

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

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Abstract: Construction engineering project development consist of several phases from decision to design, bidding, constructing and finally settlement of accounts. The cost control in the entire project is affected by every stage. At present, the construction industry in China is facing problems such as broken chain management, weak data application and low collaborative optimization of professional work. This article provides guidance for implementing more manageable cost consulting management practices based on the idea of whole-process management and draws strategic planning from core points at each phase. Using this method can improve the scientific and accurate cost consulting management, which is referred as an effective help for investment acquiring based on construction engineering project.

1. Introduction

The construction industry is at a pivotal position between the digital transformation and goals for dual-carbon. The engineering projects are showing new features of increasing scale, technology integration and green requirements. From the relatively complex renovation of urban renewal projects to the semi-precise construction of super high-rise landmark buildings, and then to the low-carbon requirements of new energy supporting projects, the investment boundaries of comprehensive projects are also constantly changing from level to stage. Costs Drivers evolved from traditional labor and material cost items to factors such as investments for carbon reduction, and application of smart technologies. At this juncture, whole-process cost consulting and management is no longer a simple tool for cost accounting but rather has become the key intermediary link between other aspects of project investment, functional requirements and green goals. The inevitable remedy for addressing this brand-new obstacle in the building and construction market is to develop a cost consulting system throughout the entire task cycle. This system can integrate cost data in all stages through digital means, providing accurate cost support for the implementation of carbon reduction measures; it can break down data barriers through professional collaboration and promote the high-quality development of the construction industry from its transformation perspective.

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

2.1 Fragmented Management, Insufficient Stage Linkage

In construction projects, cost consulting and management work are often independent of each other across different stages of a project with non-effective linkage mechanisms. The decision-making investment estimated in the design stage is not closely related to the budget, and the design stage budget is broken with the construction stage budget. Settlement during construction does not match what will be a final account at completion. This fragmented management results in limited transmission of cost information, inconsistent control objectives at different stages and ultimately large investment overruns on projects. For instance, considering a residential project, the investment estimate at the decision-making stage is 500 million CNY. In the initial design stage,

due to limited reference from budgetary estimate data, the preliminary budget was as high as 580 million CNY. As a result of design changes, the budgeted investment was not adjusted in time in the construction stage, the final settlement amount rose to 620 million CNY, far exceeding the expected investment estimate and seriously affecting project investment benefit.

2.2 Insufficient Data Application, Lack of Scientific Support

Data is the most important basis of scientific decision-making and precise control in whole-process cost consulting management. However, the quality of data collection, organization, analysis and application demonstrate a number of major failings at most cost consulting firms today. On the other hand, the narrow definition of projects in the data limit the representativeness power of data as it captures only a few selected street-level projects conducted by themselves without macro-level industry data. In contrast, data organization and analysis methods are relatively backward, mainly through manual sorting and simple statistics to carry on, the structure of some of the value behind the data can not be thoroughly mined, so it is difficult to provide a scientific basis for cost management. In project cost prediction, cost consultants can only rely on experience for estimation due to the lack of sufficient historical data collection and analysis, which leads to low prediction accuracy and difficulties in providing a basis for project investment decisions ^[1]. Second, the data sharing mechanism based on imperfect compensation contract and the hard barriers between participants make it impossible to update and share cost information in time, thus affecting the efficiency and quality of cost management work.

2.3 Weak Professional Collaboration, Low Management Efficiency

The construction project may have multiple units including the construction unit (owner) level, design unit, contractor, supervision unit and cost consulting unit. Each participant maintains different responsibilities in cost control and needs to actively coordinate and cooperate closely. Now, it is clear that the current participants' professional collaboration has some weaknesses. First of all, there is a defect in the communication mechanism among participants, the information transmission is not timely and accurate, resulting in disconnection in cost management work. Second, there is too much specialized equipment among participants creating a narrowly focused professional viewpoint with little perspective on the overall picture. During the process of controlling project costs, they usually consider only their own interests and ignore the overall investment benefit of the project. For instance, design units may put too much weight on the technicality and aesthetics of design schemes while paying little attention to their economy which might result in wasteful designs ^[2]. Contractors during construction may also seek course of the works and default erection schemes beyond their jurisdiction, materialising escalating project expenses. At the same time, cost consulting units may not be able to connect and coordinate with design units and construction parties in a timely manner, and investors are at risk of failing to plan projects effectively. This weak cooperation among professions seriously hinders the efficiency and quality of cost management work, which in turn results in unsatisfactory project investment control.

