

Evaluating the Efficiency Analysis of Supervision Organization Coordination in Engineering Management

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Abstract

The effective application of the supervision organization coordination is one of the important guarantees to improve the project management efficiency. Through the analysis of domestic and foreign research status, the contents of the coordination of the supervision organization can be determined as internal and external organization coordination. At the same time, on the basis of the analysis of the factors affecting the efficiency of the project management in the supervision organization, the mathematical model for the coordination of supervision organization is constructed by using the method of AHP and F-AHP. And with the actual case, the comprehensive evaluation model of the coordination of the supervision organization is constructed by the method of fuzzy comprehensive evaluation. The coordination efficiency of the case is poor, so the research method based on AHP and F-AHP is feasible. And the improvement of the coordination efficiency of the supervision organization in the project management is of positive significance.

Keywords: *supervision; organization and coordination; efficiency; AHP; F-AHP*

1. Introduction

With the increasingly competition in the construction industry, how to improve work efficiency, reduce management cost, improve service level and enterprise's competitive ability, become the most concerned problem for every business manager. And in the whole management process, in order to enable the various departments to cooperate with each other effectively to complete the project tasks, the thought of organizing and coordinating came into being. Coordination plays an important role in modern management theory. Similarly, life and organization coordination are closely related, as long as there is a person involved in the work cannot be separated from the organization. To select the leaders of the organization, to integrate the scattered people together, to define the common goals and their respective tasks, and then combine the good organization culture, the completion of a task will also have a certain guarantee. In social life, communication and coordination is a problem that any organization can relate to.

If there is no coordination in an organization, the organization is merely a combination of a group of people on the surface. On the contrary, if we can make full use of the organization and coordination, we will make this work more effective.

S.W. Liu believes that the organization and coordination should not only deal with external relations, but also to deal with the internal relations. He put the organization and coordination into the near and far outer layer, and put forward some common means of coordination, including administrative means, public relations, contract means and legal means. C.G. Wen, Y. Wang and X.Y. Yang believe that the coordination mechanism

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within the organization is an important part that must be concerned by leaders. The organization's objectives can be effectively achieved through the establishment and innovation of the organization's coordination mechanism [1]. Y. W. He believes that the organization and coordination of project management involves two levels of management and technology, management is the role of instruction, technology is involved in the implementation of the method.

Heinz Wei Rick made it clear that coordination is the core of the management, and points out that each management function is to promote coordination, through the coordination of individual employees to complete the target group. Because individuals have different interpretations of the common interests, therefore the main task of the management personnel is to coordinate the differences between staffs in the learning method, the working style and the effort level, so that the individual interests can be subordinate to the overall interests, so as to achieve the goal of the group.

Malone and Crowston were the first to put forward the coordination theory, and they defined coordination as inter - Coordination Management [2]. W. Griffin Ricky insists that the coordination is the process of integrating the different departments of the organization in a flexible way. He stressed that the basic starting point of the coordination is the mutual dependence between the working group and the Department.

Erick G. Guerrero and Christina Andrews thought that Leadership determined the scope and scale of efforts to provide coordinated care [3]. Lucie Kaňovská and Eva Tomášková also emphasized the importance of information coordination [4].

In the process of project management, people used to go to a dispersive thinking to study engineering, but the research of this paper is mainly focused on the overall situation. It combines the ideas of enterprise management and project management.

This paper mainly uses the following four research methods:

- (1) Deductive Analysis Method.
- (2) Combination of Theory and Practice.
- (3) Analytic Hierarchy Process.
- (4) Fuzzy Analysis of Hierarchical Process.

2. Summary of Relevant Theories

2.1. Organization and Coordination of Supervision

For supervision, organization coordination is based on the relevant laws and regulations of the state. In order to achieve the engineering quality, and progress and investment objectives, it actively with the participation of all parties, the government and the community and within the organization to communicate effectively, so that each aspect and each department work synchronization, harmonious, and can effectively achieve organizational goals. The supervision organization can be determined as internal and external organization coordination. And the external part is a relationship between the supervision and the owners, the contractor and other aspects. Other aspects involved in the design of units, environmental protection units, safety supervision departments and other organizations. No matter which organization, the supervisor must deal with the relationship, so that the project can be smoothly progress. The coordination of the supervision and the external organization is shown in Figure 1.

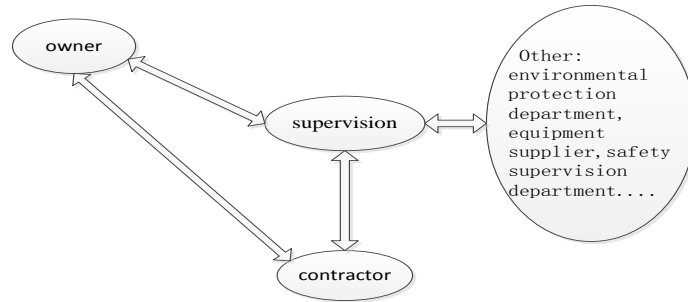


Figure 1. Supervision and Coordination of External Organization

The implementation of the coordination is based on the establishment of the organization. No organization was established, there is no coordination development. For the project, the owner, the supervision and the contractor need to have a clear concept of coordination between the various organizations. Supervision organization as a hub between the owner and the contractor, not only need it to control the realization of the three major objectives, but also to enable owners and contractors to communicate and understand each other's needs. In addition, the supervision organization should pay attention to a lot of coordination with other aspects, for example, the coordination with the design unit, the coordination with the environmental protection department, etc. The specific organization and coordination framework is shown in Figure 2.

