

Research on Performance and Decision-making Method of Project Management Mode

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Abstract. Aiming at the research of project management mode performance and decision-making method, this paper adopts the method of expert group decision-making. Group decision-making is to give full play to the wisdom of the collective. First, experts are selected and distributed to each functional department of project management, and the experts participating in the evaluation are all participants in the evaluation decision-making process. Then, according to the weight coefficient of experts and the data of experts' evaluation, the evaluation results are calculated and determined according to the data comprehensive method. The weight coefficient of experts can be customized according to the influence of each expert, or each expert can be calculated according to the same weight. There are two kinds of data synthesis methods: expert evaluation result weight synthesis and expert evaluation matrix synthesis. This paper mainly designs the performance evaluation index system of project management, and constructs the performance evaluation mode based on the perspective of project integrated management, which provides a reference for the performance and decision-making method of project management mode.

1. Introduction

At present, there are many methods about performance management and project comprehensive evaluation, such as goal management, balanced scorecard, key performance indicators, benchmarking management and so on [1-3]. For performance evaluation, Delphi, AHP, fuzzy comprehensive evaluation, data envelopment analysis and neural network are usually used. Among them, the research process of AHP is to decompose the complex problems into various components, determine the relative importance of each factor through mutual comparison, and then comprehensively calculate the weight to determine the importance of the evaluation object [4-5].

With the economic and social development and the profound changes of the market environment faced by construction enterprises, the current project management mode is changing from extensive management to lean construction, and the corresponding project management performance evaluation mode should also develop from simplification to refinement [6-7]. In this paper, combined with the research status and engineering practice of engineering project management, try to establish a more comprehensive and fine performance evaluation system of engineering project management, hoping that the research results can promote the fine management of engineering project performance evaluation and improve the level of engineering project management.



2. Design of performance evaluation index system of project management

2.1. Evaluation index system design basis

In this paper, when constructing the performance evaluation index system of project management, we should grasp and consider the following aspects:

(1) Comprehensive. Project management covers a wide range of contents, including progress, quality, cost, technology, safety, etc. the selection of performance evaluation indicators should comprehensively summarize all aspects of project management.

(2) Operability. The evaluation index constructed should be easy to collect and check data, convenient for comparison and evaluation, and can be operated and used by non professionals.

(3) Dynamic. The time span of the project construction is large, and the key points of management are different in the construction preparation, construction, completion acceptance and other stages [10].

(4) Combination of qualitative and quantitative analysis. In the performance appraisal of project management, there are directly quantifiable indicators, such as cost, but also unquantifiable indicators, such as quality. Therefore, it is necessary to use the quantitative / qualitative method to evaluate the project management performance.

2.2. Content of evaluation index system

Project management has three goals: progress, quality and cost. At the same time, more and more attention has been paid to safety. Therefore, it is determined that project safety management, quality management, progress management, contract and cost management are the key indicators of project management performance evaluation. However, only based on the above key performance indicators, the project management level can not be comprehensively and objectively evaluated. The general indicators should be further determined according to the characteristics and management status of the project. More and more attention has been paid to civilized construction and environmental protection, so green construction, technical management, material and labor management, and integrated logistics management are important supports to achieve the project objectives. On the basis of comprehensive analysis, establish project management performance evaluation indicators, as shown in Figure 1.

