

Application of Fuzzy Comprehensive Model of AHP in Performance Evaluation of University Administrators in China and Abroad

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Abstract: To improve the efficiency of the performance evaluation of university administrators, this paper applies AHP fuzzy comprehensive model to this research. This paper focuses on the model composition and mathematical principle of AHP fuzzy comprehensive evaluation method, and demonstrates it with examples. The performance appraisal of three kinds of teachers in one school was taken as an example for analysis, the full score of the evaluation is 100, with 25 points assigned to each first-level index, and the scores of each second-level index are mainly no more than the first-level index. The experiment uses the “AHP+ fuzzy comprehensive evaluation method” proposed in this paper for comprehensive evaluation. The results show that by using the improved fuzzy comprehensive evaluation method proposed in this paper, the final score of A is 3.8027, which is higher than that of B and C by 0.0497 and 0.0762 respectively. According to the experiment, it can be seen that the method proposed in this paper can comprehensively, objectively and truly evaluate the performance of university administrators in practical work.

1. Introduction

Tests, also known as performance appraisal, target each employee in the company and uses a combination of quantitative and qualitative methods to assess and evaluate the impact of behavior and its contribution to the company [1]. At present, the performance evaluation methods mainly include 360-degree evaluation method, target management method, arrangement method, forced distribution method, critical event method, grade evaluation method, behavior observation scale method, behavior anchoring method, etc. These tests are qualitative, subjective and random, in particular, the weight distribution of the test indicators is very simple, and this test is difficult to distinguish. Modern resources managers need to use a scientific test where they can evaluate the quality of staff and their training work [2]. The center of human resources is to evaluate the existing science and scientifically, improve the reliability of tests and realize the purpose of human resources management. As far as the valuation's concerned, we must apply a combination of qualitative and quantitative methods, establish a scoring model, adequately determine the index's rating system and index weight, and conduct better results. Evaluations are a matter of many factors because the degree of everything is

determined by subjective judgment and the evaluation inevitably leads to ambiguities in the conclusion. Therefore, to enhance the performance, it is necessary to find a review that will deal with good things, fuzziness and subjective judgment, and other factors. AHP - Fuzzy's comprehensive oversight is proposed as the situation, which is based on performance numbers and calculations, provides a basis for testing for human resources [3]. The analytical hierarchy process (AHP) is a systematic decision-making process. Its realization process is to make a qualitative and quantitative analysis of the studied objects so that the final assessment results are fair, effective and objective. The main implementation process of AHP is as follows. Step1. Analyze the relationship between assessment factors and establish a complete hierarchical structure. Step2: Establish a judgment matrix by judging the relative importance between two factors. Step3: Quantify the values of each assessment factor and get the best choice [4]. Fuzzy comprehensive evaluation method is a systematic analysis method with "fuzziness". Using fuzzy mathematics principle, we can make a comprehensive evaluation of employee assessment. In the process of assessment, the assessors start from many assessment factors, make relatively vague judgments according to different job properties, and then make calculations through fuzzy exchange principle, so as to make correct assessment judgments [5].

