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Research on Internal Audit and Bim Technology Application in Construction Phase

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Abstract

The research technology of internal audit and BIM technology in the construction stage effectively solves the efficiency problem of construction internal audit through a full range of BIM technology. Traditional audit methods cannot effectively solve this problem due to accounting difficulties caused by environmental manpower problems. The successful development of internal audit and BIM technology research in the construction phase will reduce audit risk, improve efficiency, and thereby reduce costs.

Keywords: *Construction Cost of Construction Project, BIM Technology, Internal Audit, Risk Control;*

1. Introduction

The amount of engineering costs of construction companies is usually relatively large, which leads to excessive engineering costs during the entire construction process, so internal audit of the project is necessary[1-3]. How to improve audit efficiency and reduce risks has also become the focus of engineering companies[4-6]! This article takes Company A as an example to innovate and improve the internal audit of engineering costs, and combine with the building information model to conduct an in-depth building information model for all aspects of the construction project, in order to improve the audit efficiency and project management, and make the construction cost of the construction project. cut back.

2. Current status of construction cost and internal audit of company A's construction project

The construction phase of company A's construction works mainly consists of railway, highway, municipal and other projects. Figure 1 shows an overview of the organization of the internal audit of project costs during the construction phase of company A. As shown in Figure 1, the audit department of Company A reports to the chief accountant and general manager in administration and functions, ensuring the independence of the audit work. Among them, the internal audit of the construction cost of the construction project was commissioned by the company's economic management department. The audit department audited the actual construction cost of the project based on the approved construction project construction plan, and the problems found in the audit Rectification and closure within the time limit.

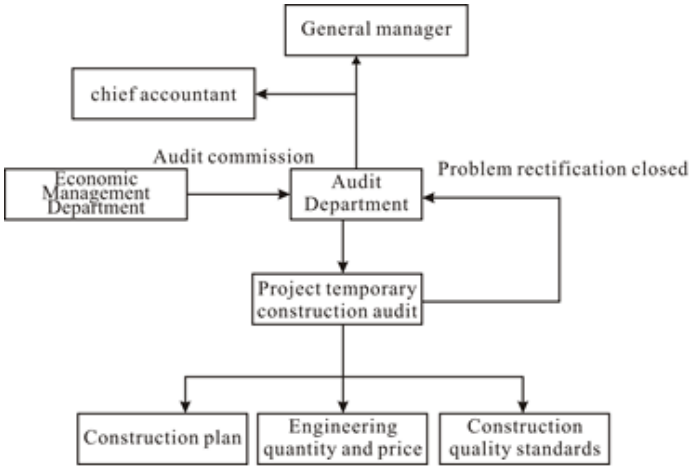

Figure 1. Organizational structure of internal audit of construction costs during construction.

Four auditors are currently responsible for the implementation of the internal audit of construction costs during the construction phase of Company A. In terms of age, there is 1 person under 30 and 3 persons over 30. The age structure of auditors is reasonable. From the perspective of academic background, all 4 people have a bachelor's degree

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with a higher level of education. From the perspective of professional background, the audit team leader is a major in engineering cost, and the other members are majors in finance, audit, and civil engineering. They have worked in related positions for more than 5 years, and the professional background structure is basically comprehensive (Table 1).

Table 1. Comparison of project budget and actual settlement amount during construction phase of construction project (unit: ten thousand yuan).

Serial number	project name	Budget amount	Settlement amount	Excess amount	Section excess ratio/%
1	A project	6 901	9 449	-2 548	-36.92
2	B project	6 351	10 224	-3 873	-60.98
3	C project	4 738	8 334	-3 596	-75.90
4	D project	5 520	8 560	-3 040	-55.07
5	E project	6 994	11 000	-4 006	-57.28
6	Project F	8 888	13 250	-4 362	-49.08

3. Analysis of risk points of internal audit of engineering costs during construction

3.1. Difficulty in engineering quantity calculation, resulting in inaccurate data

Due to the problems of temporary facilities planning and the provision of image data in construction projects, it is difficult to calculate the engineering quantity. In the construction phase of the construction project, the preliminary temporary facility planning of the project is not detailed enough and the consideration is insufficient. During the construction of temporary facilities, there will be an increase in the length of the access road, soft foundation treatment, and retaining walls due to topography and geomorphology, which deviates greatly from the original plan. During the construction phase of the construction project, there is no process disclosure of the project, especially the concealed project without image data, which brings great difficulties to the audit to confirm the completed project volume. Some construction projects are sporadic and temporary in the construction phase, most of which are only sketches, no construction plan, many visas and easy writing. These problems make it difficult for the audit to confirm the amount of completed works, and it is difficult to confirm the settlement amount of actual temporary facilities. , It is very easy for the construction unit to exploit the loopholes in the engineering quantity management, and the downstream construction party cheats, which damages the interests of the enterprise and increases the audit risk.

