabilities of data acquisition, processing, and analysis. Second, strengthen the training of auditors, formulate systematic training plans to not only strengthen their professional knowledge of financial auditing but also focus on improving their skills in big data processing, data mining, and programming, cultivating a group of compound auditing talents who understand both financial auditing and big data technologies.

Third, continuously improve auditing standards and norms. Revise and supplement existing auditing standards according to the characteristics and requirements of the big data environment, clarify the objectives, scope, procedures, and methods of auditing in the big data environment, and provide clear guidance for auditing work. Finally, establish and improve a data security management system, strengthen the security protection of data during storage, transmission, and processing, and adopt encryption technologies and access control to prevent data security risks and ensure the authenticity, integrity, and security of audit data.

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