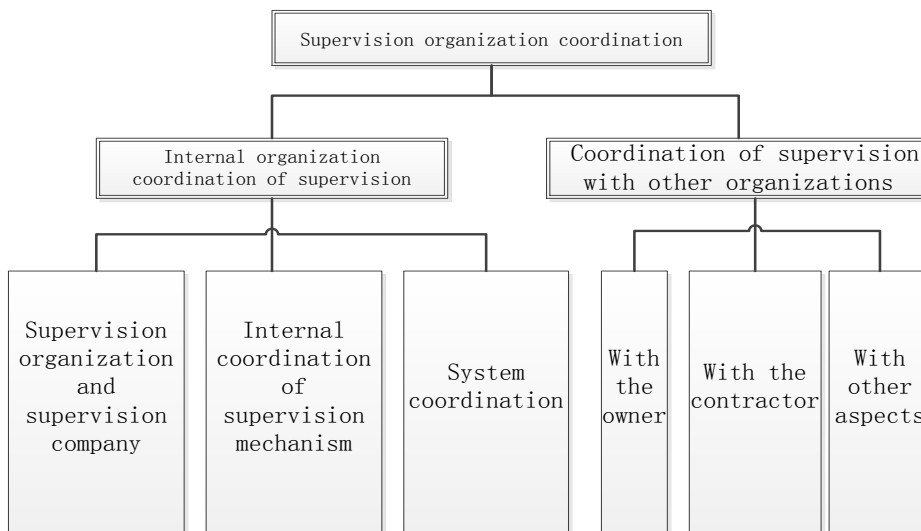


Figure 2. Supervision Organization Coordination Frame Diagram

2.2. Effect of Supervision Organization Coordination on Project Management Efficiency

2.2.1. Internal Organization Coordination of Supervision: Supervision organization is the hub to the construction organization and the owner. Therefore, the coordination capacity of the supervision organization will have a great impact on the efficiency of the project management. To establish a harmonious working atmosphere is the key to achieve the project objectives, which also requires the supervision engineer to have a certain ability of organization and coordination. Organization and coordination ability is the ability of the organization to achieve organizational goals through the rational allocation of resources and the effective

control of the group members [3]. The effects of the organization and coordination capacity of the supervision engineer on the project management efficiency are mainly the following:

- (1) Uphold work orientation and always clear goals.
- (2) Strengthen responsibility consciousness and improve the work efficiency.
- (3) Improve the operation mechanism of the organization, so that the project is carried out in an orderly.

2.2.2. Coordination Between Supervision and External Organization: Construction organization is the important part of the project management. Whether it is the supervision organization or the owner, all they do is to oversee the project. Construction organization is the main body of project management. The coordination management of construction organization includes the coordination management of people, and also the coordination of the object. In the construction organization, because of the process of the implementation of the project which lasted longer and more involved in the project, the project manager's ability to organize and coordinate is an essential skill. The contents of the project manager to complete the construction project and improve the efficiency of project management are mainly the following points:

- (1) Analyze contract documents carefully to avoid unnecessary misunderstanding.
- (2) To analyze the project objectives and plan the project implementation plan.
- (3) Communicate regularly with the supervision organization and let the owners understand the progress of the project.
- (4) Correctly guide the staff to complete the task.
- (5) Cherish the environment and promote the emergence of green building.

2.3. AHP and F-AHP

The theory cannot be carried out is not operational, and it also has no significance for research [6]. AHP is a qualitative and quantitative decision method which is proposed by T.L.Saaty in 1970s [7]. AHP is a method of evaluating the correlation between the various components of a complex problem. Fuzzy analytic hierarchy process (F-AHP) whose basic idea and the main steps are similar to AHP is obtained by extending AHP to fuzzy environment. In this paper, we first do a detailed introduction of AHP, and F-AHP is a combination of specific case analysis.

For the AHP method, the research steps are as follows:

- (1) Analyzing the whole system and making clear the system's overall goal;
- (2) Establishing a multi-level evaluation model;
- (3) Determining the correlation between the elements of the adjacent in the established hierarchy model;
- (4) Calculating the weight of each element in the system and making a general order;
- (5) According to the results of analysis, the corresponding decision is determined.

The evaluation index system for the coordination of the supervision organization is shown in Figure 3.

