



High-Quality Project Management Process Research Based on Both Excellent Cost and High Quality

Ruilin Ge^(✉)

School of Civil Engineering, Huaqiao University, Quanzhou 362021, China
geruilin@foxmail.com

Abstract. In project management, high quality with low cost is the ultimate goal. Cost management and quality management are particularly important. Research on high-quality construction project management with excellent cost has a positive effect on improving project quality. Cost management needs to be done well at each phase of the whole life cycle of the project, such as design phase, tendering and purchasing phase, and construction and implement phase. In the design stage, the results of the design should be fully integrated with the cost, and the calculation of the design phase should be carried out to further deepen the design under the premise of controllable quality and controllable cost. In the tendering and purchasing phase, we should consider multiple factors when preparing contracts and selecting bid-winning companies, and attach importance to reasonable planning and coordination. During the construction stage, we should improve the supervision mechanism. Crossing departmental and multi-disciplinary integration, training comprehensive professional, and formulating perfect action guidelines and relevant specification are the strategies can apply in each process to ensure an excellent project management.

Keyword: High Quality · Project Management · Full-cycle management

1 The Necessity of Cost and Quality Management Research in Construction Project Management

In the past 30 years, Chinese economy has developed rapidly, and the process of urbanization has evolved from rapid development to gradual stability. With the decline of housing reform dividends, demographic dividends, and land capitalization dividends, Chinese population of just-needed housing buyers has begun to show a net decrease, and the commercial housing market has entered the era of stock, see Fig. 1 [1].

On one hand, the state's policy on the real estate industry is based on housing not speculating and implementing policies based on the city. The real estate industry has entered a period of intensive control [1]. The competition of real estate companies has become increasingly fierce, the industry situation has become more and more severe, and the development of enterprises is also facing more difficult challenges. On the other

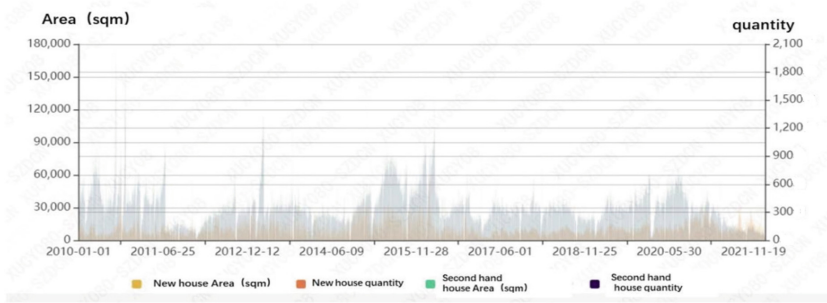


Fig. 1. New house and second hand house deal number from 2010–2021 (source: <http://zjj.sz.gov.cn/xxgk/ztl/pubdata/sjcx/fdcqs/>)

hand, as the cost of materials and labor is getting higher and higher, the profitability of the real estate industry is decreasing, and companies demand dividends from the market through management methods, customer-oriented, positioning the right products, and making good products have become an inevitable choice and strategic basis.

In a promising household market, focus on improve standard of qualified household to take the lead in the high-end market, build reputation through quality, and provide good products and services. While in the descend market era, profile making switch into the cost management, create profits through reasonable project management means and ensure quality at the same time.

The real estate strategy is to start from the process of this project cycle management, optimize and improve the quality and cost and its sensitive stages, and it has become an obvious means to make the best quality products at the lowest price. This research is carried out on this background to study how to achieve high-quality construction management under the condition of excellent cost.

2 Problems in Quality and Cost in a Full Cycle Project Management Process

There are generally five major stages in the life cycle of a construction project: land acquisition, design and planning, bidding and procurement, construction, and completion. Each stage is closely related to cost management and quality management.

The design stage is important in the relationship between technology and economy, and an important stage in determining and controlling the quality of the project. Reasonable design will definitely make a great significance to the quality of the project.