According to BIM technology, the direction of the intersection line L of Q1 and Q2 is the direction of the geodesic at point A. Because the line of intersection L is perpendicular to the normal vector of Q and Q2, it is also perpendicular to the plane determined by the normal vector of planes Q1 and Q2. Therefore, the direction of the intersection, that is, the direction vector of the signal propagating at Ai+1 is:

$$\vec{\tau}_{i+1} = \vec{n}_{i+1} \times \vec{\tau}_i \times \vec{n}_{i+1} \quad (1)$$

After setting the value of the initial point, iterate according to formula (1) to obtain the coordinates and ray directions of all discrete points on the geodesic line of signal propagation with an interval of h.

Suppose a total of two base matrices are involved in positioning, and the j-th discrete point of base matrix 1 and the k-th discrete point of base matrix 2

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are arbitrarily taken, and the coordinate and acoustic signal direction vectors at these two points are Aj , $\vec{\tau}_j$ and Ak, $\vec{\tau}_k$. The straight lines Lj and Lk that have made discrete points and whose directions are the direction vectors to be sought, the parametric equations with s and t as parameters are:

$$\begin{cases} L_j(s) = A_j + s\vec{\tau}_j \\ L_k(t) = A_k + t\vec{\tau}_k \end{cases} \quad (2)$$

3.2. The construction specifications are not uniform, which makes it more difficult to manage and control temporary facilities

In the company's practice, there is a lack of clear construction specifications and standards for projects in the construction phase of construction projects. Although the company has a standard atlas of temporary facilities, it cannot fully guide the construction. The project management personnel need to choose the plan reasonably according to the actual situation of the site and the local conditions, which makes the management and control of the temporary facilities more difficult. Due to the lack of clear and fixed construction specifications and standards in the construction phase of construction projects, it brings great uncertainty to the audit work and increases the audit risk.

3.3. Insufficient experience of auditors, resulting in low audit efficiency

There is a big difference between engineering auditing and professional financial auditing and economic responsibility auditing, and its complexity puts forward higher requirements on the professional quality and skill level of auditors. First of all, in terms of professional quality, in addition to financial management knowledge, auditors also need to understand laws and regulations, industry policies, economics, management, architecture and different engineering disciplines, and understand construction drawings, construction technology, building materials, and Familiar with the market. Especially in the construction phase of the construction project, the project involves roads, housing construction, steel structure, water and electricity and other majors, involving many majors, and requires a wide range of knowledge and rich construction experience to meet the audit requirements. Secondly, in terms of skill level, auditors need to be proficient in using office software, the Internet, and software related to engineering costs to ensure improved work efficiency. At present, only one auditor of Company A has a professional background in civil engineering, and the other auditors have a financial background. The knowledge of ordinary auditors is relatively single, and the construction experience is relatively insufficient, which makes the comprehensive ability of the auditors unable to fully meet the construction stage of construction projects Internal audit requirements for engineering costs.

4. Features of BIM and its advantages in internal audit

4.1. The concept and application of BIM

BIM technology has been widely recognized by the global industry. It can help companies realize the integration of building information from building design, construction to operation. At the end of the entire life cycle, all types of information are integrated into the model's three-dimensional information database. The design team, construction unit, facility operation department and owner can work together on the basis of BIM to effectively improve work efficiency, save resources and costs, and achieve sustainable development.

When auditors use BIM technology in project audits, they cannot do without the use of BIM software. The BIM software market currently has two main directions: one is technology-oriented, users can adjust according to the BIM technology itself; the other is to meet user needs and provide some functions for users' needs. Most BIM software vendors and consultants provide product and service solutions that usually focus on BIM technology and design products around BIM technology, rather than users. The characteristics of products developed by domestic software suppliers based on user

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orientation are becoming more and more important. Currently, the BIM software used by Company A is shown in Table 2.

