

Original Paper

Research on the Problems and Optimization of Informationization of Internal Audit in Engineering Projects under the Background of Big Data

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Abstract

Driven by the background of big data, the development of big data technology has led to a significant transformation in the internal audit of engineering projects. As a core link in the social economic supervision system, the importance of audit work has been continuously strengthened, and it has accelerated its evolution towards modernization through the integration of information technology and intelligent technology. As a branch of the audit field, the internal audit of engineering is no longer able to adapt to the current development trend. To enhance the efficiency of the internal audit of engineering projects, the introduction of big data technology has become a key approach. This informatization strategy not only optimizes the quality and efficiency of audit operations but also significantly enhances the construction of the unit's internal control system, marking the inevitable trend and practical demand of the development of the internal audit of engineering projects under the background of big data. This study focuses on the background of big data and aims to explore the construction path of the digital system of engineering internal audit, with the expectation of improving audit efficiency, optimizing risk prevention and control, and providing theoretical frameworks and practical references for both the academic and industrial communities.

Keywords

Big data, Internal audit of engineering projects, Audit informatization

1. Introduction

In recent years, with the rapid development of the Internet and information technology, new models, processes, business forms and technologies have continuously emerged in various industries. The in-depth application of cutting-edge technologies such as big data has led to an explosive growth in the

data scale within the industry. The global economy has gradually completed the transition from the industrial era to the information era. Informationization has become the core driving force for the rapid progress of the economy and society. Along with the wave of informatization and digitalization of the economic system, the content, functions, scope, objects and models of the auditing system have undergone significant reconfiguration. However, internal auditing in the engineering project field still adheres to the traditional stage, relying excessively on outdated paper materials and high-intensity manual review, failing to keep up with the times and lagging significantly behind the development needs of the industry. Due to the large investment, long cycle and complexity of engineering projects, a wide variety and large quantity of data will be generated throughout the construction process. Due to technical and methodological limitations, traditional engineering internal auditing is unable to obtain extensive data, and the data quality and utilization rate are both poor. Moreover, the existence of industry barriers makes the traditional auditing model unsustainable and unable to meet current development needs, resulting in a significant decline in auditing quality and effectiveness, which hinders the high-quality progress of auditing work.

2. The Necessity of Informationization in Internal Audit of Engineering Projects

Under the macro framework of the new era, the wide application of information technology has permeated every aspect of society like the spring breeze. With its core characteristics of digitization and intelligence, these technologies demonstrate remarkable enabling capabilities, stimulating innovation vitality in various industries and promoting the deep evolution of management models towards informatization. This technological innovation not only modernizes business processes but also profoundly changes the functional positioning of internal engineering audits. Traditionally serving as the core of supervision, it has now expanded to become a comprehensive management partner with both supervision and service functions, playing a key role in the diverse fields of internal organizational management. As an important mechanism for ensuring the stable operation of the organization, internal engineering audits must respond to the requirements of informatization transformation, thereby strengthening the effectiveness of their "probe" warning and verification functions. This trend of transformation is closely related to its inherent logic and the current era's demands, mainly reflected in the following key aspects.

1) Facing the urgent challenge of environmental change, internal management in engineering is gradually achieving automation and networking along with the wave of industry informatization. This prompts internal auditing to simultaneously complete the digital transformation to adapt to new requirements such as data processing, boundary expansion, and comprehensive coverage, thereby completely replacing the outdated model of traditional manual auditing. The integration of various audit stages and the deep optimization of processes will establish an efficient audit closed-loop system. From the external environment perspective, the country continuously strengthens the standards and requirements for auditing work, which significantly promotes the acceleration of the informatization

process of internal auditing in engineering, thereby significantly improving the efficiency of auditing and laying a solid foundation for the modernization of the auditing cause.

2) Under the background of digital transformation of auditing work, internal auditing in engineering, through its supervisory function, utilizes information technology means and its comprehensive analysis capabilities to conduct systematic evaluations of the audit objects, accurately identifying potential risks and deep-seated mechanism problems. This process integrates both micro and macro analytical dimensions and relies on data-driven objective conclusions to offer suggestions to management and propose predictive risk prevention suggestions, not only enhancing the value of internal auditing but also providing a strong guarantee for the stable operation of the enterprise's economic activities.