The construction phase is the final implementation phase of project construction and the final step to form engineering products. It is difficult to change the impact of all aspects of work in the construction phase on the quality of the project. Therefore, the project management in the design and planning phase and the construction phase is difficult to change. The links that are strongly related to quality management in the entire construction project management process, see Fig. 2 [2].

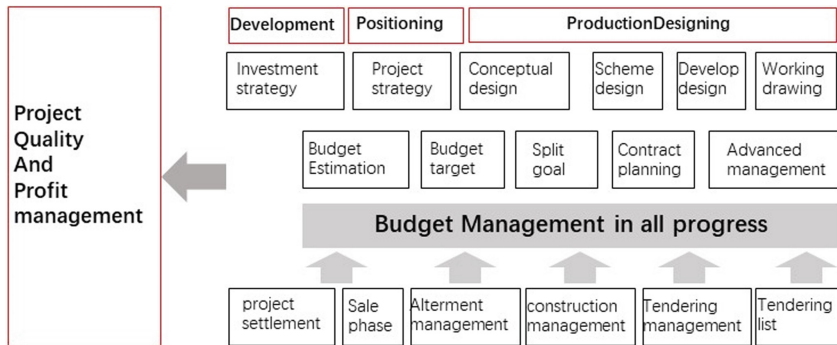


Fig. 2. Project quality and profit management through the whole real estate development process

The bidding and procurement stage includes determining the cost, purchasing engineering materials and equipment, forming and determining the cost management framework for construction and settlement, which is an extremely important stage for the cost management of the entire construction project.

However, in the actual personnel organization and structure management of the project development chain, the assessment or powers and responsibilities of the person in charge at each stage are limited to their own majors. They often think in a single line and only consider the aspects they are responsible for. They lack dialectical thinking, and rarely can fully understand A comprehensive review of the project management from the perspective of the entire project cycle, and only considering the completion of the relevant indicators of the department or profession, which will lead to the blind pursuit of high quality in the design, planning and construction phases while ignoring the cost of overhead or only reducing costs in the bidding and procurement phases ignore quality issues.

Life cycle cost refers to all costs incurred by producers. Consumers and the public during the life cycle of the construction project from the perspective of the whole society. The whole life cycle of an engineering project refers to the whole period from the submission of a feasibility plan to the full delivery of the completed project. Therefore, the whole life cycle of the project can be divided into five stages. The cost management in the construction phase is only a part of the whole life cycle management. However, in the traditional project cost management, the managers attach great importance to the cost management in the construction phase, and often simply take the cost management in the construction phase as the most important management content, while ignoring the costs in other phases and the interrelationship between the costs in each phase. But in fact, cost management needs to be done well at each stage of the whole life cycle of the project. The project life cycle is shown in Fig. 3.

2.1 Problems Facing in Design Phase

Designers often hold design feelings and are too obsessed with design works. When designing schemes, they often “emphasize design and neglect cost”, lack cost awareness, lack understanding of budget control, do not design strictly according to quotas, and often

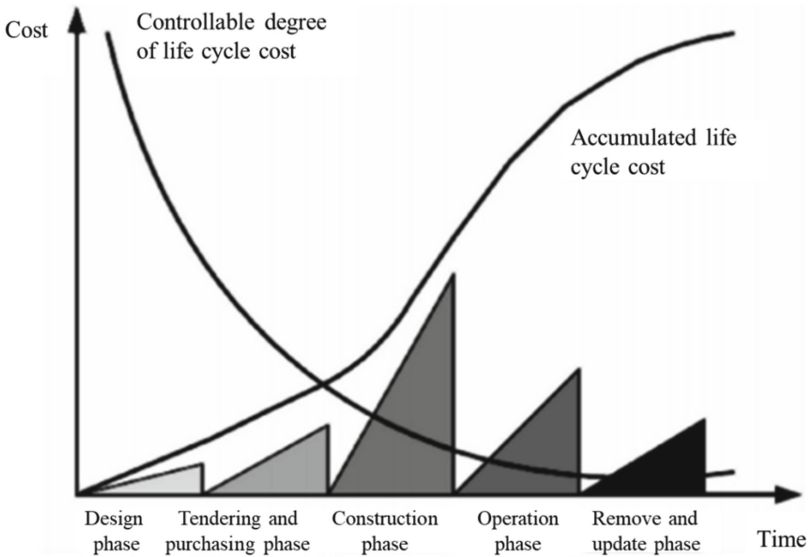


Fig. 3. Cost chart of project life cycle

ignore design effects while pursuing design effects. The actual cost requirements have led to overspending.

