Discussion on Fine Management Level of Real Estate Development Project Based on FAHP

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Abstract. With the rapid development of social economy, the real estate industry has become an important part of China's national economy. In recent years, due to the increasingly exposed drawbacks of extensive management within real estate enterprises, it is particularly urgent for enterprises to implement refined management. Through the analysis of the entire process of real estate project development, this paper recognizes the key factors affecting the refined management level of real estate projects and establishes a refined management evaluation model based on Fuzzy Analytic Hierarchy Process (FAHP). The practical engineering case is taken as an example to verify the feasibility and reliability of the model. Moreover, this model provides a certain reference for the establishment and optimization of the subsequent refined management model as well.

Keywords: Fined management, The real estate, Fuzzy analytic hierarchy process

1. Introduction

Recently, the steady development of the real estate industry plays an important role in social and economic development. However, in the development of the real estate industry, problems such as inconsistent industry standards, inadequate corporate systems, and inadequate management methods also emerged [1]. The management concepts under these extensive management modes have caused waste of resources, delays in construction periods, reduction in project quality, and increase in construction costs. Nowadays, one of the most difficult problems facing enterprises is to improve resource utilization while ensuring the cost, quality and duration of the project, which can be overcome by the theory of refined management. The development of refined management has become an inevitable choice for the sustainable development of enterprises [2].

The concept and idea of refined management were first proposed by Taylor. The core of Taylor's theory is to quantify and clarify the work quota, standardization, and establishment of a special planning layer, etc., and to divide the detailed steps of complex work in Complex work becomes several sub-tasks that are easy to perform, thus greatly improving the economic efficiency of the plant. After the Second World War, with the slow recovery of the economies of various countries, due to changes in market demand, refined management theory has made another leap forward. Some famous companies such as Toyota and Motorola. They optimized the working steps and links in the...
production process of the enterprise and obtained great economic benefits at the time. Since then, refined management theory has achieved many remarkable achievements [3].

This article analyzes the development process of real estate companies' projects and identifies the existing problems in project development. Based on the theory of refined real estate management, important factors affecting the effectiveness of refined real estate management are identified. Finally, the hierarchical fuzzy evaluation method (FAHP) is proposed to evaluate the refined management level of real estate projects. The evaluation is beneficial to the improvement of enterprise management level.

2. Fine management of real estate projects
In recent years, the pace of development of real estate companies has become more and more fast, the problems existing in real estate companies are as follows.

1. Poor management system
   The management system of an enterprise is the cornerstone that supports the long-term development of an enterprise [4]. Many current real estate companies have problems such as multiple leaders, cumbersome approval processes, and mismatched material procurement in the course of conducting business, which are all caused by the chaos of the company's management system.

2. Lack of function performance
   In the development of real estate projects, business processes are usually complex, numerous, and out of control. The different standards of responsible managers and blind spots in the work docking are the main reason in a way [5].

3. Insufficient standardization innovation
   At present, most real estate companies ignore innovative research and development. Although many companies are committed to the improvement of standardization, the standardization results are fragmented, and in the process of establishing standardization, many companies copy the construction models of other successful projects, thereby resulting in failed results.

4. Lack of the evaluation system of refined management
   Most domestic real estate companies focus on how to establish a refined management system that suits the situation of the enterprise and lacks the evaluation and summary of the effectiveness of refined management [6]. The lack of a summary of the management effect is very detrimental to the long-term development of the enterprise.

3. Evaluation model of refined management for real estate projects

3.1. Establishment of refined management index system
   The pre-investment management of real estate development projects mainly involves three parts: project information collection and project approval, feasibility analysis and investment decision-making, and land acquisition. The enterprise will first collect land information through government announcements, partners, relevant intermediary agencies, etc. When the suitable land is determined, conduct feasibility analysis for pre-developed projects.

   The design management stage mainly includes design draft of the feasibility stage, conceptual design, scheme design, initial design, construction drawing design and construction process design. According to the requirements of the feasibility study stage, design work such as building outline and land arrangement are carried out. Next, choosing reliable design companies through bidding to complete the design of the overall and details of the project.