3) The current new environment and tasks have set higher standards for internal auditing work and imposed stricter restrictions, thereby significantly increasing the overall workload of auditing work. By leveraging advanced information technology for assistance and support, it can effectively replace a large amount of repetitive and mechanical labor, significantly alleviate the professional burnout of auditors, and effectively reduce their workload. This will help optimize the allocation of audit resources, enabling auditors to focus on substantive issues and core links, thereby enhancing the accuracy and application effect of internal auditing work, and creating more possibilities for the deep expansion of auditing functions.

4) As internal auditing enters a comprehensive upgrade stage, the importance of strengthening the internal control system is increasingly prominent. Auditing practitioners should actively adopt cutting-edge information technology tools to build a diversified auditing framework that integrates pre-warning, intervention, and post-review. This model helps promote the shift of the focus of auditing management from result-oriented to a systematic governance that combines process and results. In addition, it is necessary to promote the transformation of auditing supervision objects from general matters to the standardization and transparency of specific business terms and operational processes. This not only significantly improves the efficiency of auditing operations but also promotes the full coverage of the auditing scope, thereby facilitating the continuous and efficient optimization of the internal control mechanism within the unit.

3. Problems in the Informatization Construction of Internal Auditing in Engineering under the Background of Big Data

3.1 The Data Sharing of Audit Informatization is not very High

(1) During the process of promoting audit informatization, the problem of data silos has become increasingly prominent, becoming a major bottleneck for its development. In the construction of audit informatization, data plays a core role, but if there is a lack of smooth interface mechanisms among various systems, an insurmountable information gap will be formed. Due to the strong independence of each system, their operation being closed and incompatible with external interfaces, the efficiency and quality of data sharing cannot be reliably guaranteed, and thus data circulation faces significant

obstacles. Currently, most systems still maintain their original information barriers, and data sharing among systems is severely restricted. Specifically, the data connection effect between internal business systems and audit systems is poor, while the methods for accessing external structured, semi-structured, and unstructured data are not yet perfect. A large amount of data resources are idle, and the available data is seriously insufficient, which greatly weakens the overall efficiency of audit work. The absence of a data sharing connection mechanism has made it more difficult for auditors to obtain project data, thereby adversely affecting the quality and efficiency of audit work, highlighting the urgency of building a unified data sharing platform.

(2) The severe lack of data standards has become a significant problem, and the degree of connection between the audit system and various business systems is too low, which is deeply worrying. To build an efficient internal audit informatization platform, it is necessary to integrate resources from multiple systems such as finance, engineering management, and procurement. However, the reality is that internal systems of enterprises and institutions are mostly independently developed by different technical teams and lack a unified management mechanism, which leads to inconsistent data formats and diverse interface standards, and even a large number of heterogeneous data sources. This situation leaves auditors in a predicament when dealing with massive data, making it difficult to sort out data logic and accurately assess the reliability and authenticity of data, severely restricting the efficiency and quality of audit work. During the process of building the audit informatization platform, in order to achieve data exchange between different information systems, a large number of interface programs need to be developed, which not only significantly increases the difficulty of system integration but also leads to a significant increase in overall construction costs. The omission of data standardization work may hinder the effective integration of systems, impede information sharing, and form independent and closed data silos, significantly weakening the overallity and accuracy of audit work.

3.2 The Functions of the Audit Information Platform are not Complete

Under the rapid development of the digital age, the current management framework has generally exposed significant deficiencies in the risk prediction mechanism. Due to the large-scale and complex nature of the data generated by construction projects, it is urgent to use advanced data analysis methodologies to systematically mine and identify this massive information, in order to precisely identify any logical discrepancies or abnormal hidden dynamic trends. Given this, the auditing entity must conduct rigorous assessment and analysis of the generated alarm signals. The core purpose is to minimize the impact of potential threats and quickly identify and address potential issues, thereby significantly enhancing the quality and operational efficiency of the auditing results. Therefore, the system design must continuously strengthen its risk warning capabilities, focusing on multiple dimensions and hierarchical structures such as cost monitoring, amount monitoring, and time point monitoring, to meticulously build an integrated comprehensive warning system, ensuring intelligent review and forward-looking risk disclosure of the entire project life cycle and all elements. At the same time, efforts should be made to actively promote the deep integration and efficient collaboration of

information technology and the auditing process, aiming to respond promptly and effectively prevent risks at their inception, ultimately achieving the established requirements of continuous auditing, thereby enabling it to fully comply with and support the strict standards set for auditing work in the new era.

