The Evaluation Model of Construction Enterprises Culture Development Based on FAHP

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Abstract. An evaluation method is presented to evaluate the effect of construction enterprises culture development. This paper gives a brief introduction to the connotation and path of construction enterprises culture, also the project-oriented characteristics of it. On this basis, the evaluation index system is given by the literature. Then the disadvantages of AHP are enumerated, and a more effective method of fuzzy analytical hierarchy process (FAHP) is presented, which is proved to be effective by a case.

Keywords. Evalution model; construction enterprises; FAHP

1 Introduction

As project-oriented enterprise, construction enterprises must develop its own unique culture, through strengthening cultural construction, and enhance the core competitiveness, to create a good external environment for the development.

The aim of the evaluation is to analyses the current situation of the development of enterprise culture, inspects the scientific and rationality, finds the problem, and determines the advantages and disadvantages of the development of enterprise culture. But how to evaluate scientifically the effect of the construction enterprise culture development needs a scientific, simple and effective method. And also a set of evaluation indexes must be presented.

Based on a large amount of references and materials, the relevant study is confined to non-construction enterprises. So it is necessary that the study combined with the characteristics of the culture of the construction enterprise.

The valuation of construction enterprise culture development is a systematic project, each part of the system to be decomposed at each level and to be evaluated respectively, and then each evaluation resulted integration, finally the corporate culture of the whole system of evaluation results to be obtained. In this paper, it is discussed the influence of enterprise culture construction on the performance of the activities of the enterprise through the establishment of evaluation model.

2 Construction enterprise culture development connotation and path

2.1 Connotation

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Construction enterprise culture, as a kind of organization culture, is the formation of long-term stability of the enterprise cultural values and historical traditions and unique management style, passes through in the enterprise daily life and production and operation activities, rooted in the hearts of employees. As the enterprise system construction is the cultural construction, more and more attention has been paid to the positive role played by the Enterprises culture on the formation of internal cohesion and external competitiveness. In order to maintain the development of enterprise, it is importance to the cultural construction of construction enterprises, in particular, to build an excellent corporate culture in line with the trend of the times[1].

2.2 Path

Construction enterprise culture is a complex system, including many sub system. Through literature study, the path of construction enterprise culture development can be from the project culture development, system culture development, enterprise image etc. Meanwhile, bring the CIS strategy into construction industry corporate, to explain how the corporate image is build.

3 The evaluation index system of enterprise culture development

3.1 Establishment Principle

In order to make the evaluation index system meet the needs of the target, the establishment of evaluation index to comply with the principle of objectivity, scientific principles, and operational principles [2].

3.1.1 The Principle of Objectivity

The evaluation index system should be fully and truly reflect the essence and the enterprise culture appraisal targets, index system designed can reflect the overall, based on objective facts, the evaluation results must reflect the real situation of enterprise culture.

3.1.2 The Principle of Operability

When the evaluation index system established, it is considered that the evaluation index system is implemented, ensure the evaluation work smoothly, and is enough accuracy.

3.1.3 The Principle of Science

The scientific principle requires the use of scientific classification, and the different influence factors are classified. Then the analysis of different influence factors on the construction enterprise culture development, scientifically define the scope of enterprise culture system. In addition, the coupling relationship between the evaluation index should be reduced as much as possible, the structure is as clear as possible, which is the best combination point of the evaluation index system of authenticity and operability.

3.2 Index System

In this paper, through the literature statistics method to determine the enterprise culture evaluation index system[3,4,5,6], according to the content of enterprise culture, combined with the present situation of the construction enterprise culture development, the construction enterprise culture development of performance evaluation index system has been established and is shown in Table 1. The index system includes constitute three systems.

Table 1. Index of enterprise culture development effect evaluation

Target layer (A)	One class index(B)	Two level index(R)
Index System	Spiritual culture development B_1	Degree of members recognition of enterprise values(r_{11})
		Emphasis on leadership and staff of corporate culture(r_{12})
		Enterprise development clear goal or not (r_{13})
	Behavior culture development B_2	Enterprise custom unique (r_{21})
		Internal atmosphere and staff image(r_{22})
		The validity of enterprise external public relations,publicity(r_{23})
		The proportion of excellent engineering (r_{24})
	Visual culture development B_3	The construction site image(r_{31})
		Business office environment(r_{32})
		Unified daily necessities design rationality (r_{33})
	Human resources development B_4	The proportion of the high degree of talent(r_{41})
		Employee satisfaction of personal development(r_{42})
		Talent exchange activities (r_{43})
		Training of personnel capital (r_{44})
	Project culture development B_5	Project organization structure rationality(r_{51})
		The project manager performance(r_{52})
		The project team spirit (r_{53})
		Project innovation strategy (r_{54})
	Material culture development B_6	The facilities equipment(r_{61})
		The facilities effectiveness(r_{62})

