Research on Project Cost Management Throughout the Entire Process of EPC Project Construction

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Abstract: With the deepening of market-oriented reforms in China's engineering construction sector and the advancement of the "New Infrastructure" strategy, the EPC (Engineering, Procurement, and Construction) general contracting model has become a mainstream mode due to its ability to integrate resources and shorten construction periods. However, issues related to whole-process project cost management have become increasingly prominent. This paper takes the entire process of EPC project construction as its research object, aiming to analyze the key points of cost management at various stages, identify deficiencies in current management practices, and subsequently propose targeted implementation paths. Utilizing methods such as literature research and incorporating practical project experience, the study concludes that optimizing cost management requires efforts across multiple dimensions, including preliminary planning, process control, and technology integration. It provides references for enhancing the investment efficiency of EPC projects and promoting high-quality development within the industry.

1. Introduction

Currently, China is in a critical period of transformation and upgrading of its infrastructure construction. The "14th Five-Year Plan for New Infrastructure Construction" explicitly calls to "innovate engineering construction organization models, promote models such as EPC general contracting, and enhance project construction efficiency and quality." The application of the EPC model continues to increase its share in fields such as transportation, energy, and municipal engineering. However, EPC projects encompass multiple links like design, procurement, and construction, where costs at each stage are closely interrelated and influenced by complex factors. Some projects suffer from disjointed cost control and cost overruns, which not only affect project economic benefits but also hinder the full realization of the EPC model's advantages. Against this backdrop, in-depth research on project cost management throughout the entire EPC project construction process, sorting out key management points, analyzing existing deficiencies, and exploring scientific implementation paths holds significant practical importance for standardizing the order of the engineering construction market, safeguarding project investment benefits, and promoting the high-quality development of the construction industry.

2. The Importance of Project Cost Management in the Entire Process of EPC Project Construction

The EPC model involves numerous project construction links with strong interconnections. Cost deviations in any single link can have a chain reaction on the overall project benefits. Therefore, whole-process project cost management plays an indispensable role throughout the project progression. Its importance can be analyzed from multiple dimensions.

2.1 Core Means of Guaranteeing Project Investment Benefits

For EPC projects, which typically involve large investment scales and long construction cycles, investment benefit remains a core concern for all project participants. Whole-process project cost management runs through all stages of the project, including design, procurement, and construction.

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It employs professional methods for accurate cost estimation at each stage, establishes dynamic monitoring mechanisms based on these estimates, and promptly identifies and controls potential cost anomalies [1]. This effectively avoids investment overruns caused by loss of control over costs. This management model not only ensures project completion within the initially set investment budget but also guarantees the realization of expected functions and benefits, ultimately significantly improving the project's return on investment and providing reliable economic returns for participants.

2.2 Key Pathway to Optimizing Project Resource Allocation

The EPC project construction process requires the investment of substantial resources, including human, material, and financial resources. The efficiency of resource allocation directly affects the project's progress and quality. Whole-process project cost management can closely integrate with the cost requirements of each project stage while fully considering the actual construction situation, enabling scientific evaluation and rational allocation of various resources. By conducting comparative cost analyses of different construction schemes, the most cost-effective option can be selected, minimizing resource waste while meeting project requirements. This cost management-oriented approach to resource allocation can significantly improve resource utilization efficiency, allowing all resources to achieve their maximum utility during construction, thereby enhancing the overall project construction level.

2.3 Important Guarantee for Promoting Smooth Project Implementation

EPC projects have long construction cycles and involve multiple parties, making them susceptible to various uncertainties during execution. These factors can trigger cost risks, subsequently affecting the smooth implementation of the project. Whole-process project cost management possesses the capability for early risk identification. It can comprehensively investigate and predict potential cost risks at various stages, such as material price fluctuations and design changes, and develop practical response measures for different risks. During construction, through continuous dynamic tracking of costs, problems arising in cost management can be identified and resolved promptly, effectively avoiding project delays caused by cost disputes. This provides a solid guarantee for the project to proceed smoothly according to the established plan, ensuring timely delivery. Simultaneously, it can build a stable communication bridge among all project participants, reduce conflicts arising from cost issues, and further ensure the orderly progress of the project throughout its lifecycle.

