

# *Research on Design Quality Management Based on PDCA Quality Cycle Theory*

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**Abstract:** Housing quality is the key to social stability and sustainable development of real estate. However, in the process of rapid development of the industry, in order to seize market share and accelerate the speed of capital turnover, real estate development companies ignore the control of project quality and have a weak awareness of design quality management. This paper takes the design quality management of A company as the research object, finds out the influencing factors of the design quality management of A company through the analytic hierarchy process, and uses the PDCA quality cycle theory to propose improvement strategies for the design quality management of A company, and also provides practical reference for the design quality management of other real estate enterprises' development projects.

## 1. Introduction

The real estate industry is an important part of China's economy as a strong driving force, but due to the rough and tumble management model in the past, it has caused a large number of engineering quality problems and social issues. As the core of real estate development project management, design quality management plays a decisive role in project quality. In the overall downward environment of the industry, how to improve the design quality management level of real estate development company projects, so as to improve the quality of engineering construction and promote the long-term, stable, sustainable and healthy development of real estate enterprises, has become an important issue in China's real estate industry. This paper takes the design quality management of Company A as the research object, and uses the PDCA cycle quality theory to propose improvement measures and safeguards for the design quality management of Company A.

## 2. Current status of design quality management in Company A

Company A's design management has formed a relatively mature design quality management system after years of development and precipitation, relying on the perfect design management system of the Group's product development centre. company A has formed a series of quality management tools such as scheme review, construction drawing joint review, construction practice confirmation form, site restoration management, design change management, third-party drawing

review, etc. according to the project management needs and quality management objectives, and has formulated corresponding quality control measures in different stages of project development. The corresponding quality control measures have been formulated at different stages of project development to achieve the goal of effective design quality management through the control of each stage, as follows.

## 2.1 Programme phase

According to the development and operation nodes of the project, the scheme design is divided into three stages: concept scheme review, preliminary scheme review and deepening scheme review, controlling the design quality through control means such as the Scheme Score Sheet at different stages, implementing the conditions for marketing input and capital raising, controlling the key design contents such as project planning form, building house type, landscape, home-coming dynamic line, public area finishing, saleable ratio and basement selection, and completing the We also complete the flow of programme sign-offs and approvals at all stages to avoid major product risks and quality issues at the initial design stage through multiple levels of control.

## 2.2 Construction drawing stage

Construction drawings are the basis for the construction of project works, the preparation of construction drawing budget and construction organisation design, and also an important technical document for technical management, the quality of which directly affects the quality of engineering construction. In the quality management of the construction drawing design stage, Company A has developed a set of relatively perfect construction drawing quality management system. In addition to the mandatory external drawing review required by the government, Company A internally implements the joint review mechanism of professional drawing review by the design department, third party drawing review and the project general as the main responsibility.

## 2.3 Construction phase

The construction phase is an important stage in the construction of the project and is also a test phase for the quality of the design, and Company A has developed corresponding measures for design quality management during this phase.

(1) Confirmation of building construction practices. After the construction drawings are completed, the Design Department will be responsible for organising the Cost and Contract Department, the Operations Management Department, the Supervision Company and the General Contractor to review the building construction practices to avoid problems such as unreasonable design practices and defects in construction practices that may arise during the design process.

(2) Site restoration management. Construction sampling and on-site process control is an important aspect of design restoration management. The main materials, auxiliary materials and key components of the building façade need to be sealed for sample selection, and the design quality is verified through the construction of a physical sample section. On-site process control management can identify many problems due to professional non-crossover circles and unreasonable design structures, and then make timely revisions to design quality problems.

(3) Design change management. The rate of design changes is an important indicator of design quality. Company A strengthens quality awareness by formulating design change management methods, strengthens design supplier management, and subcontracts and penalizes design units responsible for invalid costs caused by errors, omissions, touches and shortages in drawings by the design department, and assesses design units according to the company's supplier management

methods.

### 3. Analysis of factors influencing design quality management in Company A

#### 3.1 Identification of design quality management factors

At present, Company A has a sound design management process, standardised management actions and design quality management measures in design quality management, but there are still problems with project design quality management. From the Group's 2021 product satisfaction survey (see Fig. 1), it can be seen that the satisfaction survey results score 100 out of 100, and the benchmark real estate enterprises have scored 85 or above in all indicators, while Company A has a large gap with the benchmark real estate enterprises in the four aspects of housing design, landscaping, planning design and planning environment, so it is imperative to analyse the factors affecting design quality management and identify the root causes of the problems.