3.2.1 Elements of the System

Its function is the main aspect of the construction of enterprise culture or explicit feature. According to the content of enterprise culture from 6 layers, namely, the construction of spiritual culture, behavior culture construction, material culture construction, human resource management, information construction, the enterprise image construction.

3.2.2 Index of the System

Its function is to refine each element as an index, the enterprise culture factor so as to be more intuitive and quantitative embody explicit feature, it is the basis for calculating the corporate culture status, which consists of 20 indexes component.

3.2.3 Operating of the System

Its function is to explain the calculation method of the specific contents and quantitative indexes of qualitative indicators.

4 The evaluation method of enterprise culture development

It is a complex multi-object decision making problem of the evaluation of enterprise culture development. The commonly methods, such as linear weight method, analytic hierarchy process (AHP), multi objective mathematical inductive method, and the fuzzy comprehensive evaluation method[7,8]. Establishing judgment matrix is the key to AHP, the reasonable and scientific of the judgment matrix has an important influence on the AHP application. There are some deficiencies in the AHP application, such as it is difficult to check the consistency of judgement matrix, etc..

Because of the lack of AHP, fuzzy consistent matrix is applied to the evaluation system, the fuzzy consistent matrix and the fuzzy comprehensive evaluation method combined to form a new, relatively scientific and reasonable evaluation method, which is Fuzzy Analytic Hierarchy Process Based on fuzzy consistent matrix.

4.1 Fuzzy Consistent Matrix[9]

Matrix $R = (r_{ij})_{n \bullet n}$, if: $0 \le r_{ij} \le 1, (i = 1,2,3,\cdots,n, j = 1,2,3,\cdots,n)$, then matrix R is a fuzzy matrix. The fuzzy matrix $R = (r_{ij})_{n \bullet n}$, if: $\forall i, j, k$ and $r_{ij} = r_{ik} + r_{jk} + 0.5$, then R is a fuzzy consistent matrix. The fuzzy matrix $R = (r_{ij})_{n \bullet n}$, if: $r_{ij} + r_{ji} = 1$, then R is a Fuzzy complementary matrix.

Based on the fuzzy consistent matrix in FAHP, the weight ω of evaluation factors can be obtained. Determine the fuzzy matrix according to Eq. (1).

$$\omega_i = \frac{1}{n} - \frac{1}{2a} + \frac{1}{na} \bullet \sum_{k=1}^{1} r_{ik}, i \in \Omega.$$

(1)

4.2 The Model of the Fuzzy Comprehensive Evaluation [10]

There are n index factors, recorded as u1,u2,u3,$\cdots$, un, then the n evaluation factors constitute one of a finite set of evaluation factors:

$$U = \{u_1, u_2, u_3, \cdots, u_n\}.$$

If according to the need of evaluation results will be divided into m grade, recorded as v1,v2,v3,$\cdots$, vm, then obtain a finite set of evaluation results:

$$V = \{v_1, v_2, v_3, \cdots, v_m\}.$$

The degree of importance of actual evaluation work of the evaluation factors are not the same, the evaluation factor set is actually a collection of factors on the U of a fuzzy set W:

$$W = \{w_1, w_2, w_3, \cdots, w_m\}$$ w_i for an element in the W, and $w_i \in [0,1]$, $\sum_{i=1}^{n} w_i = 1$.

The fuzzy comprehensive evaluation is the evaluation factors set U on a fuzzy set of fuzzy relation W after R transform for the evaluation of the result set V on a fuzzy set B(Eq. 2):

$$B = W \bullet R$$

(2)

5 The case study

For a construction enterprise culture construction, carrying out a comprehensive evaluation based on FAHP. 10 experts invited at the scene, invest thoroughly enterprise culture construction, then the comprehensive evaluation of the various factors of the evaluation index. The evaluation of each index score by the experts is as shown in Table 2.