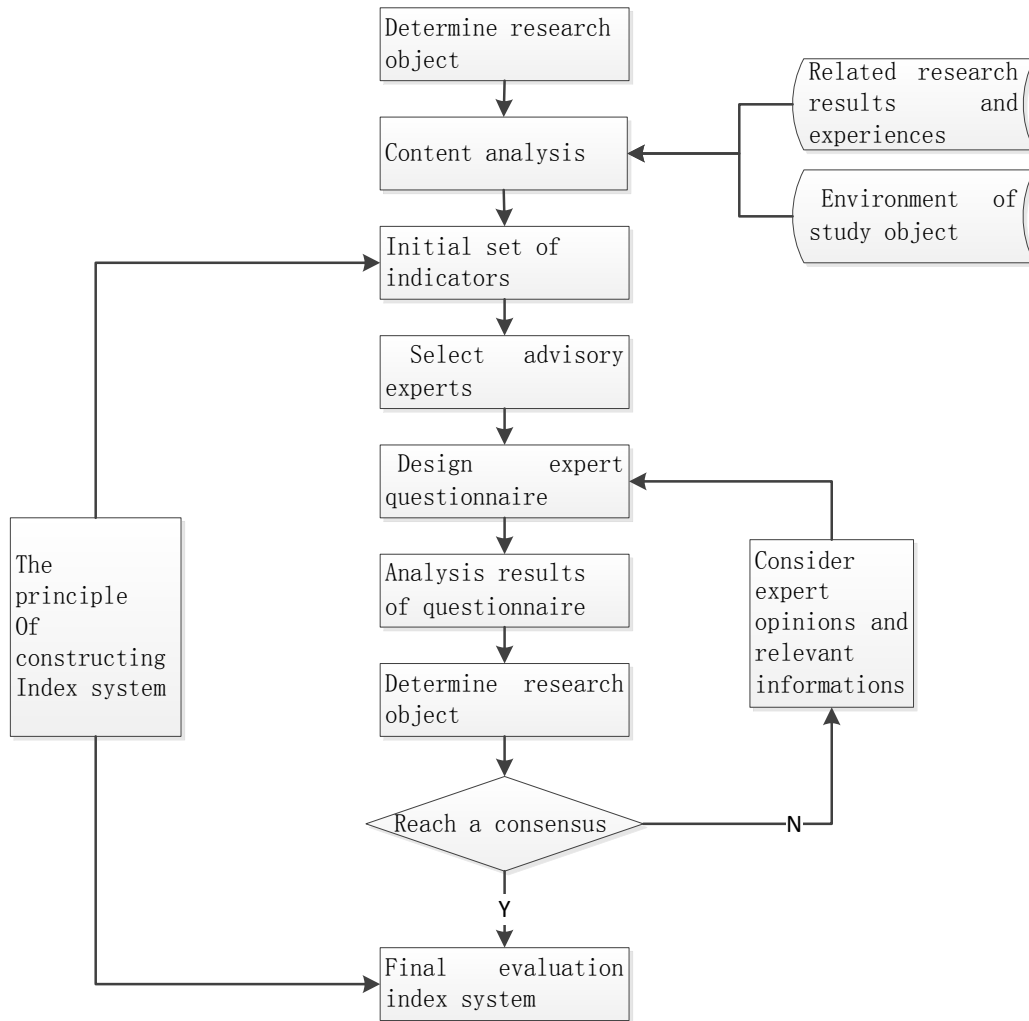


Figure 3. Flow Chart of Building an Evaluation Index System

3. Construction of Efficiency Evaluation Model for Supervision organization Coordination

3.1. Construction of the Comprehensive Evaluation Index System of Supervision Organization Coordination

3.1.1. The Principle of Building Index System: Supervision organization coordination is an important work in project management. Because people are the main participants in the process of organization coordination, there are some particularities and difficulties of constructing the index system. The index system should be scientifically and comprehensively reflect the evaluation objectives. Therefore, the construction of the index system should meet the following principles:

- (1) Scientific principles;
- (2) Systematic principle;
- (3) Practical principles;
- (4) General comparability principles;
- (5) Goal oriented principle.

3.1.2. Selection of Comprehensive Evaluation Index: In order to determine the appropriate evaluation index, we need to analyze the important factors that affect the coordination of the supervision organization. It is necessary for us to determine the index layer of the evaluation system through the analysis of the content of supervision organization coordination to carry out comprehensive evaluation on the coordination of the supervision organization. The purpose of the organization and coordination is to achieve organizational goals effectively, so that the organization target management can be used as one of evaluation indexes. Appropriate organizational structure is the basis of achieving organizational goals, at the same time, the organizational culture as the nervous system of the organization, so they can also be used as the evaluation indexes of organization coordination. In addition, the effect of communication and the way of coordination plays very important roles to improve the efficiency of coordination. To sum up the contents of the foregoing discussion, we can determine the criterions layer of the organization and coordination. Besides, through the analysis of the various elements, the final index layer can be determined. The final evaluation index is as follows:

(1) Organization target management

1) Clarity of organizational goals. In the course of the project, the organization goals should not be changed at random. The random change of organizational goals will affect the direction of coordination, resulting in delays in the project.

2) Rationality of target decomposition. The reasonable decomposition of the total goal will be easier for each work to implement the individual.

3) Hierarchy of organizational goals. It is a must to establish a link system throughout the whole organization.

4) The severity of the goal's conflict. In the process of the project, if the realization of a certain goal will affect the realization of other targets, the target conflict is caused.

(2) Organization structure

1) Rationality of management range. The horizontal distribution and vertical distribution of the organization structure is determined by the management extent.

2) Unity of organization and command. In the process of determining the management level, it is necessary to form a continuous hierarchical chain between the upper and lower levels.

