STUDY ON KNOWLEDGE UNION BASED ON FUZZY SYNTHESIZED EVALUATION

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Abstract

According to the result of investigation, we obtain the integrated performance concerned of six kinds of capability management index and eight kinds of target management index. Based on the synthesized analysis, we put forward the mathematic model to discuss the fuzzy synthesized evaluation. We construct the relative tree about the elements and give an efficient evaluation on three different grades according to this model.

1. Introduction

Knowledge alliance is one of the strategic alliances and it analyzes the motivation and content of alliance based on knowledge [1]. The main

input resources in the knowledge alliance are invisible assets such as patent, technical skill, and experience and lessons etc. The output is mainly tangible assets such as the economic benefit tested by short-term test market and huge market opportunity etc., and intangible asset is difficult to evaluate such as new knowledge, new technical skill and lessons. So, it is very difficult to give an accurate evaluation of comprehensive performance of the knowledge alliance [2].

The analysis to the comprehensive performance of the knowledge alliance involving many factors and there is big fuzziness of the factor index and their relationship. Therefore, the aim of the model given in this paper is to give an accurate assessment to the comprehensive performance of the knowledge alliance.

2. The Fuzzy Comprehensive Evaluation Model

The fuzzy comprehensive evaluation is a mathematical tool of combined decision and is a comprehensive evaluation of things using fuzzy transform theory and maximum subordination principle [3, 4]. This model can be divided into the following several steps.

2.1. Establishment of evaluation index factor set

Let U be the set of various main factors of evaluation objects, and

$$U = \{u_1, u_2, u_3, ..., u_m\}.$$

The factor U embodying the knowledge alliance tissue performance includes ability management index and target management index, such as the ability of product technology's application, work efficiency, technological innovation capability, market strategy, education and training and the ability of comprehensive management; the attendance rate of employee's exchange meeting, attendance rate of manager's exchange meeting, attendance rate of education training, regulation measures quality, knowledge sharing rate, utilization ratio of communication tool, brand influence and cooperative consciousness of organizers etc.

2.2. Establishment of evaluation factors' weight set

Endow the different weight according to the importance degree of every factor and then compose the weight set A, denoted by $A = \{a_1, a_2, a_3, ..., a_m\}$. The weight set can be made by using the outcome of sampling investigation of large sample.

2.3. Establishment of evaluation set

Establish the comprehensive evaluation set V on the basis of concrete evaluation standard, denoted by $V = \{v_1, v_2, v_3, ..., v_n\}$.

2.4. Do the singular factor fuzzy evaluation and establish the single factor fuzzy evaluation matrix R

We can obtain the evaluation set $r_i = (r_{i1}, r_{i2}, ..., r_{in})$ of the ith factor, where r_{ij} is membership degree of thing to evaluation grade v_j $(j = 1, 2, ..., n)$ obtained from factor u_i $(i = 1, 2, ..., m)$ and r_i is fuzzy subset of evaluation set. Then we obtain a fuzzy function f from U to V, and it can establish a fuzzy relationship R, that is evaluation matrix, obtained by

$$R = \begin{pmatrix} r_{11} & r_{12} & \cdots & \cdots & r_{1n} \\ r_{21} & r_{22} & \cdots & \cdots & r_{2n} \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ r_{m1} & r_{m2} & \cdots & \cdots & r_{mn} \end{pmatrix}.$$
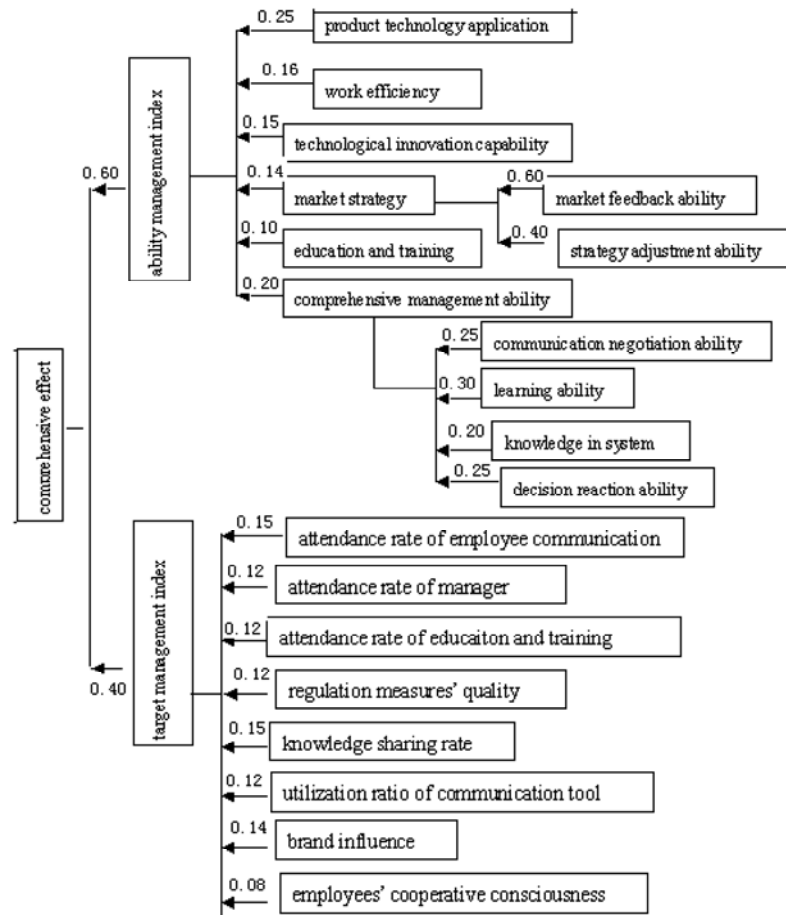
2.5. Fuzzy transform operation

When A and R are given, we do evaluate comprehensively and obtain the comprehensive evaluation set D,

$$D = A \otimes R = \{d_1, d_2, d_3, ..., d_n\}.$$

Here d_x $(x = 1, 2, ..., n)$ is the comprehensive evaluation result.