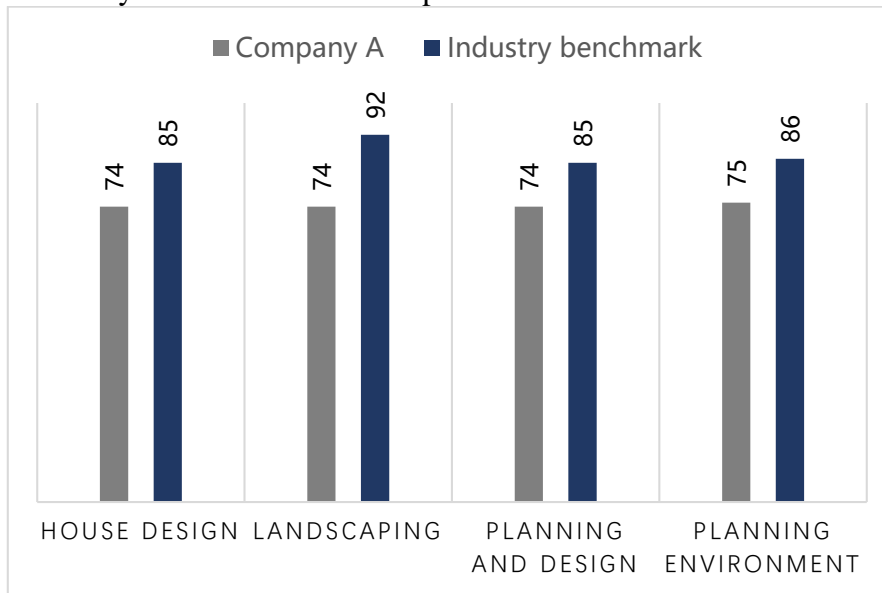


Figure 1: Product Satisfaction

Table 1: Final Checklist of Influential Factors

Serial number	Influencing factors	Serial number	Influencing factors
1	Selection of External Designers <sup>[2]</sup>	7	Quality management system for design units <sup>[1]</sup>
2	Communication with local authorities <sup>[3]</sup>	8	Designing a full-cycle reward and punishment system <sup>[7]</sup>
3	Project design and positioning <sup>[6]</sup>	9	Implementation of the design review system
4	Selection of the design team <sup>[4]</sup>	10	Owner's design quality requirements <sup>[5]</sup>
5	Design process communication <sup>[1]</sup>	11	Retrofit design quality requirements
6	Design project leadership professionalism	12	Cost quality requirements

In order to improve the design quality management of Company A's projects, this paper

summarises the initial list of design quality management influencing factors from the perspective of design quality management of real estate companies by reading a large amount of literature, and completes the revision of the initial list of design quality influencing factors by combining the specific situation of design quality management of Company A with a questionnaire survey of design managers to form a process list. Finally, the final list of design quality management influencing factors of Company A was obtained by applying the expert scoring method and combining the interview opinions of the design technical experts of Company A, as detailed in Table 1.

### **3.2 Weighting analysis of design quality management factors**

Hierarchical analysis <sup>[8]</sup> is a decision-making method that decomposes the elements always relevant to decision-making into levels such as objectives, criteria and solutions, on the basis of which qualitative and quantitative analyses are carried out. Through the analysis of the elements of indicators at different levels, the interplay between multiple interrelated factors is analysed, providing a reliable qualitative analysis for decision-making.

This paper uses hierarchical analysis to analyse the four dimensions that affect design quality. From the results of the analysis, we can conclude that the four factors are, in order of importance: personnel competence level, material quality requirements, external factors, and management system. A united and collaborative design team can guarantee high efficiency and high quality design drawings to ensure the smooth operation of all phases of the project, so the level of personnel competence is the most important to ensure the quality of design; followed by material quality requirements, an excellent design must be built on the ground to be considered successful. If you choose materials that do not meet the construction standards of the project, it may affect the completion and acceptance of the project and its delivery. In the process of project construction, changing design units will affect the progress of project design and construction, and will also bring inconvenience to the subsequent quality management of the project; finally, the management system, the management system is mainly to have clear design standards and a perfect reward and punishment system, unified design standards can guarantee the standardization of design drawings, reduce the understanding of errors, and a perfect reward and punishment system will give back to the efforts of designers, improve the enthusiasm of work and innovation, to ensure the quality of the design.

