Research on Project Cost Management Based on Whole-Process Engineering Consulting

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Abstract: For construction units to achieve good investment returns, the key lies in the efficient management and control of construction project costs. This paper, centered on the perspective of whole-process engineering consulting, explains its role in ensuring the quality and benefits throughout the entire project lifecycle. It points out existing problems in current cost management and proposes optimization measures: establishing a whole-cycle system, building a collaborative hub, and strengthening technical personnel support. The aim is to provide reference opinions for the practical work of relevant personnel.

1. Introduction

In the current development of the construction industry, some pre- and post-construction cost estimators have failed to accurately present construction expenses or implement the requirement for upfront cost accounting. This has adversely impacted the economic benefits of construction units. The service model based on whole-process engineering consulting, with its professional support covering the entire lifecycle (decision-making, design, construction, etc.), can help construction units improve their upfront cost estimation mechanism. It enables proactive cost control throughout all stages of construction, thereby effectively mitigating the negative impact of inadequate pre- and post-construction cost estimation on economic benefits. This provides a guarantee for construction units to achieve their investment return objectives.

2. The Importance of Whole-Process Engineering Consulting

Whole-process engineering consulting encompasses the entire lifecycle of a project, including decision-making, design, construction, and operation. It is a core element in ensuring project quality, efficiency, and benefits. Firstly, it is key to risk prevention and control during the project decision-making phase. Consulting institutions, through feasibility studies, investment estimation analysis, and consideration of policy orientation and market demand, assist clients in avoiding blind investment risks. This ensures precise project positioning, controllable investment returns, and prevents resource waste due to client decision-making errors [1]. Secondly, during the design phase, whole-process consulting enables design optimization and upfront cost control. Consulting teams can bridge design and construction requirements, offering cost-effective improvement suggestions to designers while ensuring functional requirements are met. They also control design depth, thereby reducing changes and rework caused by design omissions during construction, helping clients lower costs at the source. Thirdly, during the construction phase, whole-process consulting plays a role in coordination management and quality supervision. Consulting institutions can ensure orderly project progress by coordinating schedules among participants and resolving on-site interface issues. Simultaneously, they strictly enforce quality and safety standards, promptly identifying construction hazards to prevent quality accidents and delays, effectively safeguarding the client's interests. Finally, during the operation phase, whole-process consulting provides operation and maintenance guidance and asset revitalization suggestions [2]. Consulting teams, based on project construction data, can develop efficient operation and maintenance plans for operators, helping extend facility lifespans. They also provide professional advice on asset disposal

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for clients, enhancing the project's long-term economic benefits.

3. Main Problems in Current Project Cost Management

3.1 Significant Gaps in Full Lifecycle Cost Management Coverage

Cost management in some engineering enterprises currently does not span the entire lifecycle, focusing primarily on the post-construction final account and the construction drawing budget stages. Significant gaps exist in cost control during the early decision-making and construction process phases. Enterprises often rush project initiation during early decision-making, failing to conduct detailed cost estimation based on market dynamics, material price trends, and actual project needs. Instead, they rely on historical project experience to set cost frameworks, neglecting differences in external environments and construction requirements between the current and past projects, planting seeds for future cost overruns [3]. Concurrently, while construction drawing budgets are completed during the design phase, some enterprises do not prioritize cost optimization as a core design objective. Design teams focus solely on technical feasibility, ignoring cost rationality, resulting in a "technology-heavy, cost-light" design approach. Furthermore, to meet specific technical specifications or aesthetic effects, some projects adopt designs exceeding actual requirements. This leads to significantly higher construction costs compared to conventional solutions, potentially prolonging the construction period and indirectly increasing labor and management costs. Ultimately, designs may be forcibly adjusted during construction due to excessive costs, causing waste in design investment and schedule delays.

3.2 Fragmentation of Cost Management Due to Ineffective Multi-Party Collaboration

Serious flaws exist in the collaborative mechanism between clients (construction enterprises), contractors (construction units), and designers (design units), leading to a fragmented state of cost management. Blurred boundaries of responsibilities, with no unified cost management accountability system defined via contracts or agreements, foster a "siloed" management pattern. Clients, as investors, focus on overall project cost control, aiming to complete within budget. Contractors, as executors, prioritize their own construction profits, often inclined to increase settlement amounts through change orders. Designers, as technical providers, emphasize meeting technical specifications in designs but lack motivation for cost optimization. These divergent objectives lead to severe "information silos" and the absence of a regular, fixed-interval communication mechanism. Additionally, after completing designs, designers lack a synchronized briefing process with construction and cost departments. Drawings are delivered via simple file transfer without detailed explanations of cost considerations or optimization potential within the design details [4]. If contractors discover costs exceeding expectations or design-actual condition mismatches during material procurement or construction, they must communicate with designers for adjustments. This often results in wasted procurement costs and schedule delays.

3.3 Weak Technical and Tool Support Capabilities for Cost Management

On one hand, some engineering companies still rely on manual calculations combined with basic office software for cost accounting. Quantifying and pricing require manual entry of drawing data and application of quota items, prone to errors and deviations leading to inaccurate cost data. Furthermore, manual accounting is inefficient; completing a full cost estimate for a medium-sized project consumes significant manpower and time, unable to adapt to larger or more complex projects or meet the timeliness demands of project progress [5]. On the other hand, specialized IT-based cost management tools have low adoption rates. Companies that do adopt them often fail to leverage their full value, using them only for basic data entry and simple quantity calculations without realizing real-time linkage and sharing of design, construction, and cost data. Even when advanced Building Information Modeling (BIM) technology is introduced in some projects, the lack of data interfaces between tools means cost data still requires manual re-entry after design changes. This causes cost updates to lag behind design adjustments, prevents dynamic cost analysis and

optimization via technology, and undermines the management value of IT tools.