3. Construct the Factors Relationship Tree of
the Comprehensive Evaluation

In this paper, we make investigation to knowledge alliance of the electronic publishing technology company and want to study the application of fuzzy comprehensive evaluation model in performance evaluation of the knowledge alliance. The organizational performance mainly depends on six ability management indexes and eight target management indexes according to a lot of questionnaire investigation to the knowledge alliance tissue. Dividing these factors and constructing the relationship tree, see, Figure 1.

Figure 1. The factors relationship tree of comprehensive evaluation.

4. The Comprehensive Evaluation Performance at all Levels

The evaluation set V concludes four tissues in knowledge alliance, that is tissue 1, tissue 2, tissue 3 and tissue 4, denoted by $V = \{v_1, v_2, v_3, v_4\}$. Based on the factors relationship tree we apply three-grade evaluation model.

4.1. First-grade evaluation

Do the single factor evaluation to the survey data and obtain the market strategy evaluation matrix R_1^t and the comprehensive management ability evaluation matrix R_2^t, respectively. Then we can obtain the calculation formula $D' = A' \otimes R'$ of the first-grade evaluation according to fuzzy transform operation formula.

Table 1. The market strategy matrix

Tissue / Elements	Tissue 1	Tissue 2	Tissue 3	Tissue 4
The market feedback ability	0.681	0.860	0.981	0.806
The strategy adjustment ability	0.746	0.560	0.900	0.831

The comprehensive evaluation of the market strategy is $D_1' = A_1' \otimes R_1'$ = (0.815, 0.740, 0.911, 0.816). The comprehensive management ability evaluation matrix is the following:

Table 2. The comprehensive management ability evaluation matrix

Tissue / Elements	Tissue 1	Tissue 2	Tissue 3	Tissue 4
Communication negotiation ability	0.904	0.806	0.950	0.940
Learning ability	0.880	0.930	0.975	0.915
Regulation measures' quality	0.864	0.676	0.938	0.906
Decision reaction ability	0.825	0.760	0.940	0.900

The comprehensive evaluation of the comprehensive management ability is:

$$D_2' = A_2' \otimes R_2' = (0.869,\ 0.806,\ 0.953,\ 0.916).$$

4.2. Second-grade evaluation

We obtain the ability management evaluation matrix R_1'' and target management evaluation matrix R_2'' according to the single factor evaluation of the survey data and the first-grade evaluation result, respectively. Then we obtain the calculation formula of the second-grade evaluation by using the fuzzy transform operation, that is, $D'' = A'' \otimes R''$. The ability management evaluation matrix is the following:

Table 3. The ability management evaluation matrix

Tissue / Elements	Tissue 1	Tissue 2	Tissue 3	Tissue 4
Product technology application ability	0.939	0.880	0.969	0.944
Work efficiency	0.852	0.847	0.894	0.865
Technological innovation capability	0.845	0.870	0.900	0.829
Market strategy	0.815	0.740	0.911	0.816
Education and training	0.876	1.000	0.854	0.874
Comprehensive management ability	0.869	0.806	0.953	0.916

The comprehensive evaluation of the ability management is

$$D_1'' = A_1'' \otimes R_1'' = (0.873,\ 0.851,\ 0.924,\ 0.884).$$

The target management evaluation matrix is the following:

Table 4. The target management evaluation matrix

Tissue / Elements	Tissue 1	Tissue 2	Tissue 3	Tissue 4
Attendance rate of employee communication	0.853	0.888	0.824	0.831
Attendance rate of manager	0.873	0.787	0.824	0.760
Attendance rate of education and training	0.913	0.880	0.950	0.889
Regulation measures' quality	0.771	0.787	0.788	0.828
Knowledge sharing rate	0.904	0.900	0.975	0.925
Utilization ratio of communication tool	0.932	0.802	0.971	0.909
Brand influence	0.767	0.760	0.786	0.737
Employees' cooperative consciousness	0.880	0.790	0.970	0.850

The comprehensive evaluation of the target management is

$$D_2'' = A_2'' \otimes R_2'' = (0.860,\ 0.828,\ 0.882,\ 0.841).$$

4.3. Third-grade evaluation

We obtain the evaluation matrix R''' of comprehensive performance according to the second-grade evaluation and get the calculation formula according to fuzzy transform operation formula as following:

$$D''' = A''' \otimes R'''.$$

The comprehensive performance evaluation matrix R''' denoted by

Tissue / Elements	Tissue 1	Tissue 2	Tissue 3	Tissue 4
The ability management index	0.873	0.851	0.924	0.884
The target management index	0.860	0.828	0.882	0.841

The comprehensive performance evaluation is

$$D''' = A''' \otimes R''' = (0.868, \ 0.842, \ 0.907, \ 0.867).$$

From above result of the comprehensive performance evaluation we can know that the highest comprehensive performance of the four tissues is tissue 3 and the lowest comprehensive performance is tissue 2, which is basically same to our investigation results. That is to say that the evaluation to the comprehensive performance of the knowledge alliance using fuzzy comprehensive evaluation is effective.

The study to the knowledge alliance is only primary and there are many fundamental important theories and practical problems need further research. The main aim of the knowledge alliance is sharing knowledge, constructing knowledge jointly and innovating knowledge jointly, but the understanding to the knowledge has larger subjectivity and so it needs further research of how to give the more effective quantitative evaluation to sharing knowledge, constructing knowledge jointly and innovating knowledge jointly using mathematical tool.

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