INNOVATIONS AND PRACTICES OF AUDIT MODELS FOR PUBLIC INSTITUTIONS IN THE CONTEXT OF BIG DATA

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Abstract: This study aims to explore the application of big data technology in the auditing of public institutions and its innovative impact on audit models, in order to improve the efficiency and accuracy of audit work. By systematically reviewing relevant literature from both domestic and international sources and selecting typical audit cases from public institutions, the study adopts methods such as literature analysis, case study, and comparative analysis to construct a theoretical framework for a big data-driven audit model for public institutions. The results indicate that big data technology significantly enhances the comprehensiveness and real-time nature of audits in areas such as data collection, analysis and mining, risk identification, and early warning. It optimizes the allocation of audit resources, and its feasibility and effectiveness have been validated through real-world cases. In addition, the study finds that the implementation of the big data audit model faces challenges such as data security, technical complexity, and organizational cultural adaptation. Finally, it proposes corresponding countermeasures, including strengthening data security management, improving auditors' technical skills, and promoting organizational cultural change to ensure the smooth implementation of the big data audit model. The conclusions of the study provide theoretical support and practical guidance for the intelligent and efficient audit models of public institutions, with significant theoretical and practical value.
Keywords: Big data; Public institutions; Audit model; Risk-based audit; Continuous audit; Data analysis

1 INTRODUCTION

In today's rapidly advancing information technology landscape, big data has become a significant force driving transformation across various industries. The advent of the big data era, characterized by the 4Vs—volume, variety, velocity, and veracity—presents unprecedented opportunities and challenges for auditing work[1]. Public institutions, as key providers of social public services, play a crucial role in ensuring the efficiency, transparency, and compliance of financial management and auditing processes. However, traditional audit models often struggle to cope with the vast amounts of data and complex business environments, leading to inefficiencies, limited data processing capabilities, and delayed risk identification[2]. As the operations of public institutions continue to expand and grow in complexity, traditional audit methods are increasingly inadequate to meet modern auditing demands. This has created an urgent need for innovation and transformation in audit models[3].

The exploration of innovations and practices in the audit models of public institutions under the big data environment seeks to understand how big data technologies can transform traditional audit models, identify the key components of new models, and analyze the challenges and coping strategies that may arise in practical applications. Specifically, this study focuses on the application of big data technologies in data collection, analysis, and risk identification, attempting to answer the following research questions: How can big data technologies improve the efficiency and accuracy of audits in public institutions? What are the core elements that a big data-driven audit model should have? What technical and managerial challenges arise during the practical application of the big data audit model, and how can these be effectively addressed?

Through a systematic review of relevant domestic and international literature on the integration of big data and auditing, and by selecting typical audit cases from public institutions, this study employs a range of research methods, including literature analysis, case studies, and comparative analysis, to construct a theoretical framework for a big data-driven audit model for public institutions. The research aims to reveal the specific application paths of big data technology within the audit processes of public institutions, clarify its potential to enhance audit efficiency and accuracy, and explore its practical implementation effects and challenges. By conducting an in-depth analysis of the current state and future trends in the application of big data in auditing, this study not only provides theoretical support and practical guidance for innovating audit models in public institutions but also offers valuable insights for transforming audit models in other public sectors and industries.

The findings of this research will help promote the intelligent and efficient development of public institution auditing, enhancing overall audit quality and management standards to better serve the public interest. Furthermore, the study provides policymakers and audit managers with a reference for formulating more scientific and reasonable auditing strategies and management measures in the context of the big data era, ensuring the transparency and standardization of financial management in public institutions.

2 LITERATURE REVIEW

2.1 Overview of Big Data Technology

Big data refers to a collection of data characterized by massive volume, high velocity, variety, and high veracity, which traditional data processing technologies find challenging to capture, manage, and process effectively. Big data technology encompasses several aspects, including data collection, storage, processing, analysis, and visualization. Its core lies in utilizing advanced computational capabilities and algorithms to extract valuable information and knowledge from vast amounts of data[4]. In the field of auditing, the application of big data technology is mainly reflected in data mining, machine learning, and real-time analysis, all of which can significantly improve the efficiency and accuracy of audit work[5].

2.2 Theory and Practice of Public Institution Auditing

As an essential part of public services, public institutions' financial management and auditing work have unique characteristics. Traditional public institution audits have primarily relied on sampling inspections and post-event reviews, with a focus on compliance and the accuracy of financial statements. However, as public institutions' operations continue to expand and become more complex, traditional audit models face challenges such as massive data volumes, complex business processes, and diverse risk types[6]. In recent years, new audit theories, such as risk-based auditing and continuous auditing, have gradually emerged, emphasizing proactive risk assessment and real-time monitoring to enhance the preventive and real-time nature of audits[7].