4. Optimization Measures for Project Cost Management Based on Whole-Process Engineering Consulting

4.1 Establish a Whole-Lifecycle Cost Control System to Fill Coverage Gaps

Whole-process engineering consulting units (WECUs) must promote a shift from "phased focus" to "full lifecycle integration" in cost management, centered on whole-cycle control and meeting requirements for innovative concepts and comprehensive oversight. Firstly, WECUs should lead detailed cost estimation during the early decision-making phase, abandoning reliance on historical experience. By researching market dynamics, material price trends, project needs, supply-demand relationships for materials, and policy directions, they should build dynamic cost calculation models. This clarifies differences in construction standards and environmental requirements compared to past projects, forming accurate preliminary cost estimates to support client decision-making and avoid cost framework deviations at the source [6]. Secondly, during the design phase, WECUs must integrate cost optimization as a core design objective. Jointly with designers, they should conduct dual-dimensional (technical and cost) design reviews. Based on national standards and project investment limits, they analyze the cost-effectiveness of construction methods and material selections within designs, preventing overly expensive solutions driven purely by technical specs or aesthetics. A design alternative comparison mechanism should be established, using detailed data to assess cost differences and economic benefits of different options, ensuring cost optimization while meeting technical requirements, thus reducing later costly design adjustments and waste. Finally, in the construction phase, WECUs need to implement a dynamic cost monitoring mechanism. Dedicated cost personnel should be stationed on-site to track material consumption, labor input, and change orders in real-time, updating cost ledgers accordingly. Regular comparisons between actual costs and budgeted costs should be made, with deviation causes analyzed and corrective actions devised promptly to prevent issues accumulating until project completion.

4.2 Build a Multi-Party Collaborative Hub to Overcome Fragmentation

WECUs must act as a central collaborative hub, integrating resources from clients, contractors, and designers, implementing standardized management and process optimization. Firstly, WECUs should lead in establishing a unified cost management accountability system. Based on contracts and agreements, they define the client's cost control objectives, the contractor's reasonable profit margin, and the designer's cost optimization responsibilities, eliminating ambiguity in responsibilities. A mechanism for benefit-sharing and risk-bearing should be created, linking cost control effectiveness to the parties' gains, encouraging a shift from "siloed operations" to "collaborative win-win," reducing conflicts stemming from divergent interests. Secondly, WECUs need to establish regular communication and information sharing mechanisms. They should organize periodic cost management coordination meetings among the parties to synchronize key information like project progress, cost consumption, and design changes, breaking down "information silos." WECUs should lead the drawing briefing process. After design completion, they require designers to thoroughly explain cost considerations, optimization potential, and constructability within the design details. Contractors and clients can raise questions on the spot, preventing later cost waste and delays due to misinterpretations [7]. Thirdly, WECUs must develop unified cost accounting standards and dispute resolution procedures. Aligned with national pricing norms and project specifics, they should clarify the basis, methods, and data submission requirements for final settlement, gaining consensus upfront. If disputes arise during settlement, the WECU acts as a neutral party, conducting verification and mediation according to pre-agreed standards to resolve differences swiftly and avoid "buck-passing" hindering progress.

4.3 Strengthen Technical and Personnel Support to Address Capability Shortcomings

On the technical side, WECUs must drive the digital transformation of cost management tools. Firstly, specialized IT tools like cost software and intelligent quantity take-off platforms should

replace manual/basic software hybrid models, reducing data entry errors and quota application deviations to enhance accuracy and efficiency. Secondly, deep integration between BIM technology and cost management is essential. Real-time interfaces linking design, construction, and cost data must be established, enabling automatic cost data updates after design changes. This facilitates dynamic cost analysis and optimization, avoiding update delays from manual input. Finally, an enterprise-level historical cost database should be built. Data on main material prices, labor costs, equipment usage fees, etc., from past projects must be systematically categorized, stored, and regularly updated to provide precise references for new project estimations [8]. On the personnel side, WECUs need to establish cultivation and assessment systems for cost professionals. They should collaborate with engineering companies to provide targeted training covering: whole-cycle cost management knowledge (early estimation, design optimization, construction monitoring), operation of IT tools (BIM, cost platforms), and policy/regulation interpretation. This improves cost personnel's budgeting skills, construction experience, and technical application level. Concurrently, supervision, reward, and penalty systems should be implemented. Cost control outcomes like deviation rates and accounting efficiency should be incorporated into performance evaluations. Excellent performers should be rewarded, while personnel causing cost overruns due to errors should be held accountable. This strengthens responsibility and ensures personnel proactively implement detailed control requirements.

5. Conclusion

In the context of high-quality development in construction, cost management is no longer merely cost accounting for isolated phases but a systematic project spanning the entire project lifecycle. Leveraging its characteristics of "full lifecycle, multi-dimensionality, and strong collaboration," whole-process engineering consulting provides a key pathway to overcoming current cost management dilemmas. It can fill the control gaps in early decision-making and construction processes and break down information barriers among project participants. In the future, with the deepening integration of whole-process engineering consulting and digital technologies, cost management will further achieve "data-driven decision-making," injecting more enduring momentum into the sustainable development of the construction sector.

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