The current security protection capabilities of the system have significant flaws, raising serious concerns. Research has found that enterprises in the internal auditing management information system of engineering projects generally have insufficient security protection, resulting in severe threats to the storage of auditing data. Multiple risk factors such as system vulnerability exploitation, hacker intrusion, and improper internal operations lead to a sharp increase in auditing information security risks. During the engineering auditing process, in order to ensure the reliability of the auditing conclusion, it is necessary to comprehensively collect and deeply mine project-related materials, which involve a large amount of highly sensitive information such as personal privacy and financial transactions. If these core data are illegally stolen or maliciously damaged, it will directly trigger major auditing risks, not only endangering the credibility of the auditing results, but also potentially disrupting the normal operation of the enterprise.

In the current big data environment, the auditing informatization construction still has functional deficiencies, and the existing auditing modules need further improvement. To precisely promote the informatization process of internal auditing in engineering projects, the key lies in continuously optimizing and integrating advanced big data technologies.

3.3 The Insufficient Technical Support for Information-based Auditing

(1) In the era of rapid development of big data, the post-operation maintenance of the auditing informatization system is not only urgent but often fails to receive the due attention. With the continuous update and iteration of information technology, the internal auditing system of the engineering must constantly undergo upgrading and meticulous maintenance to ensure its excellent functionality and high reliability, and be able to withstand long-term operation tests. Once the system is completed, insufficient technical maintenance investment will directly lead to frequent failures during use, thereby significantly restricting the smooth progress of auditing work. However, most current units choose to rely on external forces for system maintenance, and only a few units can achieve independent guarantee through their internal professional teams. In the outsourcing maintenance model, auditors need to maintain close communication with external technicians. If the coordination is not effective, it will seriously affect the maintenance effect and even lay hidden risks for the system operation. Moreover, the time spent on communication will also affect the timeliness of auditing.

(2) The current practical level of data processing and analysis is significantly insufficient, especially in the field of auditing big data analysis. Due to the special complexity of the engineering project and the huge volume of data, when involving cross-departmental collaboration, a large number of heterogeneous data interfaces will be generated, causing significant difficulties in data collection and standardization conversion. The data collection process of some systems has not yet been automated,

mainly relying on manual execution, and resulting in poor data quality. For the auditing team, in the face of a large amount of high-dimensional data generated during the engineering construction process, most have failed to effectively utilize advanced data analysis tools for in-depth analysis, instead habitually selecting and sampling part of the data through experience judgment. This traditional auditing mode not only limits the auditing coverage and makes it difficult to identify hidden potential risks, but also makes the data analysis superficial, unable to precisely lock the auditing focus, effectively discover abnormal problems, and thus miss the precious window period for risk control.

4. The Strategies and Assurance Measures for the Construction of Audit Informationization

4.1 The Audit Information System Construction

(1) Top-level architecture design for the informationization construction of engineering internal audit

The promotion of the internal audit informationization construction within the project should deeply integrate into the internal control system and implement a systematic layout planning within the organization. This process requires starting from the top management level to establish the corresponding strategic direction, while each business department needs to form a synergy effect to ensure that all personnel deeply participate in the informationization process, in order to optimize resource allocation and achieve the predetermined strategic goals. The current environment emphasizes that modern information technology means should be fully utilized, and this should be combined with the fundamental purpose of the engineering internal audit informationization construction to clearly define the overall strategic framework, in order to guide practice. In addition, the positioning of the internal audit function must be accurately set, focusing on key issues, implementing precise intervention, and striving to enhance audit efficiency, which promotes the evolution of audit work towards the direction of informatization and intelligence. To effectively promote the informationization construction of engineering internal audit, it is necessary to clearly define the construction idea and design a comprehensive strategic planning system. Among them, planning has a fundamental significance, data constitutes the core element, business processes occupy the dominant position, regulations provide normative support, platforms serve as the implementation carriers, technology is the decisive factor, and capability is the fundamental guarantee. This framework ensures the coordination and consistency of all links, providing comprehensive support for the informationization construction of engineering internal audit. The internal audit informationization strategic layout of this project is carried out around six core dimensions: Firstly, a collaborative and efficient data resource integration mechanism is constructed to promote close linkage and seamless data connection among departments, achieving efficient integration and sharing application of diverse data; Secondly, a complete information architecture is established to ensure data accuracy and inter-operability among systems; Further, the digital management of the audit process is optimized to promote the deep informatization upgrade of the entire audit cycle; At the same time, advanced audit informationization tools are adopted to accurately identify and completely solve potential problems in the audit; In

addition, a high-level audit informationization platform is constructed to enhance the optimization degree and long-term development potential of the system structure; Finally, it is necessary to focus on strengthening the construction of professional talent teams, especially emphasizing the recruitment of talents in the field of big data, and comprehensively enhancing the information technical level and overall professional ability of the audit team.