2. Literature Review

MD Daniela et al. said there is no consensus in the text on the definition of management and management performance. For managers of Romanian organizations, because they have to use a higher rate of data critically, they face diverse and increasingly complex backgrounds and endogenous challenges, and are prone to record claustrophobia, so the quality of their performance is more important. The first factor affecting the level of management performance is the ability of those who carry out the management process, which is, the ability to manage, and the ability of those who decide, that is, the ability of subordinates. The management activities carried out by university principals and vice-directors of university education are evaluated as potential standards and certain components and attributes in job descriptions [6]. Sadghi, A, et al. proposed a comprehensive performance model that focused on service indicators in the supply chain of products rather than the supply chain of the appliance industry, and used neural fuzzy networks to assess performance. "Products" or "services" should be included in each supply chain, produced by upstream departments and delivered to downstream departments. More recently, due to the improvement in customer expectations, competition from companies has been replaced by competition in the supply chain, so that competition in the supply simultaneously supply of goods and services has intensified. This poses challenges to the integration of companies and the coordination of previously neglected goods, data and investment flows [7]. Shided, M.S., et al. modelled the interdependence of science on sanitation infrastructure projects and simulated and quantified their cumulative impact. This model focuses on the design and construction phase of the unit's contract and can be used by the owner, the consulting firm (owner) and/or business. The planning model is helpful for owners, consultants and businesses to manage different projects, and also be used as a basis for simulating different schemes/interventions to find the best way to treat negative effects [8]. Herman Awan, A.A. and others think they believe they are one of the four levers of control and play an important role in the organization. As the four control levers work together under the control system, research is extended to include the investigation of the state matching strategic, strategic uncertainty and the other three control levers (i.e. boundaries, diagnostic management and interactive systems). Strengthen the connection between belief systems and management performance. In the fourth quarter of 2017, a questionnaire was distributed to executives from companies or strategic businesses in Indonesia with a total of 81 respondents. The OLS regression model is used for hypothesis testing. The study found that religion correlates well with management performance, suggesting that using a better faith

system brings greater performance [9]. Weber, C.E., et al. examined the misunderstanding of the different institutions of the country and the variance of differences and differences between managers. According to the limited rationality and data-based view, this report provides a theoretical analysis of the influence and later leads to controlling misunderstandings of different countries. Data from 186 managers confirmed the negative correlation between management misunderstandings and the performance of the company's host country and provided evidence of the relevance of this model to international research and practice. In addition, according to the theory, discovery variables directly affect the decisions of data and the complexity of data processing as contextual precursors of management misunderstandings [10].

3. Methods

The AHP fuzzy structure consists of mainly two sources. The first part is the analytical hierarchy process. The second, the fuzzy comprehensive screen, is available in Figure 1. Among them, a fuzzy comprehensive assessment is carried out on the basis of an analytical hierarchy process (AHP), which complements each other and together improves the reliability and quality of the tests [11].

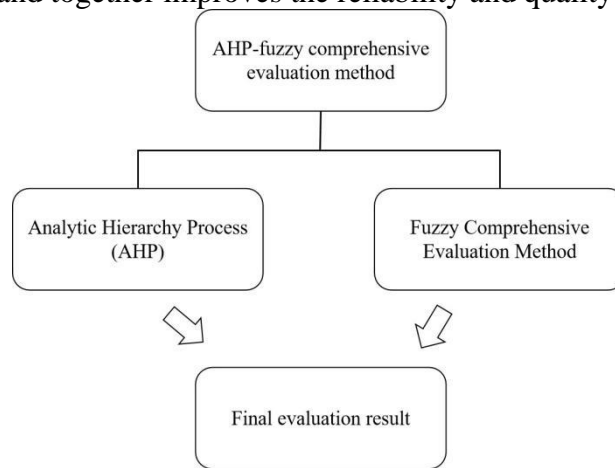


Fig.1: Ahp Fuzzy Comprehensive Valuation Model

Using an analytical hierarchy technique to determine the weight of tests will often be underway:
 Determine the hierarchical structure of the matter under investigation.

That is, the valuation product is analyzed hierarchically, a valuation index system is established, and the factors set and the subfactor set of the valuation product is specified, which is expressed underway:

$$\text{Set of factors } V = \{V_1, V_2, \dots, V_m\}, \text{ set of sub-factors } V_i = \{v_{i1}, v_{i2}, \dots, v_{ik}\}.$$

Experts used the 1-9 hour process qualitatively to explain the relative importance of each level of evaluation indicators and quantify them with the numbers to determine the pair's comparative assessment matrix, as has in Table 1 [12].

Table 1: Judgment Matrix and Meaning Table of Scale

scale	meaning
1	That means both elements are equal values compared to each other.
3	That means a season is slightly more important than others.
5	Compared to two elements, one season is obviously more important than others.
7	Compared to two elements, one season is more important than others.
9	Compared to two elements, one season is more important than others.

