Management Strategies for Whole-Process Cost Consulting in Construction Engineering Projects

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Abstract: The entire process of construction engineering project development involves multiple stages: decision-making, design, bidding, construction, and final account settlement. Cost control at each stage affects the overall investment efficiency of the project. Currently, China's construction industry faces issues in whole-process cost consulting management, including fragmented management, insufficient data application, and weak professional collaboration. Based on the concept of whole-process management and starting from the core points of cost consulting management at each stage, this article proposes actionable management strategies. The aim is to enhance the scientificity and precision of cost consulting management, providing an effective reference for investment control in construction engineering projects.

1. Introduction

The construction industry is currently at a critical juncture where digital transformation and the implementation of "dual-carbon" goals intersect. Engineering projects are exhibiting new characteristics of "increasing scale, technology integration, and green requirements." From the complex renovations of urban renewal projects to the precise construction of super high-rise landmark buildings, and further to the low-carbon requirements of new energy supporting projects, the investment boundaries of projects are continuously expanding. Factors influencing costs have expanded from traditional labor and material costs to dimensions such as carbon reduction investments and smart technology applications. In this context, whole-process cost consulting and management is no longer just a cost accounting tool but has become a core link in balancing project investment, functional requirements, and green goals. Constructing a cost consulting system covering the entire project cycle is an inevitable choice to address the industry's new challenges. This system can not only integrate cost data from all stages through digital means, providing precise cost support for the implementation of carbon reduction measures, but also break down data barriers through professional collaboration, promoting high-quality development of the construction industry during its transformation.

2. Current Status of Whole-Process Cost Consulting Management in Construction Engineering Projects

2.1 Fragmented Management, Insufficient Stage Linkage

Cost consulting and management work in construction projects is often independent across different stages, lacking effective linkage mechanisms. The investment estimate from the decision-making stage is not closely connected to the budget in the design stage; the budget from the design stage is disconnected from the budget in the construction stage; and discrepancies exist between the settlement during construction and the final account at completion. This fragmented management leads to poor transmission of cost information, inconsistent cost control objectives across stages, and ultimately results in project investment overruns. Taking a residential project as an example, the initial investment estimate during the decision-making stage was 500 million CNY. During the design stage, due to insufficient reference from budgetary estimate data, the preliminary

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budget reached 580 million CNY. During the construction stage, due to design changes, the budget was not adjusted timely, and the final settlement amount soared to 620 million CNY, far exceeding the initial investment estimate and seriously impacting the project's investment efficiency.

2.2 Insufficient Data Application, Lack of Scientific Support

In whole-process cost consulting management, data is a crucial foundation for scientific decision-making and precise control. However, current cost consulting firms exhibit significant deficiencies in data collection, organization, analysis, and application. On one hand, the scope of data collection is narrow, limited to projects undertaken by the firm itself, lacking macro-level industry data, which leads to insufficient data representativeness. On the other hand, data organization and analysis methods are outdated, relying primarily on manual sorting and simple statistics, unable to deeply mine the value behind the data, making it difficult to provide scientific support for cost management. For instance, in project cost prediction, due to the lack of accumulation and analysis of historical data, cost consultants can only rely on experience for estimation, resulting in low prediction accuracy and inability to provide a reliable basis for project investment decisions[1]. Additionally, imperfect data sharing mechanisms and severe data barriers among participants prevent real-time updating and sharing of cost information, affecting the efficiency and quality of cost management work.

2.3 Weak Professional Collaboration, Low Management Efficiency

Construction projects involve multiple entities such as the construction unit (owner), design unit, contractor, supervision unit, and cost consulting unit. Each participant bears different responsibilities in cost management and requires active coordination and close cooperation. However, there are obvious weaknesses in professional collaboration among the current participants. Firstly, the lack of effective communication mechanisms among participants leads to untimely and inaccurate information transmission, causing disconnects in cost management work. Secondly, the professional division of labor among participants is overly detailed, lacking a big-picture perspective. In the cost control process, they often focus only on their own interests, neglecting the overall investment benefit of the project. For example, design units might overemphasize the technicality and aesthetics of design schemes while ignoring their economy, leading to wasteful designs[2]. During construction, contractors might pursue construction progress and change design schemes without authorization, increasing project costs. Simultaneously, cost consulting units may fail to communicate and coordinate timely with design units and contractors, unable to effectively control project costs. This weak professional collaboration seriously affects the efficiency and quality of cost management work, leading to poor project investment control outcomes.