For example, a designer blindly pursues new technologies and new materials to improve the quality of the project and directly incorporates them into the project. It is easy to accidentally overspend. There are also designers under the pressure of assessment. In order to complete the quota indicators, they try to be close to the lower limit of the design specification. They lack the awareness of actual construction implementation. Many structural designs are prone to problems in the implementation of the project. This leads to repeated decisions of the company and additional unnecessary costs.

Designers are prone to fall into the derivation of the design itself, lack the awareness of inter-departmental communication and cooperation, and fail to set up observation points for intersecting costs at all stages of the design, and it is difficult to carry out reasonable cost optimization.

For example, in the design phase, the results of the design should be fully integrated with the cost, and the calculation of the design phase should be carried out to further deepen the design under the premise of controllable quality and controllable cost. However, in the actual operation process, the design is often advanced in a single thread. Costs were not given timely corrections and corrections in the planning stage. In the drawing stage, the construction pace was often tight, and blueprints were urgently issued on site and cost optimization steps were omitted, which resulted in the cost exceeding the estimated cost.

In addition to the design itself, due to uncontrollable risks brought about by market or policy changes, marketing cannot accurately predict the market. The product positioning and market positioning of the project are repeated back and forth and the design can only

be adjusted to match the constantly changing plan which makes a considerable amount of sunk costs.

Design is the key stage of the entire product power shaping. This stage often pursues high quality alone, ignoring the most important cost preconditions, causing cost overruns or generating huge back and forth hidden costs.

2.2 Tendering and Purchasing Phase

The bidding and procurement phases are connected to the project design phase, which plays a role as a link between the whole project. The company's recruitment management is usually based on "reducing costs and increasing benefits". The principle of winning bids at low prices often results in a great impact on the quality of the project.

The procurement departments of real estate companies need to formulate and implement bidding and procurement plans in accordance with the specifications, but in the preparation of strategic contracts, they may ignore the irrationality in the actual occurrence process in order to comply with the contract specifications. In order to reduce the changes in the future construction process and control the project cost, the company has no price adjustment clauses for market price fluctuations in the prepared bidding contract terms, and cannot reasonably share the risk of market price fluctuations. If market fluctuations cause the partner to be in a long-term loss situation. In order to maintain the normal schedule, it is difficult for the partners to guarantee the quality of the materials they provide, which will seriously affect the final quality of the project.

In the bid evaluation process, due to lack of understanding of the market, insufficient knowledge of materials, etc., the recruiting and procurement personnel will only rely on the so-called "lowest bid price method" without converting factors other than prices into prices for evaluation. The winning bidder is not the best choice. Procurement personnel do not have appropriate negotiation methods and do not know enough about construction design standards, and lack subjective evaluation, it is difficult to guarantee the purchase of high-quality and more suitable materials at a low price.

The bidding and procurement phase is guided by cost priority, and the procurement plan has not fluctuated reasonably with the market, and it is difficult to implement the quality control of the materials. High-quality links are often caused by poor manufacturing of the entire product due to the failure of the procurement plan.

2.3 Construction and Implement Phase

During the construction phase, it is necessary to ensure a reasonable construction schedule, ensure the quality of high-quality goods, and rely heavily on reasonable management methods and perfect supervision methods to ensure quality and cost. However, in actual situations, there are often certain deficiencies at the project management level and the supervision level.

Construction management personnel do not have a clear understanding of the project's objectives during the construction process, and cannot reasonably arrange various tasks including the formulation of construction plans, arrangements for construction deployment, and confession to construction workers without precise planning. Design drawings and own experience, start construction without detailed planning.