## **4. PDCA cycle quality management system construction**

The core meaning of the PDCA cycle is the scientific procedure of dividing the whole process of quality management into four stages, namely Plan, Do, Check and Act, in the order of their initials, and carrying out quality management in a continuous cycle.<sup>[9]</sup>Based on the PDCA quality cycle theory, this paper combines the problems of design quality management in Company A and the analysis of design quality management influencing factors to improve the project design quality management system in all aspects.

### **4.1 Develop a Project Design Quality Management Plan (Plan) for Company A**

In the development of the plan, the problems that existed in the previous period should be fully considered, and the problems in the design quality of Company A's projects in terms of personnel management level, design team selection, quality management system and evaluation criteria should be revised and rectified. Firstly, by adding a third party assessment, the quality management awareness of team leaders and the comprehensive quality of team members will be investigated in all aspects; secondly, the design review system will be improved to address the lack of a front-end review system for design quality. A perfect design review system is a key element to ensure the smooth

implementation of the project, so that the system can function in actual application and control every step in the actual process, so that problems can be found in the subtleties and corrected in time, in order to further improve the project design quality; finally, the design quality management and control system was amended to solve the problem of information asymmetry in the company's design quality management, reduce time cost, improve and refine the design quality management plan of Company A, and enhance the management efficiency of the project design quality of Company A.

#### **4.2 Implementation of Company A's project design quality management programme (Do)**

During the implementation of the project in Company A, it was found that there was a lack of communication and exchange between the various departments on the implementation of the design quality management programme, which led to many deviations and problems in the actual implementation of the plan, while the communication between the various departments was mainly informal, with information deviations and unclear responsibilities in the process of communication, making the implementation deviate significantly from the plan. Secondly, during the implementation of the plan, there is no clear system and quality management document for each department, and the authority of the approvers of relevant important documents is confusingly assigned, without forming strict management authority standards, thus the plan formulated in the early stage of the actual implementation process becomes a mere nullity. In order to strengthen the implementation of the project design quality management plan of Company A and to enhance the awareness of each department on the implementation of the design quality management plan, the design quality management plan should be revised during the implementation process, the communication between various departments during the implementation stage should be strengthened, the system standard of quality management of each department should be improved, and the implementation efficiency of the project design quality management plan should be enhanced.

#### **4.3 Check Project design quality management in company A (Check)**

Check the project design quality management situation is for the project design quality management plan calibration and correction, project design quality management check to do horizontal, vertical multi-dimensional check, not only between the departments to do self-inspection and correction, cross-departmental also to do mutual check, so that in the inspection found project design quality management process problems, timely correction and calibration. For example, the exterior wall insulation material selection of new products, on-site construction technology cannot meet the safety and quality needs, the design department did not go deep into the construction site to understand the construction process, the engineering department for the project progress also ignored the design quality issues and construction safety issues, resulting in the construction of the exterior wall insulation, resulting in a large area off the situation. In order to strengthen the management of the design quality of the inspection project, this paper requires all departments and projects to continuously do quality management testing by refining the inspection system, implementing the standards of the quality management system during implementation, regularly checking the quality of the completed matters, doing interdepartmental and third party inspections and other related work, and checking the whole process of the project from planning to implementation in all aspects.

#### **4.4 Amend the Project Design Quality Management Programme (Act) for Company A**

In Company A's previous project design quality management process, the results of design quality management were not analysed in depth, successful experiences were not summarised properly, and failures were often seen as a reflection of the staff's ability to work, and were ignored as the project

ended.

In order to better identify the problems of project design quality management in Company A and improve the level of project design quality management in Company A, a full-cycle monitoring system for project design quality management in Company A was developed to disclose the whole cycle process of project design quality management for completed projects, from project initiation, design, implementation, inspection to revision, and then summarise the experience, and the successful experience will be The successful experiences will be standardised for promotion, and the failed experiences will be reflected upon and the wrong practices will be revised.