3) Balance of responsibility. It is necessary to have a clear definition of the responsibility of the organization and form a restricted relationship.

4) Independence of execution and supervision. To separate the external supervision personnel from the internal staff, thereby avoiding the unnecessary disputes and conflicts caused by the two party's responsibility.

(3) Organizational culture system

1) The standard of organization system. Only a standardized organizational system can enhance the overall awareness and discipline of the organization members.

2) The harmony of organization atmosphere. A harmonious cultural atmosphere not only creates a good working environment for the members of the organization, but also greatly improves the working efficiency of the staff.

3) Degree of trust among employees. The degree of trust between people is the basis for further communication.

(4) Effect of communication

1) Timeliness of information communication. Timely delivery of information is the basis of improving the work efficiency.

2) Accuracy of information communication. In the process of information communication, there are some differences in understanding of the same problem.

3) The extent of information sharing. It is a must to avoid Information Island and achieve information sharing in the process of information transmission.

(5) Coordination Modes

1) The wide range of coordination content. The content of coordinated management should be comprehensive.

2) The principle of coordination. To carry out work on the basis of project contract

3) Science of coordination method. The scientific coordination method ensures that the supervision work is effective.

3.2. The Construction of the Integrated Evaluation Model of the Supervision Organization Coordination based on AHP

(1) Establish hierarchy model

We should begin to build a hierarchical structure model after determining the evaluation index. The establishment of the comprehensive evaluation index system is shown in Figure 4.

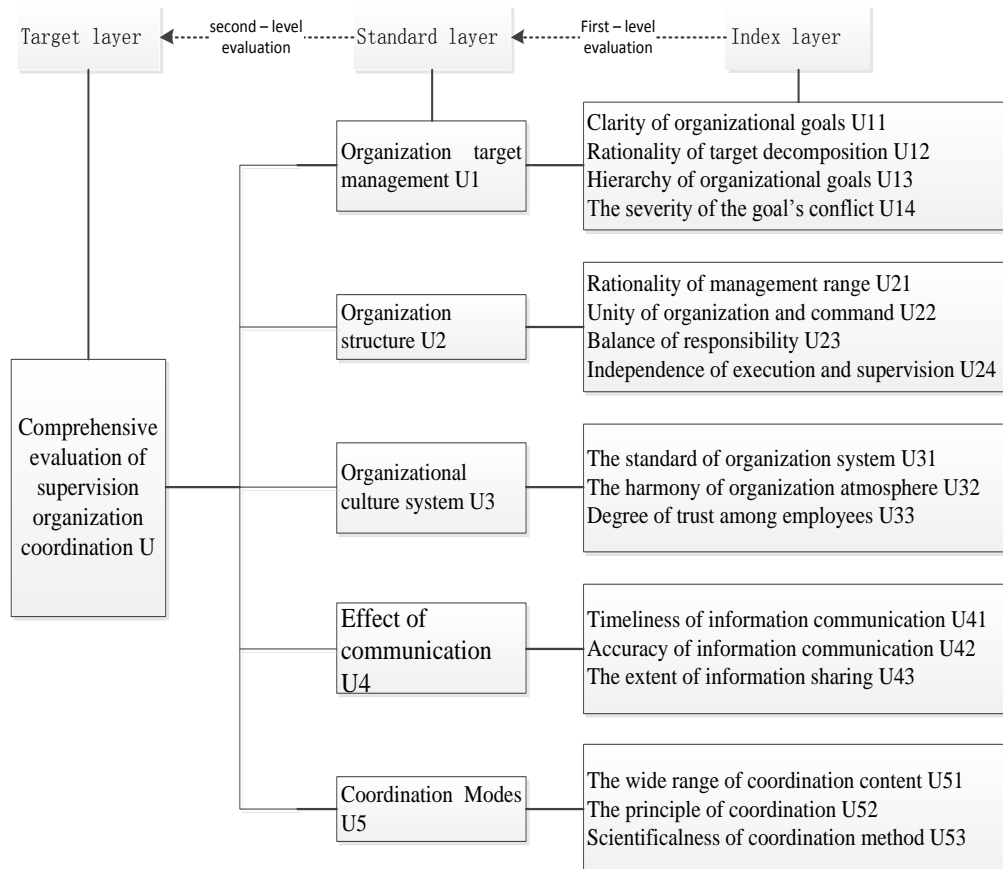


Figure 4. The Index System for the Coordination of the Supervision Organization

(2) Construct Judgment Matrix

Judgment matrix is the judgment value of the relative importance of each index of the same level [8]. Taking into account the special nature of the scale measurement of the social economic system variables, a scaling is introduced to compare the importance of the elements. A decision value is determined by experts is introduced. The judgment matrix is formed after the judgment. The form of the judgment matrix is shown in Table 1.

Table 1. Basic Form of Judgment Matrix

Index	a_1	a_2	a_3	.....	a_n
a_1	b_{11}	b_{12}	b_{13}	.....	b_{1n}
a_2	b_{21}	b_{22}	b_{23}	.....	b_{2n}
a_3	b_{31}	b_{32}	b_{33}	.....	b_{3n}
.....
a_n	b_{n1}	b_{n2}	b_{n3}	.....	b_{nn}

At the same time, in order to make quantitative evaluation, the 1~9 scale method is used to evaluate the evaluation. The definition of 1~9 scale method is shown in Table 2.

