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Research on Whole-Process Cost Control of Residential Construction Projects

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Abstract: Against the backdrop of rapid socio-economic development, the residential construction industry has also ushered in vigorous development opportunities. It has met people's growing demand for living spaces and, to a certain extent, promoted the growth of the national economy. However, in the process of advancing residential construction projects, cost control has always been one of the core challenges in project management. Effective cost control is not only a key factor in ensuring the smooth implementation of the project but also an important guarantee for improving the economic and social benefits of enterprises. Based on this, this paper mainly explores the implementation strategies of whole-process cost control for residential construction projects, aiming to provide theoretical support and practical experience for the development of the construction industry.

Keywords: Residential construction projects; Whole project process; Cost control

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1. Overview of whole-process cost control

In the field of construction engineering, whole-process cost control is a cost management concept that runs through all stages of project decision-making, design, bidding, construction, and completion acceptance. Its core lies in ensuring that construction projects are completed efficiently within the budget through scientific and reasonable cost planning and dynamic management. This concept emphasizes that cost control is not limited to a specific stage but needs to cover the entire project life cycle. From the initial project conception to the final settlement and delivery, each link is closely connected and interacts with each other. For example, in the project decision-making stage, preliminary work such as market research, analysis of policies and regulations, and technical and economic evaluation lays a solid foundation for subsequent work. Thus, whole-process cost control is a systematic project that requires the joint participation and efforts of all parties involved to achieve the best economic and social benefits. In this process, continuous improvement and innovation have always been important driving forces for promoting this work[1].

2. Strategies for whole-process cost control in residential construction projects

2.1. Cost control in the decision-making stage

In the process of project feasibility study, in-depth and meticulous work is crucial to ensuring the scientificity and

rationality of investment decisions. Firstly, the investment estimation links closely with the results of the feasibility study. The residential construction industry can utilize precise cost forecasting models that cover land acquisition fees, survey and design fees, construction engineering fees, installation engineering fees, equipment purchase fees, and other related expenses. A reasonable investment estimation not only provides a basis for subsequent fund-raising planning but also helps set cost control targets, ensuring the entire construction process proceeds in an orderly manner[2].

Secondly, multi-scheme comparison, selection, and optimization run through the entire decision-making stage. Faced with different construction scales, structural forms, and material choices, engineering managers can develop multiple feasible design schemes. Each scheme requires a detailed economic and technical evaluation, including indicators such as cost per unit area, resource consumption intensity, and construction difficulty coefficient. On this basis, a comprehensive scoring system is improved, integrating the strategic intentions, functional needs, and social benefits of the construction unit to select the optimal construction scheme. For example, under the premise of meeting safety and durability requirements, prioritizing the use of green and environmentally friendly building materials can reduce operation and maintenance costs while improving living comfort. Finally, risk assessment and response strategies are also indispensable. The risk factors affecting cost control are complex and diverse. Therefore, construction engineering personnel need to establish a comprehensive risk identification system, using a combination of qualitative and quantitative methods to scientifically predict the probability and loss degree of various risks. Contingency plans should be formulated in advance for potential risks, such as signing fixed unit price contracts to lock in material prices, purchasing insurance products to transfer unexpected losses, and establishing a sound legal consulting mechanism to respond to policy adjustments. In practice, construction personnel should also regularly review and update risk lists, and adjust response measures in a timely manner according to project progress to ensure the entire cost management system is more flexible and efficient[3].

2.2. Cost control in the engineering design stage

The engineering design stage determines the general framework of project costs, so construction engineering managers must focus on the economic evaluation of design schemes. Firstly, designers and cost engineers should cooperate closely to comprehensively consider different design schemes from multiple perspectives, analyzing their functional, technical, and economic factors to select designs that meet both usage needs and cost-effectiveness. For instance, when selecting a structural type, compare the investment and later maintenance costs of different structural systems. This evaluation method helps avoid neglecting costs due to one-sided pursuit of aesthetics or functions, ensuring the selected scheme is economically reasonable and feasible. Secondly, the compilation and review of design budgets are important links in cost control during the engineering design stage. Design units, based on preliminary design drawings and related materials, accurately calculate and summarize the expected costs of the entire project in accordance with specified quota standards and pricing methods[4]. During the budget compilation process, design units should fully consider the impact of factors such as changes in market conditions and policy adjustments to ensure the data is detailed and reliable. The review work is undertaken by independent professional institutions or personnel, who carefully examine the completeness and accuracy of the budget documents by comparing them with relevant norms and standards. Key checks include the presence of missing items or duplicate calculations, and timely modification suggestions are put forward for non-compliant parts, ensuring the final design budget truly reflects the project cost level and provides a scientific basis for the subsequent compilation of construction drawing budgets. Finally, the implementation of quota design is an important means to achieve effective cost control in the engineering design stage. Quota design refers to taking the approved investment estimation as the upper limit and achieving the goal of controlling project costs through optimized design while ensuring project quality. In the specific implementation process, engineering designers need to improve the quota design management system and clarify cost quota indicators for various professions and sub-projects. The design team should establish cost awareness, fully consider cost factors in scheme conception and technical selection, and actively adopt new technologies, new processes, and new materials to reduce project costs. For example, in equipment selection, both performance and price should be considered to choose cost-effective products, thereby improving the overall economic and social benefits of the project.