(2) The approval process control

Different auditing methods have prompted the innovative integration of fixed processes and free processes, thereby forming a highly flexible audit process configuration. Among them, the fixed process strictly follows the triple review system for review and the post-entrustment re-review steps, while the core of the free process lies in the selection of the next-level responsible person by the current operator. This audit informationization platform ingeniously designs three approval schemes: fixed process, free process, and a combined mode of both. For key processes with strong overall nature, the system adopts rigorous fixed process control, while non-key sections adopt efficient and convenient free processes.

When advancing the informatization process of internal auditing in engineering projects, it should refer to advanced information system theories and systematically design and build a dedicated platform with a scientific framework, high security, and efficient response capabilities. This platform aims to expand the scope and mode of auditing work, fully unleash the potential of information technology, deeply explore the profound meaning of data information, thereby achieving the optimization of management models and forming a unified auditing system with both process and result. Through this system, the scope of auditing supervision will gradually transition from an ambiguous state to specific detectable links and document regulations, significantly improving the depth and accuracy of the auditing field, and achieving precise control over the entire auditing process. Through data analysis, it can more thoroughly grasp the core of management, provide intelligent support for the investment management of engineering projects, and lay a solid foundation for the long-term development and quality improvement of the unit.

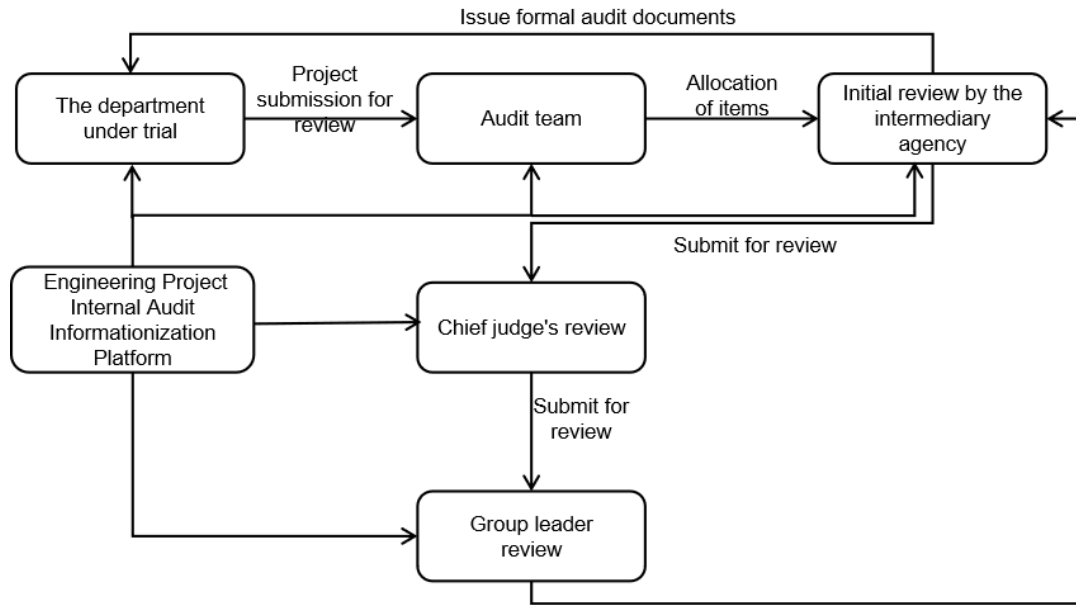


Figure 1. The Audit Procedures Based on Informationization Platform

4.2 The Audit Informationization Guarantee Measures

(1) Enhancing the importance attached to the informatization of leadership auditing. Currently, efforts should be focused on improving the internal auditing's publicity and education capabilities. By flexibly utilizing various forms such as seminars, special topic discussion reports, and special analysis meetings, systematic explanations of auditing practices at different levels should be provided. This is aimed at helping the management fully understand the core positioning and professional attributes of internal auditing. The preparation of audit reports must strictly follow the principles of objectivity and accuracy, ensuring that the description of identified problems is true and not exaggerated, especially for major risk hazards, deep communication with the senior management team should be strengthened. Through this interactive mechanism, it is intended to encourage them to truly attach importance to the substantive application of audit results and prevent them from being formalized. Additionally, it is necessary to effectively connect with the inspection and auditing linkage mechanism to ensure that the information on problems discovered during the audit process can be promptly transmitted, highlighting the forward-looking leading role of internal auditing. It is also necessary to strengthen the collaboration between the superior auditing institutions and the internal auditing units, thereby deepening the coverage of audits, enhancing the implementation effect of audits, integrating the superior auditing guidance requirements into the internal management supervision system, and constructing a more effective governance supervision framework. The firm support of the senior management constitutes the core driving force for the progress of auditing, significantly influencing the improvement of their professional standards. The continuous development of auditing needs to keep pace with the evolution of the times, fully integrate digital tools, and achieve a leap in internal auditing to a higher quality stage. Decision-makers have deeply recognized the value of the digitalization process of auditing for the

organization's long-term strategy, regarding it as a core strategic goal, incorporating it into the overall planning and assigning it key weights. At the same time, they provide comprehensive support at the procedural and substantive levels. This strategy will empower the internal auditing institution with strong execution power, ensuring the achievement of the construction goals, and stimulating the collaborative cooperation of other business units, jointly building a modernized informatized auditing framework.