Because the construction site did not carry out reasonable planning and coordination, and various resources were not properly deployed, it was difficult to ensure that the construction activities of the construction project were completed within the expected period. This led to the irrationality of factors such as the cross-working interface construction sequence, and the construction site was demolished back and forth. It is difficult to ensure that the construction activities are completed within the expected time.

For example, slotting and installing pipelines after plastering will cause the front to crack; directly filling the top bricks after masonry will cause cracks on the top of the wall beams; in the decoration, painting first and then wet work will pollute the wall and so on. In order to deliver on time and avoid schedule delays, the quality of the project cannot be guaranteed by rushing to the construction period to ensure the progress.

In the actual construction process, in addition to the experienced management team responsible for every detailed work to ensure the smooth progress of the construction, a corresponding and sound third-party control and supervision mechanism is also required. However, in actual project operation, there are often no relevant professional supervisors to control the actual situation of the site, and only the supervisors control the second deepening construction with strong expertise such as interior decoration, garden construction and curtain walls.

Since the supervisor does not have a systematic understanding of every specific process, but only manages the site based on theory and experience. If the construction personnel do not follow the designed process or materials during the construction operation, However, if the supervisors fail to detect the defects in time and stop the corrections, the actual results will deviate greatly from the design results, and rework will cause waste of materials and costs.

3 Strategies Can Apply in Each Process to Ensure an Excellent Project Management

Although the engineering management of the project is divided into the front, middle and later stages based on the development rhythm of the project, the full-cycle management and control of the project requires systematic thinking. The "departmental walls" and information barriers between various departments and positions are broken, so that full communication beforehand can be achieved. Achieve seamless connection of management actions, achieve high-quality construction project management at an excellent cost, and complete established management goals.

3.1 Cross Departmental and Multi-Disciplinary Integration

For the transfer of work content and information exchange between related parallel or upstream and downstream departments at different stages in the whole process of project development, organize cross-departmental professional exchanges to improve the systematic and multi-angle thinking ability of staff at each stage. Enhance the awareness of inter-departmental interaction. The "Guidelines for the Professional Intersection and Overlaying of Construction Drawings Review" were implemented through the intersection meeting, requiring that civil engineering, equipment, and decoration must be

synchronized design, simultaneous drawing review, and overlapping drawings to ensure the coordination of all disciplines in the later construction. Reduce unnecessary missing items and changes back and forth, and reduce invalid costs.

3.2 Training Comprehensive Professionals

The company's personnel training mechanism can add cross-post experience within the company, allowing staff to combine their own professional knowledge in other posts to experience the connection between different posts, and feel the importance of cross-departmental interaction, which is closely linked to the entire development process. The linkage has professional cognition and cultivates comprehensive talents. For example, after the cost personnel personally experience the construction site, they understand the project overview and site conditions, and will comprehensively consider various influencing factors when preparing to avoid breaking the cost limit during construction.

3.3 Formulate Perfect Action Guidelines and Relevant Specifications

Standardize the procurement process. In the procurement stage, conduct a comprehensive review of the qualifications of the building materials suppliers, and shop around; when the suppliers are determined, the imported building materials will be sampled according to the requirements. If it is found that the quality requirements do not meet the corresponding standards, then it should resolutely refuse to purchase, resolutely exit the unqualified materials, and punish the responsible unit according to the contract; after the building materials are delivered to the construction site of the construction project, they must also follow the relevant regulations and standards. Make corresponding storage work to prevent quality problems of building materials due to improper storage (the material storage yard on site should be considered in the general layout of each stage) [2].

Standardized action guidelines require the implementation of a model-first system in the construction process, and adopt model-guided technical management measures for key processes, key nodes, delivery standard rooms, and material models to ensure quality control from the nodes of the construction plan. The construction plan is required to go first, and the lean project planning needs to be reviewed by the company, and then it can be executed after passing it to ensure the rationality of the plan and the high-quality operation of the landing construction.