2.3. Cost control during the project bidding and tendering phase

In the project bidding and tendering phase, the choice of bidding method directly affects subsequent project costs. Public bidding can attract more potential bidders to participate in competition, thereby identifying the optimal price and conditions through rivalry. When selecting a bidding method suitable for the project, factors such as the project's scale, characteristics, and market environment must be comprehensively considered. First, formulating bidding documents is a crucial step in the bidding process, as they provide clear guidance and specifications for bidders and standardize quotation requirements. The bidding documents include detailed descriptions of the project scope, covering all components from foundation construction to decoration, ensuring no omissions and avoiding disputes in later stages. Meanwhile, enterprises in the industry should specify engineering quality standards, setting specific indicators based on current national laws and regulations, industry norms, and the project's own requirements—such as material specifications and construction processes. Second, contract clauses are also indispensable, as they clarify the rights and obligations of both parties, payment methods, and construction schedules. In particular, the risk-sharing mechanism for potential contingencies must be clearly defined to protect the interests of both parties. To ensure fairness and impartiality, strict bid evaluation methods should be established. For example, a comprehensive scoring method can be adopted to evaluate and score bid documents from multiple dimensions, including price, technical plans, and corporate reputation, to select the optimal bidder. Finally, formulating a cost early-warning price helps prevent risks associated with malicious low-price winning bids. Its compilation requires collecting extensive market price information, including construction material prices, labor wages, and mechanical equipment rental costs. Based on this, the cost of each sub-project is accurately calculated using the bill of quantities, and a reasonable profit margin is determined by combining the average social profit rate in the project's location. Additionally, considering potential unforeseen expenses—such as delays due to weather changes or increased construction difficulty from complex geological conditions—a certain proportion of funds is reserved as a contingency. The final result is a scientific and reasonable cost early-warning price, which serves as a reference during bid evaluation. If a bid price is lower than this threshold, bidders must provide detailed cost analysis explanations to prevent substandard project quality due to excessively low costs, thereby effectively controlling project expenses.

2.4. Cost control during the construction phase

The construction phase is a critical link in residential building projects, characterized by the longest duration and the largest resource input, directly impacting costs. During this phase, design changes are common, and each change may cause cost fluctuations. Therefore, construction project managers must establish a strict review mechanism for design changes. When a design change occurs, professionals evaluate its necessity and rationality, calculating changes in engineering quantities and costs before and after the modification. For on-site visas, their authenticity, accuracy, and evidentiary support must be ensured. All visas must be jointly confirmed by the construction unit, supervision unit, and construction owner to eliminate false visas at the source. In addition, material procurement, a key component of the construction phase, directly affects project costs. The construction team should select suppliers with good reputations and reliable quality, determining partners through public bidding or competitive negotiations. During procurement, attention should be paid to market price trends, and information-based tools should be used for price comparison to obtain high-quality materials at the lowest possible price. Finally, strengthening the material acceptance system upon delivery prevents substandard materials from entering the construction site, reducing rework losses caused by material quality issues. For fragile and consumable materials, reasonably estimate the usage, implement a quota material issuance system, and avoid waste.

2.5. Cost control during the completion phase

First, construction project managers should conduct a meticulous review of as-built drawings, engineering change documents, hidden works records, and other materials. During the review process, it is essential to ensure all materials are complete and accurate. In particular, regarding engineering changes, any change that has not undergone formal approval may lead to deviations in the final settlement. As hidden works records serve as evidence of irreversible construction

processes, their authenticity is of crucial importance. Construction project managers need to verify them against on-site actual conditions to ensure consistency with the actual construction. Second, the audit of completion settlement is a highly professional task. It not only involves checking the accuracy of the settlement amount submitted by the construction unit but also serves as a comprehensive inspection of the entire project's cost management work. During the audit, auditors conduct in-depth analyses of aspects such as engineering quantity calculation, quota application, and expense calculation in accordance with relevant national laws and regulations, industry standards, and internal enterprise management systems. Finally, settlement review and communication coordination play an important role in cost control throughout the completion phase. Controversial points are inevitable during the settlement review process, and at this time, all parties need to strengthen communication and coordination to reach a consensus. Stakeholders such as the construction unit, the construction contractor, and the supervision unit should establish a sound information-sharing mechanism, hold regular meetings to exchange opinions, and jointly explore solutions to problems. When encountering complex technical difficulties, experts in the construction industry should be invited to conduct demonstration and evaluation to provide a scientific basis for decision-making. For projects with disputes, all parties should adhere to a factual attitude and handle them through negotiation in accordance with contract agreements and relevant laws and policies, to avoid project delays or unnecessary disputes caused by differences. Effective communication and coordination not only help improve work efficiency but also promote trust and cooperation among all participants, thereby ensuring the smooth progress of the completion settlement work.

3. Conclusion

To sum up, the whole-process cost control of residential construction projects is a systematic project involving numerous stakeholders and complex technical and economic factors. Therefore, the construction industry needs to adhere to the concepts of scientific planning, refined management, and win-win cooperation to provide society with high-quality and efficient residential space products. In the future, with the continuous emergence of new technologies and methods, whole-process cost control will develop towards a more intelligent and refined direction, injecting strong impetus into the high-quality development of China's construction industry.

Disclosure statement

The author declares no conflict of interest.

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