3. Innovative Strategies for Whole-Process Cost Consulting Management in Construction Engineering Projects

3.1 Strengthen Investment Estimation, Build Dynamic Prediction Models

The decision-making stage is the starting point of construction project development and a critical stage for cost control. At this stage, cost consulting units need to strengthen investment estimation work, establish dynamic prediction models, and provide a scientific basis for project investment decisions. Specific measures are as follows:

Firstly, expand the scope of data collection and establish a comprehensive database. Cost consulting units should collect macro-level industry data, including prices of construction materials, labor costs, and machinery equipment rental prices; collect historical data from similar projects undertaken by the firm, including project investment estimates, budgetary estimates, budgets, and settlements, to establish a comprehensive and systematic database. By organizing and analyzing this data, they can grasp industry development trends and project cost change patterns, providing data support for investment estimation[3].

Secondly, adopt advanced data analysis methods to build dynamic prediction models. Cost

consulting units can introduce big data analysis and artificial intelligence to conduct in-depth analysis of the collected data, mining the value behind the data. For example, using big data analysis technology to analyze historical project cost data, identify key factors affecting project costs, and establish project cost prediction models. Using artificial intelligence technology to predict construction material prices, labor costs, etc., provides a basis for dynamic adjustment of investment estimates. By building dynamic prediction models, the accuracy and dynamism of investment estimation can be improved, enhancing the scientificity of investment decisions.

Finally, strengthen communication and coordination with the construction unit (owner) and design unit to ensure the investment estimate meets project requirements. Cost consulting units need to thoroughly understand the owner's project requirements and investment expectations. Combined with the preliminary design scheme from the design unit, they should repeatedly simulate and optimize the investment estimate to ensure it meets both project requirements and investment expectations.

3.2 Implement Limited Cost Design, Establish Design Scheme Comparison and Selection Mechanism

Implementing Limited Cost Design and establishing a design scheme comparison and selection mechanism can achieve the organic unity of the economy and technicality of design schemes. On one hand, cost consulting units need to formulate detailed limited cost design indicators based on the investment estimate determined in the decision-making stage, combined with the project's functional requirements and technical standards, and decompose them into various professional design aspects such as architecture, structure, water and electricity, and HVAC. Professional designers should conduct their work under the constraints of these indicators to ensure the economy of the design scheme. For instance, in architectural design, strictly control indicators like floor area, building height, and finishing standards; in structural design, optimize structural selection and reasonably control the usage of materials like steel and concrete[4].

On the other hand, cost consulting units should organize the construction unit (owner), design unit, and supervision unit to conduct technical and economic comparisons of multiple design schemes. Introduce the concept of Value Engineering into the comparison process, analyzing the function and cost of design schemes to select the one with the highest function-cost match. For a commercial complex project, the design unit proposed two schemes: Scheme One used a frame structure with higher cost but better spatial flexibility; Scheme Two used a shear wall structure with lower cost but poorer spatial flexibility. Through Value Engineering analysis, the cost consulting unit found that Scheme One had a higher function-cost match and ultimately recommended the owner choose Scheme One.