4.2. Advantages of BIM in internal audit

The use of BIM technology can more effectively display the construction progress, accurately summarize the engineering quantity, and avoid omissions or calculation errors. In the case of visa application and payment, the actual countersignature will be greatly reduced to avoid capital turnover problems caused by non-payment or underpayment. For the management department, the management of the construction process has been strengthened to avoid negative delays caused by overpayment of project funds by the construction unit and avoid high costs before the completion of the construction party. In the inspection and acceptance of hidden projects, auditors can directly extract data from the platform built using BIM technology. For hidden projects that do not participate in monitoring, the platform can be used to report related issues to higher-level departments and provide treatment suggestions for the future The audit provides audit basis and view the results.

In order to promote the construction of party style and clean government, audit quality is the lifeline of audit work. The construction unit uses the BIM technology platform to create and modify the engineering model, simultaneously reflect the online and offline processing of the information in the engineering model, and transparently analyze the engineering design data to effectively isolate the black box operation and engineering quantity calculation errors in the bidding process. In other cases, the audit quality can be guaranteed and the audit risk can be greatly reduced. Combining BIM technology with integrity risk management can also mobilize the enthusiasm of auditors to participate in supervision, eliminate risk awareness, and improve auditors' ability to prevent and control integrity risks.

Table 2. BIM application software platform.

Serial number	Application	Software	Version
1	3D modeling software	Autodesk Revit	2012
2	Model integration platform	Navisworks	2012
3	2D drawing software	AutoCAD	2014
4	Document generation software	WPS Office	2016
5	Schedule management	Synchro Professional	4.7.2

5. The application design of BIM technology in the internal audit of the construction cost of the construction project

BIM technology has application value in the whole process of construction projects. Utilizing the characteristics and advantages of BIM technology, this article focuses on six stages of BIM technology in strengthening construction engineering from the six stages of decision-making stage, construction engineering construction stage engineering scheme design, bidding management, construction quality control, project settlement, and construction engineering risk pre-control at construction stage The application of the internal audit of the project cost in the construction phase is analyzed, as shown in Figure 2.

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5.1. The audit application of BIM technology in the decision-making phase of the project plan during the construction phase

The investment decision-making stage of a construction project is the early stage of project construction, and it is usually the most overlooked stage. The main task of this stage is to compare investment action plans, promote feasibility studies, and determine the best plan that plays an important role in the initial stage of the project plan and influences the actual construction stage. According to relevant research and analysis, the impact of the investment decision-making stage on the overall project cost is roughly 75%-95%. The traditional method of comparing different planning schemes is based on empirical judgment, systematic scoring and economic calculation. Most of these methods start from the objective analysis or subjective judgment of technical and economic data, and are not intuitive and scientific compared with BIM technology. The development time and cost dimensions of the 3D model based on BIM technology enable BIM-5D technology to organize various programs virtually, express the entire process of project construction in a clear and intuitive way, and decompose the budget of the project cost, so that the program can be scientifically and conveniently adjusted Conduct comparative analysis and choose the best.

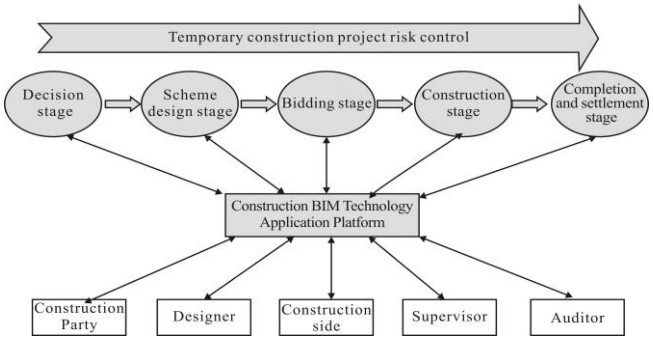

Figure 2. The application of BIM technology in strengthening the internal audit of engineering costs during the construction phase of a construction project.

5.2. The audit application of BIM technology in the engineering scheme design phase of the construction project

In the project design phase of the construction phase of the construction project, BIM technology can be used to assist the determination of data for land acquisition and house demolition inside and outside the red line. Before the BIM technology is used, the survey team needs to undergo repeated measurements to determine the red line land acquisition boundary, the area of land to be demolished, and the number of demolished houses. After the use of BIM technology, combined with the hexarotor tilt drone aerial photography line, a three-dimensional electronic information map can be quickly generated. The land acquisition area and the number of houses are marked on the map, which can be used as a reference for the project acquisition area.