Table 2. The Definition of 1~9 Scale Method

Index	Definition
1	The index a_i is as important as the index a_j
3	The index a_i is slightly more important than the index a_j
5	The index a_i is significantly more important than the index a_j
7	The index a_i is strongly more important than the index a_j
9	The index a_i is extremely more important than the index a_j
2、4、6、8	Values of the intermediate state lay between them.

Finally, according to the specific circumstances of the company, we designed the questionnaire and constructed the judgment matrix $C = (c_{ij})_{(n \times n)}$ ($c_{ij} = \frac{1}{c_{ji}}$) [9] in the way of the expert consultation.

The constructed judgment matrix is as follows:

$$U_{ij} = \begin{pmatrix} 1 & 1/3 & 2 & 1/4 & 1/5 \\ 3 & 1 & 3 & 1/3 & 1/4 \\ 1/2 & 1/3 & 1 & 1/4 & 1/5 \\ 4 & 3 & 4 & 1 & 1/2 \\ 5 & 4 & 5 & 2 & 1 \end{pmatrix}$$

$$U_{1ij} = \begin{pmatrix} 1 & 1 & 1/2 & 1/2 \\ 1 & 1 & 1/3 & 1/3 \\ 2 & 3 & 1 & 1 \\ 2 & 3 & 1 & 1 \end{pmatrix}$$

$$U_{2ij} = \begin{pmatrix} 1 & 1/3 & 1/5 & 1/2 \\ 3 & 1 & 2 & 2 \\ 5 & 1/2 & 1 & 2 \\ 2 & 1/2 & 1/2 & 1 \end{pmatrix}$$

$$U_{3ij} = \begin{pmatrix} 1 & 4 & 3 \\ 1/4 & 1 & 1/3 \\ 1/3 & 3 & 1 \end{pmatrix}$$

$$U_{4ij} = \begin{pmatrix} 1 & 1/2 & 2 \\ 2 & 1 & 2 \\ 1/2 & 1/2 & 1 \end{pmatrix}$$

$$U_{5ij} = \begin{pmatrix} 1 & 1/2 & 1/2 \\ 2 & 1 & 1/2 \\ 2 & 2 & 1 \end{pmatrix}$$

(3) Calculate the weight coefficient of each index and carry out the consistency test

The weight of each layer of the judgment matrix is calculated by using the root method. The formula $CI = \frac{\lambda_{\max} - n}{n - 1}$ [10] was used to test the consistency. When the random consistency ratio $CR < 0.10$ is considered, the judgment matrix is satisfied.

$CR = \frac{CI}{RI}$. First, calculate the product of each row's element of the judgment matrix C .

$$M_i = \prod_{j=1}^n c_{ij} \quad (i = 1, 2, 3, \dots, n) \quad (1)$$

Second, calculate n root of each row.

$$\overline{w}_i = \sqrt[n]{M_i} \quad (2)$$

Third, have a normalized processing of vector $\overline{W} = (\overline{w}_1, \overline{w}_2, \overline{w}_3, \dots, \overline{w}_n)^T$.

$$w_i = \frac{\overline{w}_i}{\sum_{j=1}^n \overline{w}_j} \quad (3)$$

w_i is the weight coefficient of each index.

$$W = (w_1, w_2, w_3, \dots, w_n)^T$$

Fourth, calculate the maximum eigenvalue λ_{\max} of the matrix.

$$\lambda_{\max} = \frac{1}{n} \sum_{i=1}^n \frac{(CW)_i}{w_i} \quad (4)$$

Fifth, perform the consistency check.

$$CI = \frac{\lambda_{\max} - n}{n - 1} \quad (5)$$

In the formula, n is the order of the judgment matrix.

In addition, which is shown in Table 3 is obtained by looking up the standard table of the average consistency check.

Table 3. Standard Value of RI

n	2	3	4	5	6	7	8	9	10
RI	0.00	0.58	0.90	1.12	1.24	1.32	1.14	1.45	1.49

Therefore, the results can be obtained according to the judgment matrix are as follows:

$$W_i = \begin{pmatrix} 0.08 \\ 0.14 \\ 0.06 \\ 0.29 \\ 0.43 \end{pmatrix}, CI = 0.0497 ; RI = 1.12 ; CR = 0.0443$$

$$W_{1i} = \begin{pmatrix} 0.16 \\ 0.13 \\ 0.36 \\ 0.35 \end{pmatrix}, CI = 0.0069 ; RI = 0.90 ; CR = 0.0077$$

$$W_{2i} = \begin{pmatrix} 0.10 \\ 0.40 \\ 0.32 \\ 0.18 \end{pmatrix}, CI = 0.0440 ; RI = 0.90 ; CR = 0.0489$$

$$W_{3i} = \begin{pmatrix} 0.61 \\ 0.12 \\ 0.27 \end{pmatrix}, CI = 0.0368 ; RI = 0.58 ; CR = 0.0634$$

$$W_{4i} = \begin{pmatrix} 0.31 \\ 0.49 \\ 0.20 \end{pmatrix}, CI = 0.0268 ; RI = 0.58 ; CR = 0.0462$$

$$W_{5i} = \begin{pmatrix} 0.20 \\ 0.31 \\ 0.49 \end{pmatrix}, CI = 0.0268 ; RI = 0.58 ; CR = 0.0462$$