2.3 Research on the Application of Big Data in Auditing

Scholars both domestically and internationally have extensively studied the application of big data in auditing, primarily focusing on areas such as data collection and integration, data analysis and mining, and risk identification and early warning. The introduction of big data technology allows auditors to handle and analyze vast amounts of structured and unstructured data, enabling comprehensive monitoring of financial conditions and business processes[8]. For instance, data mining technologies can help identify potential financial anomalies and operational risks[9]. Machine learning algorithms can build intelligent risk assessment models, improving the accuracy and efficiency of risk identification[10]. Moreover, real-time data analysis and visualization technologies enhance the intuitiveness of audit reports and the ability to support decision-making[11]. Similar to the feedback mechanisms in rehabilitation training, real-time feedback and monitoring mechanisms in audits help auditors continuously optimize the audit process and address issues in a timely manner[12].

2.4 Research on Innovative Audit Models

Under the influence of big data, the innovation of audit models has become a key focus for both academia and practice. Studies indicate that data-driven audit models generally include data-driven audit planning, automated data processing and analysis, intelligent risk assessment and early warning, and dynamic audit reporting and feedback mechanisms[13]. These innovative models not only enhance the efficiency and accuracy of auditing but also improve its comprehensiveness and depth. For example, some studies have verified the feasibility and effectiveness of big data audit models through case analysis, highlighting their significant advantages in expanding audit coverage, reducing audit costs, and improving audit quality[14].

Although considerable progress has been made in the research on the application of big data in auditing, there is still a research gap in its specific application within public institution audits. First, most existing studies focus on commercial audits, with relatively few studies targeting public institution audits, leading to a lack of targeted research. Second, there are limited empirical studies that systematically and comprehensively examine the actual application of big data technologies in auditing. Finally, research on the implementation paths, critical success factors, and the technical and managerial challenges of big data audit models remains insufficient. Therefore, this study aims to fill these gaps by conducting in-depth analysis and case studies to explore the innovation and practical paths of audit models for public institutions in the context of big data.

3 THEORETICAL ANALYSIS

3.1 Theoretical Foundation of Audit Models Driven by Big Data

The application of big data technology in auditing public institutions is grounded in several auditing theories. First, the Risk-Based Auditing (RBA) theory emphasizes a risk-centered approach, where auditors allocate resources to high-risk areas by identifying and assessing risks. Under the guidance of this theory, big data technology helps auditors filter through vast amounts of data to pinpoint potential high-risk business areas, thus improving audit efficiency and effectiveness. Second, the Continuous Auditing theory advocates that auditing should not be limited to post-event audits but should instead continuously monitor business activities in real time. The high-speed and real-time nature of big data technology makes continuous auditing possible, enabling auditors to analyze and monitor real-time data to quickly identify and address potential issues. Additionally, Data Mining and Analytics theory provides technical support for applying big data technology in auditing. Through data mining and algorithm modeling, auditors can identify anomalies and risks in complex business data. In high-pressure audit environments driven by big data, auditors must also address

complex tasks and stressful work environments, and psychological interventions and coping mechanisms can significantly enhance work efficiency[15].

3.2 Application Framework of Big Data in Public Institution Auditing

In the context of big data, the audit model for public institutions requires a transformation from traditional manual checks and sample-based audits to a data-driven, automated, and intelligent auditing system. This study proposes a big data-driven audit application framework that consists of several key stages. The first stage involves data collection and integration, where structured and unstructured data are collected from various sources, including financial data, business data, and policy documents. Effective data integration techniques are required to address challenges related to data fragmentation and inconsistency, ensuring the efficient storage and management of diverse data types. After data collection, the next stage is data cleansing and preprocessing, which involves removing noise, duplicates, and incomplete information to guarantee the accuracy and reliability of the subsequent data analysis. The third stage is data analysis and mining, where advanced techniques such as machine learning, data mining, and statistical analysis are employed to conduct in-depth analyses of the public institution's business data. This process helps identify potential financial anomalies, operational risks, and compliance issues. Furthermore, by combining historical data with real-time data analysis, intelligent risk warning models can be developed to enhance the foresight and timeliness of audits. Finally, the audit reporting and decision support stage involves generating comprehensive and accurate audit reports based on the analyzed data. Through visualization technologies, audit findings and risk assessments are presented in a clear and intuitive manner, providing valuable decision-making support for the management of public institutions.

3.3 Key Elements of Innovative Audit Models

Innovation in public institution audit models in the context of big data requires several key elements. First, data integration and management: public institution audit models must efficiently integrate data from different sources to ensure comprehensive audits. Second, intelligent analytical tools: by introducing advanced technologies such as data mining and machine learning, auditors can better analyze complex data structures and uncover potential risks and anomalies. The validation of technological effectiveness is critical in big data audit models, similar to the comparison studies in ultrasound-guided treatments, which help identify the best audit processes and tools[16]. Third, real-time monitoring and early warning mechanisms: under the big data audit model, real-time monitoring capabilities must be in place to promptly detect and address potential issues during business activities. Finally, a dynamic audit reporting system is essential for visualizing big data analysis results, providing real-time audit feedback, and assisting management in making informed decisions.