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 beginning of development for a building endeavor and an incisive period of cost control. Centering on that, cost consulting units have to carry out investment estimation work emphasis, and set up dynamic prediction model in some way, for the project investment decision provides scientific basis. Specific measures are as follows:

In the first place, broaden data collection and create a complete database. It is necessary for cost consulting units to collect some industry macro sports data, such as construction material prices, labor price and machine equipment rental rices; collecting historical information of other similar projects done by this firm, including project investment estimates, budgetary estimates, budgets and

settlements in a systematic and complete database. Through organizing and analyzing this data, they are able to understand the trend of industry development as well as predict the pattern of cost changes, thus providing data support to investment estimates^[3].

Second, using advanced data analysis methods to fit dynamic prediction models. Big data analysis and artificial intelligence technology can be introduced here, enabling cost consulting units to do deep mining of all collected data on the basis of big data. For example, one of big data analysis methods is used to mine historical project cost data, analyze key factors affecting project costs, and then build a model to forecast the cost of projects. Utilizing artificial intelligence technology to forecast construction material prices, labor costs and so on provides a necessity for dynamic adjustment of investment estimates. The use of dynamic prediction model to increase the accuracy and dynamism while estimating online investment can be made, making investment decision scientific.

Finally, improve the communication and coordination with the construction unit (the owner) and design unit to adapt the investment estimate; Accurate knowledge of this should be done by the cost consulting unit about the part of project requirement and owner's investment expectation. In conjunction with the design unit is the preliminary design scheme, we should adjust repeatedly in accordance with the investment estimate of simulated adjustment and optimization to ensure that it can comply with project requirements and user demand, etc.

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

By implementing Limited Cost Design and building a comparison and selection mechanism design avocation scheme, the organic unity of economy and technique can be realized in the engineering design. First, the limited cost design index of details need to be proposed according to the cost estimate identified in the decision stage, combined with the function requirement and technical standard of projects, and decomposed into different professional designs (architecture, structure, water and electricity use or HVAC). Professional designers should conduct their work according to the restrictions of process indicators so as not to be vague and fuzzy about the rationality of the design scheme. For example, for architectural design, implement strict control on indicators such as floor area, building height and finishing standards; For structural design, optimize the structural selection and reasonably control steel and concrete use^[4].

By contrast, cost consulting units should coordinate the construction unit (owner), design unit and supervision unit to carry out technical economic comparison of multiple design schemes. Incorporate Value Engineering into the arrangement comparison method by examining functionality and cost of design schemes, to find the scheme with maximum function-cost combination. The design unit put forward two schemes for a commercial complex project: Scheme One adopted a frame structure, and its cost was high but it had more spatial flexibility; Scheme Two used shear wall structure and its cost was low, but the space had poorer flexibility. The cost consulting unit employed a Value Engineering analysis and found that Scheme One aligns better with the function-cost match, providing suggestions to owners to choose Scheme One.

In addition, the cost consulting units should also set up a complete design change management process to ensure strict review of design changes. Before conducting a review, make sure to obtain a change application form submitted by the design unit, indicating the reasons for changing and what was changed, as well as stating which profession is involved; compare supporting drawings before and after revision with all other relevant files that list table quantity differences in order to provide a complete basis for doing such reviews. In the Review process, it is not only necessary to analyze its impact on project cost due to a design change — but also whether this is a change that must be made, depending on the functional requirements of the project and technical standards required. Such changes that merely improve the local landscape while taking up a large amount of cost, or whose content is not directly related to the core function of the project should be communicated with the design unit in a timely manner and used as an opportunity to optimize or cancel. In the case where the design unit must incorporate changes for those necessary reasons and would ultimately

escalate project cost, the design unit shall be mandated to submit a detailed report on cost analysis to specify each items driving up price including but not limited to additional material and/or labor costs. At the same time, communicate and coordinate with relevant parties such as the construction unit (owner) or contractor. Jointly agree whether to make the change or not based on utilization of overall project investment plan and construction progress, avoiding cost control problems led by unilateral decision-making, or schedule delay.