   The cost management stage of real estate development projects mainly includes target cost management, dynamic cost management, and settlement management. Cost management is the key link to determine whether the enterprise is ultimately profitable. In the target management stage, the total cost of the design board is generally used as a measure to control the cost of the project [7].

   Engineering management mainly includes the pre-construction preparation stage, the construction process management stage, the completion acceptance and delivery stage [8]. In the early stage of
construction, improve the construction organization design of the construction project, key construction technology delivery, quality assurance plan, cost control measures, safe construction measures, risk control measures, etc. During the construction process, it is necessary to increase the management of the progress, quality, and cost of the construction process, and to coordinate the reasonable allocation of resources and personnel; after the construction is completed, all the construction data will be submitted to the supervision department for acceptance.

Purchasing management is an important link about whether materials and equipment can be used. Whose management tasks include procurement planning, planning of materials and equipment in conjunction with construction projects, and comprehensive consideration of the scale, geographical location, and local climate of the project [9].

The marketing management is determining whether the enterprise can truly make a profit [10]. First, identify the main sales groups in order to choose the appropriate marketing methods. Then, the enterprise can prepare for the opening, choose a variety of sales strategies for diversified publicity.

System management is a higher requirement for refined management of enterprises, and it includes authorization system management and process system management. Different levels in the organization are assigned different responsibilities. In the accordance of the above analysis, the refined management evaluation system finally established is shown in the following table.

| Table 1. The refined management evaluation system |

| Target level | First-level indicators | Second-level indicators |
|--------------|------------------------|-------------------------|
| Investment management (B1) | Information collection management (C1), feasibility study management (C2), investment decision management (C3), development and construction management (C4) | Design standardization management (C5), design bidding management (C6), concept design management (C7), scheme design management (C8), construction drawing design management (C9), design change management (C10) |
| Design management(B2) | Project planning management (C15), construction preparation management (C16), project progress management (C17), project quality management (C18), safety and civilization management (C19), project visa management (C20), project completion management (C21) | Target cost management (C11), dynamic cost management (C12), engineering cost management (C13), contract management (C14) |
| Cost management(B3) | Purchasing planning management (C22), purchasing strategy management (C22), bidding management (C23), supplier management (C24) | Purchasing system management (C25), market pricing management (C26), opening management (C27), sales process management (C28), customer service management (C29) |
| Engineering management(B4) | Market positioning management (C25), market pricing management (C26), opening management (C27), sales process management (C28), customer service management (C29) | Authorization system management (C30), process system management (C31) |

3.2. Refined management evaluation model based on FAHP

Fuzzy Analytic Hierarchy Process (FAHP) is a method that can quantitatively analyze and evaluate indicators that are difficult to quantify. It is widely used in determining the weights of multiple schemes. Based on different tomographic analysis structures, it allows different weights to be generated under different metrics [10]. Compared with the traditional tomographic analysis method, FAHP speeds up the process of obtaining a consistency judgment matrix, and greatly improves the operability of the model. The specific steps are as follows.
1. Determine the hierarchical analysis structure

First, determine the overall goal based on the problem being studied. The overall goal can be decomposed into several sub-goals. Each sub-goal can be divided into several small goals again according to its characteristics. When decomposing the target, it should be divided according to the characteristics, content, and lower-level relationships of the target.

2. Constructing fuzzy consistent judgment matrix

The fuzzy consistency judgment matrix is a matrix formed by the relative importance of the evaluation indicators in pairs. Assume that there are elements \( b_1, b_2, \cdots, b_n \), and \( r_{ij} \) represents the membership of the fuzzy relationship of elements \( b_i \) and \( b_j \) relative to element A. The constructed judgment matrix is shown below [12].