The MATLAB is used for the calculation of $\lambda_{i \max}$. For example, data input and calculation results of $\lambda_{i \max}$ and $\lambda_{1i \max}$ is shown in Figure 5 and Figure 6.

```
>> clear all;
A=[1 1/3 2 1/4 1/5;3 1 3 1/3 1/4;1/2 1/3 1 1/4 1/5;4 3 4 1 1/2;5 4 5 2 1]
E=eig(A)

A =

    1.0000    0.3333    2.0000    0.2500    0.2000
    3.0000    1.0000    3.0000    0.3333    0.2500
    0.5000    0.3333    1.0000    0.2500    0.2000
    4.0000    3.0000    4.0000    1.0000    0.5000
    5.0000    4.0000    5.0000    2.0000    1.0000

E =

    5.1988
    0.0145 + 1.0046i
    0.0145 - 1.0046i
   -0.1138 + 0.1297i
   -0.1138 - 0.1297i
```

Figure 5. Data Input and Calculation Results of $\lambda_{i \max}$

```
>> clear all;
A=[1 1 1/2 1/2;1 1 1/3 1/3;2 3 1 1;2 3 1 1]
E=eig(A)

A =

    1.0000    1.0000    0.5000    0.5000
    1.0000    1.0000    0.3333    0.3333
    2.0000    3.0000    1.0000    1.0000
    2.0000    3.0000    1.0000    1.0000

E =

    4.0206
   -0.0103 + 0.2877i
   -0.0103 - 0.2877i
   -0.0000
```

Figure 6. Data Input and Calculation Results of $\lambda_{1i \max}$

Since the values of CR are less than 0.10, the matrix is satisfied. That is to say, the matrix has a certain practical application through the expert consultation method. Namely, the weight of each factor in the coordination of the organization is w_i . In the supervision organization coordination management interface, organization target management accounted for 8%, organization structure accounted for 14%, organizational culture system accounted for 6%, the effect of communication accounted for 29%, and coordination modes accounted for 43%. In the organization target management interface, clarity of organizational goals is 16%, rationality of target decomposition is 13%,

hierarchy of organizational goals is 36%, and the severity of the goal's conflict is 35%.The rest can be done in the same manner. Each index in each interface has a reasonable proportion of weight.

In the process of actual engineering project management, according to the weight coefficient, the importance of each item in the coordination of the supervision organization can be determined and organizational efficiency can also be improved.

4. Case Analysis

Yuexiu Hangzhou star of the Phoenix project is located in Yantai high tech Zone on the eastern side of the blue sea science and technology CBD. The ancient Pier Road to the East is the main channel for the construction of the project. The north of the project is a river 35 meters wide which is waiting for the construction. The west of the project is residential land which is currently not constructed. Plot south of the road have been constructed in the second half of 2014. Based on the structure of the supervision organization of the project, the comprehensive evaluation of the various indicators is analyzed.

The organization chart of the project supervision organization is shown in Figure 7.

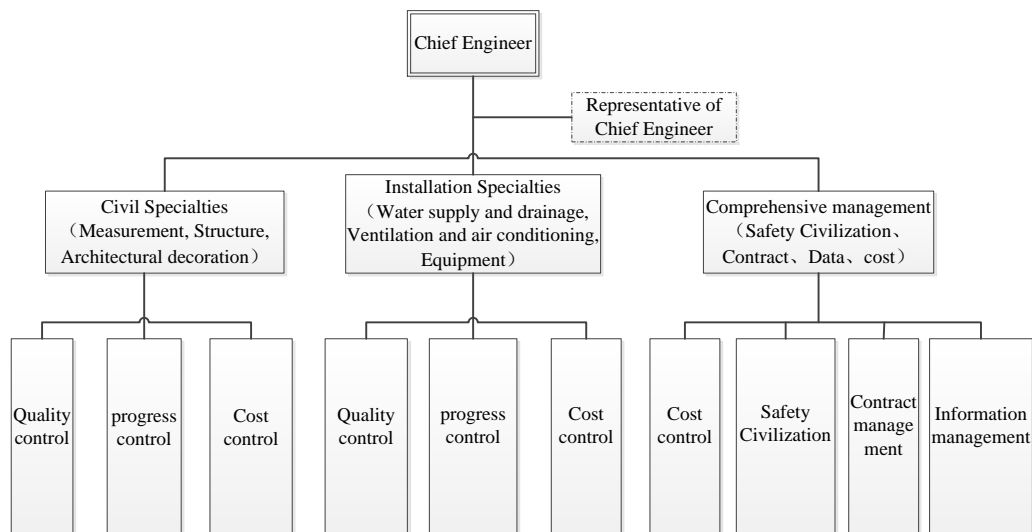


Figure 7. Supervision Organization Chart

4.1. Comprehensive Evaluation of Supervision Organization and Coordination Based on F-AHP

In this paper, the construction of the supervision organization coordination evaluation index system is a three layer structure of the index system. Most of these evaluation indexes are fuzzy. Therefore, based on the fuzzy theory, a fuzzy comprehensive evaluation model of three layers is constructed. In view of the case of this paper, the Phoenix Project of Hangzhou Yuexiu star, the fuzzy analytic hierarchy process is adopted to evaluate the coordination of the project. Its concrete evaluation steps are as follows:

(1)Make certain the comprehensive evaluation factor set $U = \{U_1, U_2, \dots, U_5\}$.