3.3 Strengthen Dynamic Monitoring, Establish Cost Early Warning Mechanism

Construction Phase is the primary stage of cost in a project and also one of the key difficult areas for cost control. Cost consulting units need to strengthen dynamic monitoring, improve the cost early warning mechanism, and timely discover and solve problems in cost management. BIM and IOT are local technologies that can help cost consulting units create a dynamic monitoring system throughout the whole process, collecting real-time data during construction of project buildings (labor costs, materials, machinery equipment rental costs and site management costs). This data can be analysed and compared in real-time, which enables an understanding of the trend regarding project-contract costs over time and provides timely notification when a financial loss may occur ^[5]. For example, if a team uses BIM technology to design a 3D engineering model and connects the bill of quantities along with this model together, they can keep track of their engineering progress and completed quantities in real time. Cost overruns can be detected early by comparing actual costs with budgeted ones.

At the same time, cost consulting units can establish early warning indicators of costs according to the budgeted cost and the actual cost of the project. Whenever actual costs near or exceed the warning thresholds, an early warning signal should be issued immediately for review to determine if the cost overrun was foreseen. The corresponding treatments will have to be performed for various causes. If the rise in construction material prices leads to cost overruns, negotiate with suppliers for rate adjustments of construction material or try and get raw materials substitution. If the cost increases from delayed construction, optimize the schedule to accelerate the necessary construction low ^[6].

Enforcing strict control over additional costs by strengthening management of site visa and design changes. There are two major causes of project cost escalation due to construction: site visas and design changes. Cost consulting units should establish a complete management process for site visas, design changes and other issues, and conducting strict reviews. The review should also assess if the site visa or design change is needed or justifiable and how it alters project cost. Reject unneeded work visas for site, reject this change of the design. Adjust the project budget in time for the necessary site visa and design changes, so that the project cost can be controlled within a reasonable range ^[7]. Also cost-consulting units ought to strengthen the monitoring and management of site visas, design modifications, etc., so that the process of implementation can comply with related regulations, meanwhile generating as less new costs as possible. In the aspects of tracking management, cost consulting units can set up personalized tracking books to mark down the site visa and design change for each major information such as application time, approval process, implementation time, amount and responsible person in detail so that all changes can be tracked. Also, it must be made clear what the roles of construction unit (owner) and supervision unit are during change implementation. The construction contractor shall build strictly in accordance with the approved construction change program, and must not modify the construction content and process without authorization. The supervision unit needs to further strengthen the supervision and inspection of the change implementation process, focusing on verifying whether the construction quality and progress meet the requirements, and whether the varieties and quantities of changed works are consistent with its approved content ^[8].

4. Conclusion

From the full text review, low-data usage, and poor professional collaboration are not merely dilemmas facing current industry practice but rather inevitable outcomes from thinking in terms of

traditional industry management fashioned for yesterday's economy with little regard to the wave of digital and green transformation hitting us today. The strategies introduced in this paper, including enhancing dynamic prediction, setting limited cost design and ensuring early warning emphasize on cost are the breakable key point to overcome this dilemma. Implementing these strategies can not only effectively avoid the risk of project investment overruns, but also promote the transformation of construction projects from an extensive model focusing on "emphasizing construction over control" to a new stage of refined development characterized by "precise investment, efficient implementation and green low-carbon". With the continuous iteration of technology in the future and continuously improving industry collaboration mechanism, this management model will surely lay a solid foundation for building high-quality development, achieving win-win situation of project value, enterprise benefits and social value.

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