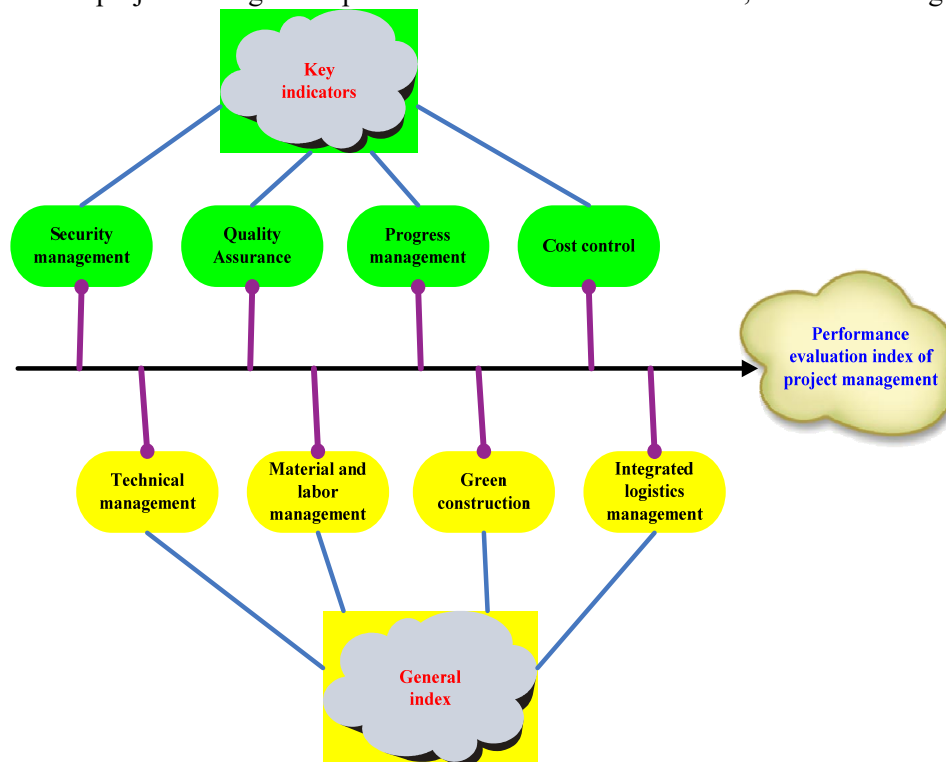


Figure 1 Index system of project management performance evaluation

This indicator system takes safety management, progress management, quality management and cost management as the main line, and each indicator includes sub indicators, which are independent, self-contained and complementary. For example, material and labor management indicators include sub indicators such as material management, equipment management and labor management. The indicators include both qualitative and quantitative indicators, which can comprehensively investigate various factors of project management and objectively, precisely and comprehensively evaluate performance.

3. Construction of performance evaluation model based on the perspective of project set management

In view of the complex internal structure of large-scale engineering projects, including a large number of sub project system characteristics, it is necessary to comprehensively consider the management performance of each sub project in the management performance evaluation. At the same time, the work content of the large-scale project management based on the project set management has been extended. On the basis of controlling the traditional project management objectives such as quality, schedule and cost, more attention is paid to the relevance between the subprojects and the maximization of the overall benefit of the project is pursued. Through the research on the connotation of performance evaluation of large-scale engineering project management, it can be seen that the relevance evaluation among subprojects should be based on the performance of subprojects. If the performance management objectives of subprojects cannot be achieved, the relevance management and performance evaluation among subprojects will lose its fundamental significance. On the contrary, if we only achieve the performance management objectives of each subproject and ignore the correlation between the projects, the overall objectives of the whole large-scale project will not be achieved, and the management of large-scale project will inevitably fail

3.1. Segment performance evaluation at subproject level

The first step of the operation of PMP large-scale project management performance evaluation system is to evaluate each sub project separately and establish the basis for subsequent evaluation. The main purpose of subproject level evaluation is to clarify the management performance level of each subproject included in a large-scale engineering project, which serves as the basis for the overall associated evaluation. After the evaluation results are obtained, problems in the management of an indicator specific to a subproject can be found.

The performance evaluation of subproject level is parallel and independent for each subproject. According to the connotation research of large-scale project management system, the project management of subproject level still belongs to the scope of project management, and the performance evaluation of each subproject management still takes the completion of cost, quality, progress and other control objectives of project management as the main evaluation standard. The management status information of each subproject is input into the PMP evaluation mode, and the performance of each subproject is comprehensively evaluated with the mathematical performance evaluation model to form a separate project management performance evaluation result.

3.2. Expert performance appraisal

When determining the weight, the evaluation results are greatly influenced by the subjective factors due to the different preferences of the experts. So this paper adopts the method of expert group decision. In this paper, the weighted arithmetic average method of expert evaluation matrix is used to calculate the group decision data. Based on the evaluation structure model, an expert questionnaire is made and distributed. According to the evaluation results of each expert, the evaluation matrix is obtained by transformation, and then the comprehensive evaluation matrix t is obtained by weighted arithmetic average method. Similarly, the comprehensive evaluation matrix M_k ($k = 1, 2, \dots, 8$) corresponding to each index of the evaluated project can be obtained.

$$M_k = (m_{ij})_{n \times n} = \begin{bmatrix} m_{11} & m_{12} & \dots & m_{1n} \\ m_{21} & m_{22} & \dots & m_{2n} \\ \dots & \dots & \dots & \dots \\ m_{n1} & m_{n2} & \dots & m_{nm} \end{bmatrix} \quad [1]$$

(1) Inspection of evaluation results

The eigenvector ω , the maximum eigenvalue λ_{max} , the consistency index DI and the consistency ratio DR of each evaluation matrix are calculated respectively. The consistency test of the evaluation results is as follows:

Consistency indicator:

$$DI = \frac{\lambda_{max} - n}{n - 1} \quad [2]$$

Inspection of evaluation results: Calculate the consistency ratio CR1 and the total sorting consistency ratio CR2.

$$DR_1 = \frac{DI}{RI} \quad [3]$$

$$DR_2 = \frac{\sum_{j=1}^n DI_j t_j}{\sum_{j=1}^m RI_j t_j} \quad [4]$$

When DR is less than 0.10, the evaluation result is valid, otherwise, the evaluation matrix should be modified.