Furthermore, cost consulting units should also establish a complete design change management process for strict review of design changes. Before initiating a review, require the design unit to submit a change application form detailing the reasons for the change, the content of the change, and the professional scope involved; attach drawings comparing before and after the change and a list of quantity differences to provide a complete basis for review. During the review process, besides focusing on analyzing the impact of the design change on project cost, it is also necessary to determine the necessity of the change based on the project's functional requirements and technical standards. If the change only enhances local aesthetics significantly increasing cost, or if the change content is unrelated to the project's core functions, timely communication with the design unit is needed, suggesting optimization or cancellation of the change. For design changes that are indeed necessary and will increase project cost, the design unit should be required to provide a detailed cost analysis report, clearly specifying the specific components of the cost increase, such as additional materials and labor. Simultaneously, actively communicate and coordinate with relevant participants like the construction unit (owner) and contractor. Based on the overall project investment plan and construction progress, jointly evaluate the feasibility of the change, and finally decide whether to proceed, avoiding cost control issues or schedule delays due to unilateral decisions.

3.3 Strengthen Dynamic Monitoring, Establish Cost Early Warning Mechanism

The construction phase is the main stage where project costs occur and is also the key and difficult point of cost control. Cost consulting units should strengthen dynamic monitoring, establish a cost early warning mechanism, and promptly identify and resolve issues in cost management. Cost consulting units can utilize BIM and IoT technologies to establish a dynamic monitoring system throughout the entire process, collecting various data in real-time during project construction, such as labor costs, material costs, machinery equipment rental costs, and site management costs. Real-time analysis and comparison of this data allow for grasping the changing trends of project costs and timely identification of potential risks of cost overruns[5]. For example, using BIM technology to create a 3D engineering model, linking the bill of quantities with the model, enables real-time tracking of engineering progress and completed quantities. By comparing actual costs with budgeted costs, cost overruns can be detected promptly.

Simultaneously, cost consulting units can set cost early warning indicators based on changes in the project's budgeted cost and actual cost. When actual costs approach or exceed the warning indicators, early warning signals should be issued promptly, and the reasons for the cost overrun analyzed. Corresponding corrective measures should be taken for different causes. If cost overruns are due to rising construction material prices, negotiate with suppliers to adjust material procurement prices or find alternative materials. If cost increases are due to construction delays, optimize the construction schedule to accelerate progress[6].

Strengthening the management of site visas and design changes can strictly control additional costs. During construction, site visas and design changes are significant reasons for increased project costs. Cost consulting units need to establish complete management processes for site visas and design changes, conducting strict reviews. The review process should focus on the necessity and rationality of the site visa or design change, as well as its impact on project cost. Unnecessary site visas and design changes should be rejected. For necessary site visas and design changes, the project budget should be adjusted timely to ensure project costs are controlled within a reasonable range[7]. Additionally, cost consulting units should strengthen the tracking and management of site visas and design changes to ensure the implementation process complies with relevant regulations and avoids generating additional costs. In tracking management, cost consulting units can establish specialized tracking ledgers, detailing key information such as the application time, approval process, implementation time, amount involved, and responsible person for each site visa and design change, ensuring every change is traceable. Furthermore, the responsibilities of the construction unit (owner) and supervision unit during the implementation of changes must be clarified. The contractor must strictly construct according to the approved change plan and must not adjust construction content and processes without authorization. The supervision unit needs to strengthen the supervision and inspection of the change implementation process, focusing on verifying whether construction quality and progress meet requirements, and whether the quantities of changed works align with the approved content[8].

4. Conclusion

From the full text review, it is evident that the current industry's dilemmas—fragmented management, insufficient data application, and weak professional collaboration—are actually inevitable results of the mismatch between traditional management thinking and the wave of digital and green transformation. The strategies proposed in this article, such as strengthening dynamic prediction, implementing limited cost design, and building cost early warning mechanisms, are key to breaking this predicament. The implementation of these strategies can not only effectively avoid the risk of project investment overruns but also promote the shift of construction projects from the extensive model of "emphasizing construction over control" to a new stage of refined development characterized by "precise investment, efficient implementation, and green low-carbon." In the future, with continuous technological iteration and the continuous improvement of industry collaboration mechanisms, this management model will undoubtedly solidify the foundation for the high-quality

development of the construction industry, achieving a win-win situation for project value, enterprise benefits, and social value.

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