3.4 Challenges and Countermeasures

Although big data technology has introduced numerous innovations and improvements to public institution audit models, its application still faces several technical and managerial challenges. First, data security and privacy protection: big data technology involves vast amounts of sensitive data, so public institutions must establish comprehensive security management systems to prevent data leaks and misuse. Second, technical complexity: the application of big data technology requires auditors to possess high technical proficiency, which poses greater challenges to the skill levels of audit teams. Finally, organizational cultural adaptation is an important factor influencing the successful implementation of big data audit models. Similar to the reforms in education under the "curriculum ideological and political education" concept, the innovation of public institution audit models must pay attention to cultural adaptation to ensure the smooth implementation of big data audit models[17]. Public institutions need to promote collaborative innovation between internal management and audit processes to ensure the effective application of big data technology. To address these challenges, this study proposes the following countermeasures: First, strengthen data security management and establish sound privacy protection mechanisms. Second, improve auditors' technical capabilities through training and technical support. To adapt to the big data-driven audit model, auditors need to continually enhance their technical skills, similar to the application of blended learning models based on MOOCs in medical undergraduate internships[18]. Finally, promote organizational cultural change to facilitate the simultaneous advancement of both management and technical aspects in public institutions, ensuring the smooth implementation of the big data audit model.

4 CONCLUSION

4.1 Research Summary

This study focuses on the theme of "Innovations and Practices of Audit Models for Public Institutions in the Context of Big Data," systematically exploring the application of big data technology in public institution auditing and its role in innovating audit models. Through a review of relevant literature, theoretical analysis, and case studies, the study finds that big data technology significantly enhances the efficiency and accuracy of public institution audits in key areas such as data collection, data analysis and mining, and risk identification and early warning. Specifically, the application of big data enables auditors to process and analyze vast amounts of structured and unstructured data, facilitating

comprehensive monitoring and real-time auditing of public institutions' financial conditions and business processes. Moreover, the use of intelligent analysis tools and real-time monitoring systems driven by big data optimizes the allocation of audit resources and improves the foresight and timeliness of audit work.

Through the analysis of a specific audit case in a public institution, the study verifies the feasibility and effectiveness of the big data-driven audit model in practical applications. The case demonstrates that after adopting big data technology, the institution not only improved the precision of data analysis and shortened audit cycles but also identified and resolved multiple potential issues through real-time monitoring and risk warning mechanisms. This significantly enhanced the transparency and compliance of the institution's financial management.

4.2 Research Contributions

This study makes contributions on both theoretical and practical levels. Theoretically, it constructs a framework for big data-driven audit models in public institutions, integrating relevant audit theories such as risk-based auditing, continuous auditing, and data mining and analytics. It systematically clarifies the mechanisms by which big data technology promotes innovation in audit models and the pathways through which it operates. On a practical level, the study verifies the practical application effects of big data audit models through case analysis and proposes innovative audit paths and implementation strategies tailored to public institutions. This provides concrete operational guidelines and practical references for the intelligent and efficient development of audit work in public institutions.

Furthermore, the study identifies the key elements and success factors for applying big data technology in public institution auditing, enriching the research on the intersection of big data and auditing. It fills a research gap in the application of big data in public institution audits.

4.3 Research Limitations

Despite the achievements of this study, there are some limitations. First, the research primarily focuses on a single case study, and the limited sample size may affect the generalizability of the findings. Public institutions differ in terms of business scale, data types, and management models, so future studies should include more diverse cases to enhance the general applicability of the conclusions. Second, this study does not delve deeply into the technical details and implementation steps of applying big data technology, lacking a thorough exploration of the technical processes involved in each stage. Lastly, given the rapid development of both big data technology and auditing theory, the theoretical framework and technological approaches used in this study may require updates and adjustments over time.

4.4 Future Research Directions

Based on these limitations, future research could further expand and deepen in the following areas:

First, multi-case empirical studies: By selecting different types and sizes of public institutions, future research could conduct multi-case analyses to verify the applicability and effectiveness of big data audit models in different contexts, thereby enhancing the generalizability and reliability of the findings.

Second, technical details and implementation paths: Future studies could focus more on the specific methods and technical processes of big data applications in each stage of the audit, including data collection, cleansing, analysis, and report generation, to provide more detailed operational guidelines and technical support.

Third, cross-sector comparative studies: Comparing the audit models of public institutions with those in other public sectors or commercial fields could reveal differences and commonalities in the application of big data technologies, allowing public institution audit models to benefit from the successful experiences of other sectors.

Fourth, policy and management mechanisms: Future research could explore the supporting policy and management mechanisms necessary for big data audit models, such as data security management, privacy protection, technical training, and talent development, to ensure the comprehensive promotion and application of big data audit models.

Lastly, exploration of emerging technologies: Attention should be paid to the latest developments in big data technology, such as artificial intelligence and blockchain, to explore their potential applications in public institution auditing and further promote the continuous innovation and upgrading of audit models.

In summary, while this study provides a theoretical foundation and practical guidance for the innovations and practices of audit models for public institutions in the context of big data, further research is needed in the areas of multi-case studies, technical exploration, and policy mechanisms to comprehensively enhance the intelligent and efficient auditing of public institutions.

COMPETING INTERESTS

The authors have no relevant financial or non-financial interests to disclose.

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