(2) Performance score of participating projects

The target layer, indicator layer and project layer are divided as shown in Figure 2. The weight of the project layer to the indicator layer and the weight of the indicator layer to the target layer are integrated to finally determine the weight of the project layer to the performance target, that is, the performance of the participating projects. The performance score of the i-th project is:

$$d_i = \sum_{j=1}^n n_{ij} t_j \quad [5]$$

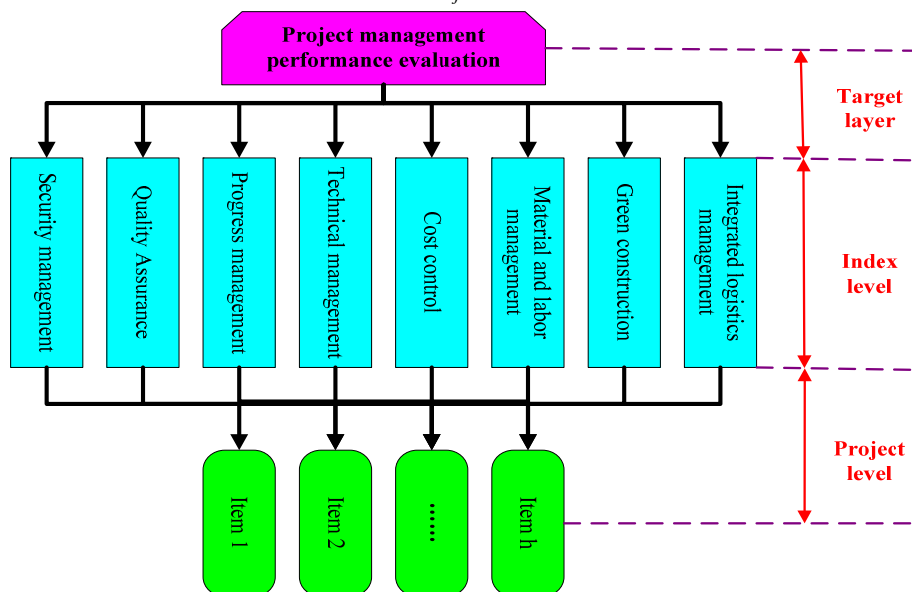


Figure 2 Performance evaluation structure model of project management

3.3 Performance scoring calculation

After determining the weight of each element in the scheme layer, we can use the scoring method to get the comprehensive performance and comprehensive ability level of the agent construction unit, and then select the most appropriate agent construction unit. Each indicator of the opposite case level uses the four-level scoring method to evaluate the performance of the agent construction unit. The performance difference score is (0.00-0.25), the general performance score is (0.26-0.50), the good performance score is (0.51-0.75), and the good performance score is (0.76-1.00). Then multiply the score of each indicator with its corresponding weight level to get the performance of the indicator, and sum the performance of all indicators, that is, get the final score of the target layer, that is, the performance of the agent (used to explain the comprehensive energy level of the agent).

According to the above-mentioned four-level scoring method, each expert scores each factor of the other's case level, and the indicator scores of five agent construction units are obtained through expert scoring, as shown in Table 1 and Figure 3 below.

Table 1 Index scores of each scheme level

Scheme layer	M ₁	M ₂	M ₃	M ₄	M ₅
Profitability	0.86	0.91	0.76	0.81	0.86
Management situation	0.71	0.76	0.81	0.66	0.76
Cost control	0.81	0.86	0.81	0.76	0.86
Risk Management	0.86	0.81	0.76	0.86	0.81
Enterprise qualification	0.86	0.96	0.91	0.91	0.96
Corporate reputation	0.91	0.86	0.86	0.86	0.91
Customer service	0.91	0.96	0.91	0.86	0.91
Environmental protection	0.96	0.91	0.86	0.8	0.76
Safety control	0.71	0.86	0.81	0.76	0.71



Figure 3 Index scores of each scheme level

Multiply the scores of each indicator of each agent in the above table by the corresponding weights

of each indicator, and then add the products of each indicator to get the comprehensive scores of each agent. See table 4-8 below for the results, with three decimal places reserved. It can be seen that M2 has the highest comprehensive score, so M₂ should be selected as the construction agent for the construction of this project.

4. Conclusion

Combined with the current situation and practice of project management performance evaluation research, a more comprehensive and fine index system of project management performance evaluation is designed, and the method of expert group decision-making weighted arithmetic average method is used to sort out, trying to establish a more comprehensive and fine multi project management performance evaluation mechanism. Through the establishment of project management performance evaluation system, strengthen the dynamic performance evaluation of multiple projects, provide an early warning mechanism for correcting and checking the existing problems of the project, provide a comprehensive and reasonable competition platform for project participants, and form an effective incentive mechanism. Whether it's examination or evaluation, whether it's reward or punishment, it's just a way of management. Evaluation is not an end in itself. The ultimate goal of evaluation is for decision-making management

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