|    | \( A_k \) | \( B_1 \) | \( B_2 \) | \( \cdots \) | \( B_n \) |
|----|----------|----------|----------|-----------|----------|
| \( B_1 \) | \( r_{11} \) | \( r_{12} \) | \( \cdots \) | \( r_{1n} \) |
| \( B_2 \) | \( r_{21} \) | \( r_{22} \) | \( \cdots \) | \( r_{2n} \) |
| \( \vdots \) | \( \vdots \) | \( \vdots \) | \( \vdots \) | \( \vdots \) |
| \( B_n \) | \( r_{n1} \) | \( r_{n2} \) | \( \cdots \) | \( r_{nn} \) |

This article chooses a judgment standard of 1-9.

| Materiality criteria | Meaning |
|----------------------|---------|
| 5                    | Indicating that two elements are of equal importance |
| 6                    | Indicating that the two elements are slightly more important than the latter |
| 7                    | Indicating that the two elements are significantly more important than the latter |
| 8                    | Indicating that the two elements are more important than the latter |
| 9                    | Indicating that the two elements are extremely important than the latter |
| 1, 2, 3, 4           | If the elements \( b_i \) and \( b_j \) are compared to get \( r_{ij} \), then the elements \( b_j \) and \( b_i \) are compared to get \( r_{ji} = 1 - r_{ij} \) |

When the constructed judgment matrix is inconsistent, further adjustment is needed. If the relevant problem decision maker is very confident in determining the comparison of one element with other elements. Then, the \( r_{1j} \) and \( r_{2j} \) of the judgment matrix are used for subtraction. If the difference values are obtained as constants, the adjustment of the elements in the second row is not required, otherwise adjustment is performed until all the difference values are constant. Repeat the above steps until the difference between the elements of all rows and the first row is constant.

3. Calculate weights

When sorting the evaluation indicators, conducting from top to bottom according to the hierarchical structure. The ranking of the evaluation index of the k-1 layer relative to the target layer is shown as follows.

\[
\mathbf{w}^{(k-1)} = (w_1^{(k-1)}, \cdots, w_n^{(k-1)})
\]

(1)

If the weights of the elements \( b_1, b_2, \cdots, b_n \) are known as \( w_1, w_2, \cdots, w_n \), then the following expression should be existed.

\[
r_{ij} = 0.5 + a(w_i - w_j), i,j = 1,2,\cdots,n
\]

(2)

Where \( a \) is a constant term, which is generally determined according to the degree of difference of known objects, and the value range is 0-0.5. If the number of evaluation indicators is large or the difference is large, the value of \( a \) is large as well.
If the judgment matrices are inconsistent, the final weights can be obtained by least squares method. Then the original problem can be transformed into a set of constraint programming problems.

\[
\min z = \sum_{i=1}^{n} \sum_{j=1}^{n} [0.5 + a(w_i - w_j) - r_{ij}]^2
\]

\[
\text{s.t. } \sum_{i=1}^{n} w_i = 1, w_i \geq 0
\]

The constrained programming problem can be transformed into an unconstrained programming problem P1.

\[
\min L(w, \lambda) = \sum_{i=1}^{n} \sum_{j=1}^{n} [0.5 + a(w_i - w_j) - r_{ij}]^2 + 2\lambda \sum_{i=1}^{n} w_i - 1
\]

Where \( \lambda \) is a Lagrange multiplier, and the partial derivative of \( w_i \) in formula (4) is made zero. Problem P2 can be obtained.

\[
\sum_{j=1}^{n} 2a^2(w_i - w_j) + a(r_{ij} - r_{ji}) + \lambda = 0
\]

\[
2a^2(n - 1)w_1 - 2a^2w_2 - 2a^2w_3 - \cdots - 2a^2w_n + \lambda = a \sum_{j=1}^{n} r_{1j} - r_{j1}
\]

\[
-2a^2w_1 - 2a^2w_2(n - 1) - 2a^2w_3 - \cdots - 2a^2w_n + \lambda = a \sum_{j=1}^{n} r_{2j} - r_{j2}
\]

\[
-2a^2w_1 - 2a^2w_2 - 2a^2w_3 - \cdots + 2a^2(n - 1)w_n + \lambda = a \sum_{j=1}^{n} r_{nj} - r_{jn}
\]

\[
w_1 + w_2 + \cdots + w_n = 1
\]

After solving all existing equations, \( w = [w_1, w_2, w_3, \cdots, w_n]^T \) can be determined.