3. Current Deficiencies in Project Cost Management

Although whole-process project cost management is crucial for EPC projects, its current practical application, influenced by various factors, still exhibits significant shortcomings. These problems, to some extent, restrict the full play of project cost management's role and require in-depth analysis.

3.1 Insufficient Accuracy of Cost Estimation in the Preliminary Decision-Making Stage

As the initial phase of EPC project construction, the cost estimation results in the preliminary decision-making stage significantly impact subsequent cost control throughout the project. However, in some EPC projects, key contents such as determining the project scale and selecting technical schemes lack sufficient demonstration at this stage, leading to cost estimation work lacking a reliable basis [2]. Often, estimations rely solely on historical project data or staff experience, without fully considering the characteristics of the local market environment (e.g., local material supply, price levels) or comprehensively analyzing applicable policies and regulations. The absence of these factors results in significant deviations between the estimated costs and the actual costs incurred during construction. This lack of accuracy means the estimates cannot provide scientific guidance for subsequent cost control and sows hidden dangers for cost management in later stages, potentially leading to issues like cost loss of control.

3.2 Disconnections in Cost Management Linkages Between Stages

The design, procurement, and construction stages of EPC projects are closely connected, and their cost management activities should form an organic whole. However, significant disconnection issues exist in some current projects. During the design stage, work often focuses only on the technical feasibility and innovation of the design scheme, without fully considering cost factors such as material supply costs in the procurement stage or construction difficulty and costs in the construction stage. This leads to frequent design changes during subsequent procurement and construction phases, each increasing project costs. Similarly, there is a lack of effective communication mechanisms between procurement and construction stages. Procurement plans developed by the procurement department may not match the construction schedule, resulting in either early material purchases causing inventory waste or delayed material supplies hindering progress—both adversely affecting cost control. Furthermore, cost information from various stages fails to be effectively shared, creating relatively independent information silos at each stage. This makes it difficult to establish a cost control system covering the entire project process, impacting the overall effectiveness of cost management.

3.3 Information Technology Level of Cost Management Needs Improvement

With the rapid development of information technology, informatization has become an important means to enhance management efficiency and quality across various industries. However, in the cost management of some current EPC projects, the level of informatization remains low. Many projects still use traditional manual accounting and management methods, requiring staff to spend significant time on data sorting and calculations, which is not only inefficient but also prone to human error [3]. Although a few projects have introduced cost management software, the functionality of these software is relatively singular, only meeting basic cost calculation needs. They cannot achieve real-time collection of whole-process cost data, perform in-depth analysis of collected data, or facilitate cost information sharing between different departments and stages. This low level of informatization struggles to support dynamic and refined cost management, reducing the efficiency of cost management and affecting the accuracy and reliability of its results, thereby hindering the modernization of cost management practices.

4. Implementation Path for Whole-Process Project Cost Management in EPC Project Construction

Addressing the current deficiencies in EPC project cost management requires formulating scientific and operable implementation paths based on actual project needs and industry development trends. These paths must cover the entire project construction process, focus on key links, and utilize innovative management methods and technical means to effectively enhance the level of project cost management and ensure project construction quality and benefits.

4.1 Strengthen Cost Control in the Preliminary Decision-Making Stage to Improve Estimation Accuracy

The accuracy of cost estimation in the preliminary decision-making stage directly determines the foundational quality of subsequent cost management. A comprehensive control system needs to be built from aspects such as team formation, data collection, and method selection. The project initiator should collaborate with professional institutions like design and cost consulting firms to form a cost management team with cross-disciplinary knowledge reserve. Team members must be familiar with the market rules and policy orientation of the project location [4]. During data collection, the team needs to conduct in-depth research on local market price fluctuation patterns, sort out the impact clauses of the latest local policies and regulations on project costs, and survey the potential impact of site geological conditions on construction costs, forming a comprehensive and dynamic database. Regarding estimation methods, sole reliance on experiential estimation should be abandoned in favor of a composite approach using the Bill of Quantities (BOQ) pricing

method combined with cost analysis. First, a detailed bill of quantities should be prepared based on the project design scheme. Then, cost analysis should be used to break down the cost composition of each link, identify cost optimization spaces, and finally generate highly accurate and traceable cost estimation results.