(2)For the first level evaluation: make comprehensive evaluation on each evaluation factor set.

1) Comment set: $V = \{V_1, V_2, \dots, V_5\}$.It means excellent, good, general, poor and very poor.

2) Weight index set: $\tilde{A}_i = \{a_{i1}, a_{i2}, \dots, a_{ij}\}$.Calculation results are as follows:

$$\tilde{A} = (0.08 \quad 0.14 \quad 0.06 \quad 0.29 \quad 0.43)$$

$$\tilde{A}_1 = (0.16 \quad 0.13 \quad 0.36 \quad 0.35)$$

$$\tilde{A}_2 = (0.10 \quad 0.40 \quad 0.32 \quad 0.18)$$

$$\tilde{A}_3 = (0.61 \quad 0.12 \quad 0.27)$$

$$\tilde{A}_4 = (0.31 \quad 0.49 \quad 0.20)$$

$$\tilde{A}_5 = (0.20 \quad 0.31 \quad 0.49)$$

3) According to the above evaluation set, the evaluation index of $U_1 \sim U_5$ was carried out and the fuzzy evaluation matrix \tilde{R}_i is constructed.

$$\tilde{R}_1 = \begin{pmatrix} 0.35 & 0.25 & 0.18 & 0.10 & 0.12 \\ 0.20 & 0.35 & 0.25 & 0.15 & 0.05 \\ 0.18 & 0.20 & 0.20 & 0.21 & 0.21 \\ 0.10 & 0.35 & 0.25 & 0.20 & 0.10 \end{pmatrix}$$

$$\tilde{R}_2 = \begin{pmatrix} 0.15 & 0.25 & 0.20 & 0.30 & 0.10 \\ 0.08 & 0.22 & 0.20 & 0.40 & 0.10 \\ 0.10 & 0.15 & 0.20 & 0.35 & 0.20 \\ 0.25 & 0.16 & 0.15 & 0.34 & 0.10 \end{pmatrix}$$

$$\tilde{R}_3 = \begin{pmatrix} 0.25 & 0.15 & 0.30 & 0.20 & 0.10 \\ 0.30 & 0.25 & 0.20 & 0.15 & 0.10 \\ 0.20 & 0.22 & 0.20 & 0.28 & 0.10 \end{pmatrix}$$

$$\tilde{R}_4 = \begin{pmatrix} 0.20 & 0.15 & 0.20 & 0.20 & 0.25 \\ 0.30 & 0.10 & 0.15 & 0.25 & 0.20 \\ 0.18 & 0.20 & 0.22 & 0.30 & 0.10 \end{pmatrix}$$

$$\tilde{R}_5 = \begin{pmatrix} 0.20 & 0.35 & 0.30 & 0.10 & 0.05 \\ 0.20 & 0.16 & 0.20 & 0.34 & 0.10 \\ 0.10 & 0.15 & 0.20 & 0.35 & 0.20 \end{pmatrix}$$

4) According to FUZZY theory, MATLAB is used to synthesize the fuzzy matrix (\wedge, \vee) , and the comprehensive evaluation vector of U_i is \tilde{B}_i ($\tilde{B}_i = \tilde{A}_i \circ \tilde{R}_i = (b_{i1}, b_{i2}, \dots, b_{i5})$). The results are as follows:

$$\tilde{B}_1 = \tilde{A}_1 \circ \tilde{R}_1 = (0.18 \quad 0.35 \quad 0.25 \quad 0.21 \quad 0.21)$$

$$\tilde{B}_2 = \tilde{A}_2 \circ \tilde{R}_2 = (0.18 \quad 0.22 \quad 0.20 \quad 0.40 \quad 0.20)$$

$$\tilde{B}_3 = \tilde{A}_3 \circ \tilde{R}_3 = (0.25 \quad 0.22 \quad 0.30 \quad 0.27 \quad 0.10)$$

$$\tilde{B}_4 = \tilde{A}_4 \circ \tilde{R}_4 = (0.30 \quad 0.20 \quad 0.20 \quad 0.25 \quad 0.25)$$

$$\tilde{B}_5 = \tilde{A}_5 \circ \tilde{R}_5 = (0.25 \quad 0.25 \quad 0.25 \quad 0.35 \quad 0.25)$$