4. The case study

4.1. Background of the project

The main business of XXX real estate company is real estate development and property management. The company has developed a residential housing project with a total construction area of 1.35 million \( m^2 \) and an area of 300,000 \( m^2 \). The whole project is divided into three development periods. The second phase of the project was completed as scheduled in 2017 and has been delivered. During the construction process, the project took the lead in adopting the concept of refined management to refine business processes and achieve timely and dynamic monitoring of project development. In the end, the project's construction period was 19 days ahead of schedule, and the opening rate of the current period was 92%.

4.2. Results and discussion

The FAHP hierarchy analysis structure established in this paper is shown in Table 1. The judgment matrix finally formed according to the criterion of 1-9 is represented as follows.
After using MATLAB software to solve the unconstrained linear equations, the weights of each index in each evaluation criterion layer can be obtained directly, as is indicated in Fig. 1 and Fig. 2.

### Table 4. Index judgment matrix under the control of the target layer

| A   | B1 | B2 | B3 | B4 | B5 | B6 | B7 |
|-----|----|----|----|----|----|----|----|
| B1  | 1  | 3  | 5  | 5  | 7  | 7  | 5  |
| B2  | 1/3| 1  | 3  | 3  | 5  | 5  | 3  |
| B3  | 1/5| 1/3| 1  | 1  | 3  | 3  | 1  |
| B4  | 1/5| 1/3| 1  | 1  | 3  | 3  | 1  |
| B5  | 1/7| 1/5| 1/3| 1/3| 1  | 1  | 1/3|
| B6  | 1/7| 1/5| 1/3| 1/3| 1  | 1  | 1/3|
| B7  | 1/5| 1/3| 1  | 1  | 3  | 3  | 1  |

After using MATLAB software to solve the unconstrained linear equations, the weights of each index in each evaluation criterion layer can be obtained directly, as is indicated in Fig. 1 and Fig. 2.

Figure 1. The coefficients of the second-level indicators

Figure 2. The coefficients of the first-level indicators

As is indicated in Fig. 2, the ultimate purpose of refined management is to save costs, and cost has a huge impact on the effectiveness of refined management. The profit level of an enterprise is directly related to cost management. In the process of refined management, the cost flow trajectory can be traced and visualized through the process-oriented tasks [11]. Which can increase the transparency and execution of cost management. In addition, the core of refined management is system management. A complete and flexible authorization system and process system are directly related to the completion of various business processes. To establish a refined management system, an enterprise must implement a full-scale and full-process division of responsibility rights and definite a clear authorization process. At present, some real estate companies have begun to explore design
standardization in terms of refined management. Standardization is also one of the core concepts of refined management. Companies should continuously accumulate experience in prefabricated buildings, and strengthened the core competitiveness of enterprises by advancing the process of design standardization. Furthermore, engineering is directly related to the quality of construction results. Project management planning is a guide to the specific process of project development. Enterprises should pay attention to the planning work. The initial planning assumptions must be reasonable and scientific, and a good comparison and analysis of multiple plans should be conducted. What’s more, enterprise should enhance the ability to develop new products, using the big data platform to collect information in the segment, and accurately conduct market positioning and customer segmentation. Under the impact of new technology, the refined management is an important tool to ensure the sustainable development of enterprises. Real estate companies need to reflect deeply to make a more scientific and competitive management adjustments to adapt to changes in the times.

5. Conclusion

The refined management of enterprises is already a trend of modern enterprise development, and it is also an effective method to solve the extensive management phenomenon that currently exists in enterprises. Refined management is the standardization and concreteness of the enterprise's project process. This article discusses the important indicators in the process of fine management of real estate projects, establishing a fine management evaluation system based on FAHP, and takes the actual engineering project as an example to evaluate the refined management level. By weighing the importance of each evaluation index, identifying the key influencing factors in the project construction process, so as to accumulate experience for the subsequent similar projects. This model also provides a certain reference for the establishment and optimization of subsequent refined management models.

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