4.2 Establish a Collaborative Management Mechanism Across Stages to Achieve Seamless Cost Management Linkages

Breaking down the barriers between cost management stages in EPC projects requires building a collaborative management mechanism centered on information sharing and supported by clear responsibilities. Project participants should jointly establish a digital collaborative management platform. This platform should have dedicated modules for design, procurement, construction, etc., with data interfaces reserved in each module to ensure real-time flow of cost information. The design module needs to embed value engineering analysis tools. During scheme development, designers should simultaneously access material price data from the procurement module and process cost data from the construction module to optimize design details from a cost perspective and reduce later changes. After scheme completion, an opinion solicitation process should be initiated via the platform to procurement and construction departments, and the scheme should be adjusted based on feedback to improve implementability [5]. The procurement department must formulate batch material procurement plans based on the construction schedule within the platform. During procurement, information such as material prices and quality standards should be uploaded in real-time for verification by design and construction departments. In case of abnormal price fluctuations, linkage meetings should be initiated via the platform to jointly discuss alternative materials or adjust procurement timing. During construction, the construction department needs to compare actual cost data with budget data in the platform in real-time. Upon discovering deviations, the source should be traced through the platform, and adjustment plans should be formulated jointly with relevant departments to ensure closed-loop cost management across all stages.

4.3 Advance the Informatization Construction of Cost Management to Improve Efficiency and Quality

Leveraging cutting-edge technologies to upgrade the cost management model requires advancing informatization construction from three aspects: system development, technology integration, and personnel training. The project entity should invest resources in developing a customized cost management information system. This system must possess multifunctional modules for data collection, analysis, sharing, and early warning. The data collection module should interface with the business systems of all project participants, automatically capturing data such as design drawings, material procurement, and construction progress. The analysis module needs to utilize big data algorithms for multidimensional analysis of the collected data, generating cost trend reports and cost composition analysis charts. The early warning module should set cost deviation thresholds and automatically issue alerts when actual costs approach these thresholds [6]. At the technology integration level, artificial intelligence (AI) technology should be embedded into the system to develop intelligent quantity takeoff functions, replacing manual tedious calculations and reducing human error. Building Information Modeling (BIM) technology should be introduced to construct a 3D model of the project, associating cost data with model components to achieve visual cost management, facilitating intuitive identification of abnormal cost areas. Regarding personnel training, systematic training plans should be formulated. Cost management personnel should regularly participate in information technology training covering system operation, data analysis methods, and new technology applications. Case-based teaching should be conducted, selecting projects with significant results from informatization management as examples to explain key application points and lessons learned. Assessment mechanisms should be established, incorporating the ability to use informatization tools into employee performance evaluations to incentivize staff to proactively improve their IT literacy, promoting the comprehensive advancement of cost management towards intelligence and refinement.

5. Conclusion

Project cost management throughout the entire process of EPC project construction is a systematic and complex task, whose quality directly relates to the project's investment benefits and smooth implementation. Currently, although China's EPC project cost management has made some progress, deficiencies still exist in areas such as preliminary estimation, inter-stage connectivity, and informatization construction, restricting the full utilization of the EPC model's advantages. By implementing paths such as strengthening preliminary cost control, establishing cross-stage collaborative mechanisms, and advancing informatization construction, the level of whole-process project cost management in EPC projects can be effectively enhanced, project investment benefits safeguarded, and the construction industry propelled towards high-quality development. In the future, with the continuous deepening of reforms in the engineering construction field and ongoing technological innovation, EPC project cost management will require further optimization and improvement to adapt to the industry's new development needs.

References

[1] You Juan. Research on Project Cost Management in Various Stages of the Entire Process of EPC Project Construction[J]. China Tendering, 2025(9):210-213.

[2] Yu Ming. Countermeasures for Project Cost Management in the Entire Process of EPC Project Construction[J]. Urban Construction, 2025(18):43-45.

[3] Li Xin. Exploring Whole Process Cost Management and Control in Construction Projects[J]. Ju Ye, 2025(4):169-171.

[4] Zhang Gongfa. Research on Strategies for Whole Process Cost Consulting Management in Construction Engineering Projects[J]. Engineering Technology Research, 2025, 10(7):143-145.

[5] Liu Yafen. Analysis of Whole Process Cost Consulting Management in Engineering Project Construction[J]. China Construction, 2025(4):44-45.

[6] Cao Yingying. Discussion on Strategies for Whole Process Cost Consulting Management in Construction Engineering Projects[J]. Ju Ye, 2025(3):109-111.