(3) For the second level evaluation: the built fuzzy matrix is as follows:

$$\tilde{R} = \begin{pmatrix} \tilde{B}_1 \\ \tilde{B}_2 \\ \tilde{B}_3 \\ \tilde{B}_4 \\ \tilde{B}_5 \end{pmatrix} = \begin{pmatrix} 0.18 & 0.35 & 0.25 & 0.21 & 0.21 \\ 0.18 & 0.22 & 0.20 & 0.40 & 0.20 \\ 0.25 & 0.22 & 0.30 & 0.27 & 0.10 \\ 0.30 & 0.20 & 0.20 & 0.25 & 0.25 \\ 0.25 & 0.25 & 0.25 & 0.35 & 0.25 \end{pmatrix}$$

$$\text{Accordingly, } \tilde{B} = \tilde{A} \circ \tilde{R} = (0.29 \quad 0.25 \quad 0.25 \quad 0.35 \quad 0.25)$$

The results can be obtained according to the principle of maximum relevancy after the above calculation results are normalized:

$$B = \max (b_1, b_2, b_3, b_4, b_5) = \max (0.21, 0.18, 0.18, 0.25, 0.18) = 0.25$$

According to the maximum principle of membership, the comprehensive evaluation of the supervision organization coordination of the project is poor. We can know the problem of engineering supervision organization by analyzing the result of the fuzzy matrix synthesis. The interface of U_1 is good, and the interface of U_2 and U_5 is poor, the evaluation of U_3 is good, and U_4 is excellent. That is to say, the communication of the supervision organization is very good; comparatively speaking, the organization target management and organizational culture system is also more reasonable; in the aspects of organization structure and the selection of coordination methods, the organization needs to be improved. Therefore, we can put forward reasonable and feasible suggestions according to the specific circumstances of the project.

4.2. Suggestions on Improving the Coordination of the Project Supervision Organization

About the supervision organization, the concrete content of the improvement can be determined by R_2 matrix and R_5 matrix. The evaluation of each index in the organization structure is poor according to the maximum principle of membership. Therefore, it is necessary to readjust the structure of the organization according to the contents of the various indicators in order to improve the efficiency of the organization. In the interface of the coordination, the evaluation of the wide range of coordination content

is good, but the evaluation of the principle of coordination and the method of the coordination is poor. It can be concluded that there are some problems in the coordination of the project. In addition, the way of the coordination also needs to be further improved.

Therefore, according to the specific circumstances of the project, we can put forward some suggestions from two aspects: the organization structure setting and coordination modes.

(1) Organization structure setting

First of all, the management range of the supervision organization of Yuexiu Hangzhou star of the Phoenix project is small. Therefore, the management chain is so long that the management process is confused. Secondly, the supervision organization chart shows that there is no clear boundary between the tasks of the various organizations. Because of the lack of a clear responsibility of the right system and the organization of the command is not uniform, so that the work efficiency is greatly reduced. So the following suggestions can be put forward for the construction of the supervision organization structure:

1) To formulate a reasonable structure of the supervision organization and determine the management level of the content, so as to ensure the unity of the organization.

2) A clear responsibility system is set up to form a restrictive relationship among organizations at all levels of management, which makes the whole balance of the whole organization.

3) To separate the external supervision personnel from the internal staff, thereby avoiding the unnecessary disputes and conflicts caused by the two party's responsibility and guarantying independence of execution and supervision.

(2) Coordination modes

In addition to the improvement of the structure of the organization, the project also needs to improve the scientific nature of coordination. The following two suggestions are put forward for the improvement of coordination methods:

1) The project needs to develop a clear principle system to ensure the organization's responsibilities.

2) Different coordination methods are used in the face of different objects. Draw on the experience of the work and form a proper coordination method.

In a word, the combination of F-AHP and AHP can be used to determine the efficiency of specific management organization. So as to improve the efficiency of project management, the improvement method is put forward.

5. Conclusions and Outlook

The research on engineering project management has been paid more and more attention by many scholars. Along with the development of science and technology, the technology and the specialty of the project construction are more and more complex. So the role of the organization and coordination has become an indispensable existence. The main results of this paper are as follows:

(1) On the basis of comprehensive analysis of the various understandings of the coordination of the organization, this paper defines the research scope of the coordination of the supervision organization. The whole frame which has laid a good theoretical foundation for the whole article is clear;

(2) According to the content of the coordination of the supervision organization, five evaluation indexes are determined, including organization target management, organization structure, and organizational culture system, effect of communication and

coordination modes. In this paper, the AHP is used to determine the proportion of the five indexes in the interface of supervision organization coordination;

(3) In this paper, the fuzzy evaluation matrix is constructed according to the five indexes of the specific case, and the coordination of the supervision organization is poor. This research can reflect the problems in the present engineering project supervision organization coordination, and some suggestions for the improvement of the project are put forward;

(4) That AHP and F-AHP are combined to make a qualitative and quantitative analysis of the coordination of the supervision organization makes the research of this topic is more practical significance. It can greatly improve the efficiency of the project management to use the two methods to track and manage the organization and coordination of the project.

In the future, we should further explore the following aspects:

(1) The index system is based on the analysis of the content of organization coordination in this paper. There is still a lack of specific indicators for the different needs of a particular organization. How to make full use of the research results is still worth studying

(2) The efficiency evaluation of the coordination of the supervision organization can establish a set of system. And the combination of engineering management and information management method makes the supervision organization coordination information. So it can effectively improve the efficiency of supervision organization coordination.

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