According to the evaluation index system and method in this paper, the establishment of fuzzy matrix and the weight of each evaluation factor as shown in Table 3 - Table 9.

According to the principle of maximum degree of membership, the performance evaluation of construction enterprise culture as shown in Tab.10. From Table 10 can intuitively see the advantages and disadvantages of enterprise in the cultural construction, to the building of enterprise culture in the future have a definite object in view, provides guidance for the construction of enterprise culture construction.

Tab.2 Scores of the index given by experts

Index	Comment				
	Excellent	Good	Medium	Poor	Very poor
r_{11}	0	3	6	1	0
r_{12}	1	5	2	1	1
r_{13}	1	3	3	2	1
r_{21}	4	2	2	1	1
r_{22}	3	3	2	1	1
r_{23}	2	5	2	1	0
r_{24}	6	3	1	0	0
r_{31}	7	2	1	0	0
r_{32}	5	4	1	0	0
r_{33}	0	6	3	1	0
r_{41}	6	3	1	0	0
r_{42}	1	5	3	1	0
r_{43}	3	4	2	1	0
r_{44}	4	3	2	1	0
r_{51}	1	5	3	1	0
r_{52}	1	4	3	1	1
r_{53}	0	5	4	1	0
r_{54}	0	4	5	1	0
r_{61}	1	1	5	2	1
r_{62}	1	0	5	3	1

Tab.3 A-B judging matrix

A	B_1	B_2	B_3	B_4	B_5	B_6	ω_i
B_1	0.5	0.8	0.9	0.8	0.7	0.7	0.260
B_2	0.2	0.5	0.6	0.5	0.4	0.4	0.140
B_3	0.1	0.4	0.5	0.4	0.5	0.5	0.127
B_4	0.2	0.5	0.6	0.5	0.6	0.6	0.167
B_5	0.3	0.6	0.5	0.4	0.5	0.5	0.153
B_6	0.3	0.6	0.5	0.4	0.5	0.5	0.153

Tab.4 B1-R judging matrix

B_1	r_1	r_2	r_3	ω_i
r_1	0.5	0.4	0.5	0.300
r_2	0.6	0.5	0.6	0.400
r_3	0.5	0.4	0.5	0.300

Tab.5 B2-R judging matrix

B_2	r_1	r_2	r_3	r_4	ω_i
r_1	0.5	0.1	0.2	0.1	0.067
r_2	0.9	0.5	0.6	0.5	0.333
r_3	0.8	0.4	0.5	0.4	0.267
r_4	0.9	0.5	0.6	0.5	0.333

Tab.6 B3-R judging matrix

B_3	r_1	r_2	r_3	ω_i
r_1	0.5	0.9	0.9	0.600
r_2	0.1	0.5	0.5	0.200
r_3	0.1	0.5	0.5	0.200

Tab.7 B4-R judging matrix

B_4	r_1	r_2	r_3	r_4	ω_i
r_1	0.5	0.5	0.4	0.3	0.200
r_2	0.5	0.5	0.4	0.3	0.200
r_3	0.6	0.6	0.5	0.4	0.267
r_4	0.7	0.7	0.6	0.5	0.333

Tab.8 B5-R judging matrix

B_5	r_1	r_2	r_3	r_4	ω_i
r_1	0.5	0.2	0.5	0.4	0.183
r_2	0.8	0.5	0.8	0.7	0.383
r_3	0.5	0.2	0.5	0.4	0.167
r_4	0.6	0.3	0.6	0.5	0.251

Tab.9 B6-R judging matrix

B_6	r_1	r_2	ω_i
r_1	0.5	0.9	0.900
r_2	0.1	0.5	0.100

Tab.10 Evaluation results of construction industry enterprise culture development

Index	Comments of subordinate degree					Result
	Excellent	Good	Medium	Qualified	Unqualified	
B_1	0.070	0.380	0.350	0.130	0.070	Good
B_2	0.380	0.347	0.167	0.067	0.400	Unqualified
B_3	0.520	0.320	0.140	0.020	0	Excellent
B_4	0.353	0.367	0.200	0.080	0	Good
B_5	0.057	0.437	0.369	0.100	0.038	Good
B_6	0.100	0.090	0.500	0.210	0.100	Medium
A	0.221	0.330	0.303	0.107	0.095	Good

Acknowledgement

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