2, 4, 6 and 8 are the median values of the neighbouring order mentioned above. If the comparison

between indicators A and B results in A, the comparison between indicators B and A is judged as $1/a_{ij}$ [13].

The judgment matrix of pairwise comparison of the importance of each factor in set $V = \{V_1, V_2, \dots, V_m\}$ relative to the overall evaluation objective is as follows:

$$A = \begin{Bmatrix} V_1 \\ V_2 \\ \dots \\ V_m \end{Bmatrix} \begin{bmatrix} 1 & V_{12} & \dots & V_{1m} \\ V_{21} & 1 & \dots & V_{2m} \\ \dots & \dots & \dots & \dots \\ V_{m1} & V_{m2} & \dots & 1 \end{bmatrix} = (V_{ij})_{m \times m} \quad (V_{ij} = 1/V_{ji}) \quad (1)$$

Where V_{ij} represents the judgment value of the relative importance of element V_i to V_j for the overall evaluation goal of M. The matrix is characterized by the fact that the diagonal element is 1, that is, the importance of each element relative to itself is 1[14].

Relative to factor V_i , the judgment matrix of pairwise importance comparison of each element in sub-factor set $V_i = \{v_{i1}, v_{i2}, \dots, v_{ik}\}$ is as follows:

$$B_i = \begin{Bmatrix} v_1 \\ v_2 \\ \dots \\ v_k \end{Bmatrix} \begin{bmatrix} 1 & f_{12}^i & \dots & f_{1k}^i \\ f_{21}^i & 1 & \dots & f_{2k}^i \\ \dots & \dots & \dots & \dots \\ f_{k1}^i & f_{k2}^i & \dots & 1 \end{bmatrix} = f_{k \times k}^i \quad (i = 1, 2, \dots, m) \quad (f_{ij}^i = 1/f_{ji}^i) \quad (2)$$

Among them, f_{ij}^i represents the judgment value of the relative importance of element v_{il} to v_{ij} relative to V_i -each evaluation criterion (i.e. the first-level evaluation index) [15].

(3) The sum-product method is used to solve the judgment matrix, and the relative weights of the compared elements under the single criteria M and V_i , namely hierarchical single ranking, are obtained respectively.

- 1) all elements in matrix a are normalized according to the columns;
- 2) adding the processed matrices by rows;
- 3) respectively normalizing the obtained row vectors to obtain the ranking weight vector ω of each compared element under a single criterion;
- 4) Calculate into λ_{\max} [16] according to the following formula.

(3)

(Find the other judgment matrix B_i as above)

(4) Hierarchical total ranking-1. Calculate the combined weight of all elements in the same hierarchy.

(5) Consistency inspection

1) firstly, calculating a consistency index $C.I.$, $C.I. = \lambda_{\max} - n / n - 1$, where n is the order of a jury matrix;

2) Average index R.I.;

3) Calculate the consistency ratio C.R, w $\lambda_{\max} = \sum_{i=1}^n \frac{(A\omega)_i}{n\omega_i}$ here c.r = c.1/r.1.

For $C.R < 0.1$, it is often assumed that the consistency of the jury matrix is acceptable. The small amount of C.R., the small deviation from the judge's matrix of the situation and the closer it is to the

situation [17].

Tests are a multi-level, fuzzy comprehensive decision. For multi-level problems, the high-level main factors can be regarded as sub-problems, and the sub-problems can be comprehensively evaluated first, and then the overall problem can be comprehensively evaluated. That is, the low-level factors are integrated first, and then the higher-level factors are integrated [18].

Establish the evaluation set $U = \{u_1, u_2, \dots, u_n\}$, and set the final evaluation grade of the performance evaluation of this university to be divided into four grades: excellent, good, qualified and unqualified. $U = \{u_1, u_2, \dots, u_n\} = \{\text{excellent, good, qualified, unqualified}\}$.