(2) Promoting the implementation of auditing informatization regulations and systems. When promoting the informatization process of internal auditing within the organization, it is necessary to be vigilant against disorderly expansion and lack of planning. Based on detailed investigation of the work situation and precise analysis of business needs, relying on the systematic sorting and integration of national-level institutional norms and guiding opinions, internal auditing informatization should be constructed. This system should provide full-process guidance and supervision for the construction of internal auditing informatization, ensuring that auditing practices are traceable, data standardization construction has clear rules, and audit process operations have standardized support, thereby reducing potential audit risks. Moreover, the system should be dynamically adjusted in accordance with the actual progress and effectiveness of internal auditing informatization construction, promoting the full implementation of policy requirements in the application section, and thereby enhancing its professional status and core role. The successful implementation of this project requires cross-departmental collaboration. Relevant units such as internal auditing and informationization must strengthen collaboration, clarify the boundaries of responsibilities, and establish an efficient linkage team mechanism. Only through multiple rounds of consultation, careful discussion, and rigorous assessment can a universally recognized normative document system be ultimately formed.

5. Conclusion

In the current context of big data development, promoting the informatization construction of internal auditing in engineering projects urgently requires the establishment of a complete supporting system. Talent development is a key aspect. The unit should focus on cultivating a group of professionals with both auditing expertise and big data analysis capabilities. Through deepening the joint training between universities and enterprises on an order basis, they should shape professionals who are familiar with auditing practices and possess data analysis skills. They should also hire data scientists and information technology experts at high salaries to form cross-disciplinary collaboration teams. Technological implementation should rely on the "cloud-edge-end" integrated architecture. By deploying intelligent auditing systems and applying machine learning algorithms to achieve automatic monitoring of transaction anomalies, and introducing blockchain technology to solidify auditing data and ensure its immutability and full traceability. At the institutional level, a complete and executable auditing data management standard should be constructed, clearly stipulating the operational procedures and quality control requirements for each link of data collection and analysis. The data collaboration mechanism

among departments should be strengthened, through process optimization and resource integration, to completely eliminate data islands among core departments such as finance, procurement, and engineering, and ensure the real-time and completeness of data interaction. Simultaneously, the digital auditing efficiency evaluation framework should be upgraded, incorporating core dimensions such as data insight capabilities, risk prediction efficiency, and system processing efficiency into the comprehensive evaluation criteria. In the supervision system, an information-based auditing guidance committee with senior management as the collaborating cross-functional teams, can be established. A quarterly operational effectiveness monitoring mechanism can be implemented, and a professional third-party institution can be entrusted to conduct independent verification of system security and algorithm transparency. In addition, the enterprise should establish a dynamic improvement cycle mechanism, relying on the continuous expansion of the audit practice case library and the dynamic optimization of algorithm models, to gradually enhance the intelligent analysis capabilities and risk identification accuracy of the system.

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