3.4 Establish Management and Supervision at All Stages

High-quality projects are inseparable from high-quality management teams and scoring teams. The establishment of a quality supervision committee, the supervisors of the committee shall fully control the actual situation of the site, and achieve the supervision and overall control of the whole process of the project. In the design and construction stage, the change rate and the additional cost of the change are assessed. During the implementation of quota supervision, the supervisors adopt corresponding assessment standards for specific problems; during the construction period, they supervise the quality

and completion of the project, and monitor the construction site. Carry out detailed inspections, identify construction problems from an objective perspective, inform the construction management personnel of the detected problems, so that they can deal with them and make corrections in a timely manner, and provide reliable guarantees for the project to be completed on schedule through daily inspections [3].

After the completion of the project, the project results will be scored and evaluated or the owners can be scored through questionnaires. On the one hand, the committee members can evaluate the project with their professional knowledge and ability, and on the other hand, they can score the project results from the perspective of users to obtain More comprehensive and complete assessment results. Only by improving management and supervision, and forcing the attention of front-end development from the source, can we truly guarantee low cost and high quality [4].

4 Applications of AHP in High-Quality Project Management Process

We use expert interviews and expert questionnaires to determine the relative neutrality of each indicator using a discrete scale of 1 to 9, taking the average of the judgment values, and constructing a judgment matrix B. Matrix B represents the relative importance of C_i and C_j relative to project management (A). For the N monitoring indicators of each layer, a paired judgment matrix of $n * n$ needs to be established, as shown in Table 1. Usually $b_{ij} = k$ ($k = 1, 2, \dots, 9$), then $b_{ji} = 1/k$. Secondly, each element b_{ij} represents a relative pairwise comparison between the abscissa index C_i and the ordinate index C_j , and the results of their importance are represented by 1 to 9 or their reciprocal. Based on the above model construction principles, and on the comprehensive analysis of expert discussions and questionnaires, first compare each factor in pairs to establish a judgment matrix for project management evaluation indicators, as shown in the following table.

After obtaining the weight of each index relative to the criterion layer, consistency testing simulation is conducted using MATLAB software, and it can be considered that the weight values obtained through these four sets of comparison matrices have credibility. Based on the process optimization object evaluation system obtained from the previous study, this article evaluates the effectiveness of process optimization from four dimensions and 12 indicators [5]. The evaluation is divided into three layers, with the middle layer being the four dimensions of optimization effectiveness evaluation. Using AHP, we can obtain the weight of each indicator, as shown in Table 2.

Table 1. Judgement matrix of B-A

Indicator	B1	B2	B3	B4
B1	1	3	5	6
B2	1/3	1	3	2
B3	1/5	1/3	1	3
B4	1/6	1/2	1/3	1

Table 2. Weights of various indicators of project management

Progress management	0.192	Rationality of the schedule	0.241
		Number of schedule changes	0.427
		Completion of precision plan	0.332
Security management	0.315	Number of security incidents sent	0.351
		Quantity of hidden danger rectification	0.301
		Risk monitoring degree	0.348
Quality management	0.221	Quality control degree	0.257
		Quality acceptance efficiency	0.227
		Process acceptance qualification	0.516
Cost management	0.272	Engineering calculation accuracy	0.239
		Number of engineering changes	0.558
		Cost error	0.203

At the same time, through the cloud platform, we can form a cloud centric communication mechanism for the construction party, the construction party, and the supervision party. The company and project management can view the summary of quality and safety issues at various stages of the project and the funding curve through the cloud, timely identify on-site issues, optimize management, improve production and management efficiency, and save costs.

5 Conclusion

With the increasingly fierce competition in the real estate industry and stricter regulation by the state, the real estate market is shrinking day by day. Real estate companies should make reasonable use of cost management and quality management to realize their own interests while creating real value for customers. Specifically: in the design stage, we must strengthen inter-departmental cooperation and cultivate awareness of interaction. In the recruitment stage, multiple factors need to be considered when preparing contracts and selecting bid-winning companies. In the construction stage, we must pay attention to reasonable planning and coordination and a sound supervision mechanism. Only with full-cycle management process to the end can we achieve high-quality construction projects with excellent costs, and the products we make can be popular.

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