## **5. Design quality management improvement measures for A Real Estate Company**

In recent years, the loss of front-line design staff in Company A has been more serious. It was found that the staff left mainly for the following three reasons: dissatisfaction with salary, lack of confidence in the future development of the company and the attraction of welfare benefits in developed regions.

For Company A, talent development and talent protection are the core drivers of the company's growth and require efforts in the following areas.

### **5.1 Improving the company's incentive system**

The income of employees in Company A is made up of two parts: basic salary and bonus performance. The bonus performance is related to the current development and profitability of the company, but mostly unrelated to the workload, and there are deviations in the ratio of performance bonus allocation between grassroots employees and management, which leads to the majority of employees' annual income coming from basic salary. Considering that in order to mobilise staff motivation, attach importance to the development of talents and protect them, a two-line assessment mechanism should be established, linking bonus performance with staff workload and work results, and implementing a bonus performance allocation system with different ratios for ordinary staff and management, in order to better mobilise the motivation and initiative of grass-roots staff and thus strengthen the cohesion and creativity of the team.

### **5.2 Utilise the work initiative of staff**

More than 90% of the employees of Company A have a bachelor's degree and belong to intellectual talents, who have to give full play to their initiative and motivation in carrying out their work. Intellectual talents are not controlled by others in the subjective consciousness of the will, in the objective fact that they like to be free, have strong independence and autonomy, so in the actual work process, they do not want to be confined to work by the book, like to play to their own advantage so as to make up for the defects, in this case to give full consideration to the intellectual staff's initiative, brainstorming, the formation of a good comparison in the company to learn and catch up, so that each In this case, we should give full consideration to the initiative of knowledgeable employees, pool their ideas, form a good competition in the company, let each person have the autonomy, the opportunity to speak and show themselves, and strengthen the weight of the results of their work and the value of their work in various assessments.

### **5.3 Improve the training mechanism for workers**

At present Company A does not have a standardised and systematic approach to staff development and training. It should be maintained from the beginning of the staff's entry into the long-term,



continuous observation and tracking. First of all, at the beginning of the staff's employment, do a good job of staff training, publicity and education system, so that the staff from the heart to achieve cultural identity, ideological identity, followed by the staff in the process of work, do a good job of monthly, quarterly, semi-annual and annual work report, on the one hand, based on the staff to show their own opportunities, the other in the staff growth process to explore other aspects of the staff potential, so as to enhance the overall quality of the staff. This will enhance the overall quality of the staff. Secondly, we will do a good job in caring for our staff, forming a manual to help them in their work and life, helping them to solve difficulties in their work and life, and forming an atmosphere where they can learn from each other and catch up with each other.

#### 5.4 Cultivating the craftsmanship of workers

The core of craftsmanship is to see work as a practice, not just as a tool to make money. Craftsmanship is a reverence for the profession that applies to every job.[10] In order to strengthen the cultivation of craftsmanship among employees, the company's leaders are the first to set an example. First and foremost, company leaders, as role models, should strive to practise craftsmanship. Business leaders are the prime movers in determining and building a quality culture. Therefore, the attitude, commitment and involvement of senior leaders are crucial in shaping a high-level corporate quality culture of craftsmanship. It is important to focus on the personification of the artisan spirit and on the promotion of typical events and figures. For design management practitioners, attention should be paid to design details, assessing the potential adverse effects that each design detail may have on manufacturing, construction and use. At the same time, listen to customers with great patience, identify the real causes of problems with dedication and persistence, and then continuously drive continuous improvement of products and services, always aiming for customer satisfaction.

### 6. Conclusions

Based on the research status of quality management and design management at home and abroad, this paper briefly explains the current situation of project design quality management in Company A, combined with quality management theoretical methods. Secondly, through questionnaire surveys and expert interviews, 12 factors influencing the design quality management of Company A are identified, the hierarchical analysis method is applied to construct a project design quality management model for Company A. The weights of each influencing factor are calculated and analysed, relevant experiences are summarised, and improvement mechanisms and measures are proposed for the project design quality management of Company A based on the PDCA quality cycle theory to ensure the development of project design quality management for Company A. The results are analysed and the weights of each influencing factor are calculated.

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