BIM technology is convenient for internal audit to control on site engineering quantity confirmation. The application of BIM technology in land acquisition and demolition inside and outside the red line improves the data accuracy of land acquisition area and the number of houses, and can provide reliable data support for the risk assessment of land acquisition and demolition in the early stage of the project. Auditors can use these data to verify the cost of the previous acquisition and demolition. Compare and evaluate the reasonableness of the cost of demolition and demolition, thereby effectively avoiding the risk loopholes caused by demolition and relocation, and effectively controlling the personal fraud of the internal demolition personnel of the enterprise.

5.3. The audit application of BIM technology in the pre-control of engineering risks during the construction phase of construction projects

Making full use of the advantages of BIM's forward design technology can effectively reduce the audit risk of engineering projects in the construction phase of construction projects, as shown in Figure 3.

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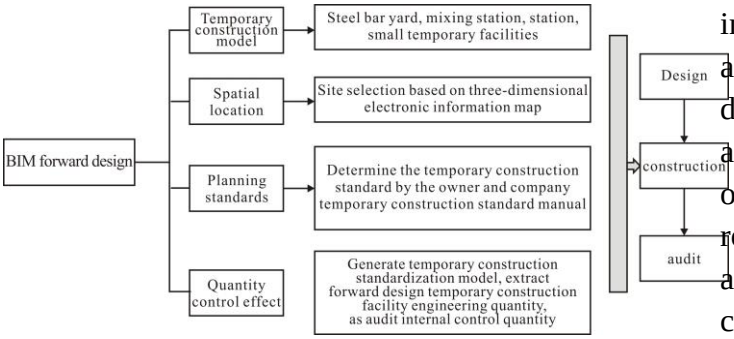

Figure 3. The audit application of BIM technology in the pre-control of engineering risks in the construction phase of construction projects.

5.3.1. Quickly measure the workload of demolition and confirm the number of houses to be demolished

The accurate determination of the engineering workload in the construction phase of a building project has an important impact on its cost control. In the pre-control of engineering risks in the construction phase of construction projects, BIM technology can be used to confirm the demolition workload, making it faster and more accurate. For example, using BIM technology to quickly measure the area of land requisitioned within the red line and confirm the number of houses to be demolished, and to check the amount of land requisition and demolition works given by the owner: when the number of works is greater than 10%, negotiate with the owner in advance and require compensation; less than 10 % Will make a plan for requisition and demolition in advance to reduce costs; if it is less than the amount in the list, it will be controlled as a profit point for the project.

5.3.2. Assist cost estimation of high-risk levy points

BIM technology can be used to estimate the cost of high-risk requisition and demolition sites in the pre-control of engineering risks in the construction phase of construction projects. Use BIM technology to extract risky requisition points from aerial electronic information maps, and make cost budget assessments in advance to minimize requisition costs. Land acquisition outside the red line, such as access roads, project sites, steel yards, mixing stations, tunnel entrances, etc., can be directly framed in the three-dimensional electronic information map, based on the actual construction and production services, considering the shortest distance and the best access road , The minimum amount of excavation and filling, maximize the use of existing national roads, county roads, village roads, etc., and calculate the length of access roads and the amount of temporary facilities such as concrete, steel bars, rubble, slab houses, decoration, etc. The project cost was reduced to a minimum during the construction phase.

5.3.3. Engineering quantity accounting is more accurate and cost controllability is stronger

The traditional method of engineering engineering audit in the construction phase of building engineering is to manually calculate the number of 2D engineering drawings and the number of sketches of the drawings. Due to misunderstandings of drawings, measurement deviations or calculation errors, it is easy to cause the calculation results to deviate from the true value, and the audit results obtained are not reliable. After using BIM technology, the calculation of engineering quantities will be faster and more accurate, and auditors do not need to spend too much time and energy on lengthy calculations, thereby reducing cost management problems. The data analysis function of BIM can export relevant information that auditors need to verify, so as to avoid wasting time by communicating with various departments through paper materials. In addition, BIM Cloud provides auditors with guidance based on their professional knowledge and past experience, enabling them to find details that are often overlooked during audits and improve the quality of audits.

6. Conclusion

Engineering costs in the construction phase of construction projects are an important expenditure of construction companies. In practice, various factors have been found to cause serious excess costs and waste. Relying only on traditional internal audit methods, the efficiency of auditing costs in the construction phase of construction projects is improved limited. This article selects Company A as

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a case study to study how BIM technology can be introduced into internal auditing of construction costs during construction. This article believes that the application of BIM technology in the three dimensions of project design during construction phase, engineering risk pre-control during construction phase, and construction quality control is important for strengthening internal auditing of construction costs in construction phase, improving audit efficiency and reducing construction Phase engineering costs have important practical significance.

Acknowledgments

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