(2) The membership is being used to describe the degree to which all other level indexes belong to the valuation scale U, and a factor in fuzzy rating matrix is getting.

(3) First-class fuzzy comprehensive evaluation is carried out to determine the fuzzy relation matrix $R = (R_1, R_2, R_3)^T$.

(4) An entire two-stage fuzzy - determine the vector of the assessment.

(5) Determine the ultimate rating of the material found as principal of membership more than [19].

4. Results and Analysis

The assessment of three school administrators in the experiment was necessary to use the fuzzy tests proposed in this report, and the results compared to the original results, as shown in Table 2.

Table 2: Comparison of Experimental Results

Name number	Total score	Score of this experiment
A	95	3.8027
B	95	3.7530
C	96	3.7265

Through the experimental results, it can be seen that the assessment scores of A, B and C are ranked as C's best according to the total score. Using the fuzzy overall assessment proposed in this report, the final score of a 3.802 was 7 points, which was 0.0497 points and 0.0762 points higher than that of B and C, respectively. Therefore, in this performance assessment process, according to the library's comprehensive assessment standards, the comprehensive performance of A is better than that of B and C[20]. In the year-end evaluation of the department, A ranks ahead of B and C. of the experiment, it will prove that the proposed plan in this report will comprehensively, objectively and truthfully investigate the performance of university administrators in employment.

5. Conclusion

At present, the performance evaluation of education funds in China is still at the initial stage. The current performance evaluation of colleges and universities remains at the level of expenditure allocation, completion of budget expenditure goals, compliance of implementation, etc., and has not made a scientific evaluation of the economy, efficiency and effectiveness of expenditure, Therefore, this project takes the lead in establishing the comprehensive performance evaluation model of colleges and universities based on AHP to try to solve the theoretical and practical issues of comprehensive performance evaluation and management of colleges and universities, which is of positive significance. This paper establishes the AHP fuzzy comprehensive evaluation model to comprehensively evaluate the post-evaluation and performance evaluation, which can objectively reflect the real situation in the actual management of Chinese and foreign universities and make the qualitative description quantitative. Applying AHP to post-value evaluation can provide a method for

Chinese and foreign university managers to determine the weight according to their actual situation, and provide a reliable basis for the scientific management of Chinese and foreign universities. It is highly scientific and operable, and further promotes the application of AHP. Through the application of the analytic hierarchy process, the artificial qualitative description and scientific quantitative calculation are organically combined, which effectively weakens the impact of subjectivity, improves the reliability and validity of indicator weight determination, and lays a solid foundation for the first step of a quantitative assessment of management posts in Chinese and foreign universities. AHP fuzzy comprehensive evaluation makes the whole calculation steps of performance appraisal grade evaluation clear, easy to judge and easy to calculate. It not only saves the time of evaluation committee members and improves the efficiency of work, but also effectively converts the qualitative evaluation of evaluation committee members into quantitative calculation through the use of fuzzy comprehensive evaluation, effectively synthesizing the evaluation results of each evaluation committee member, thus obtaining a more accurate result. The comprehensive evaluation of post-evaluation and performance evaluation by establishing an AHP fuzzy comprehensive evaluation model can objectively reflect the real situation in the actual enterprise management and make the qualitative description quantitative. The application of the analytical hierarchy process (AHP) for postage valuation will provide company managers with a harsh decision based on the situation of their company and provide a reliable approach to the management companies. It's scientific and operable and also supports the use of AHP. Through the application of the analytic hierarchy process, the artificial qualitative description and scientific quantitative calculation are organically combined, thus effectively weakening the influence of subjectivity, improving the reliability and validity of index weight determination, and laying a solid foundation for the first step of a quantitative assessment of enterprise management positions. AHP- fuzzy comprehensive evaluation makes the whole calculation step of performance appraisal grade clear, the judgment is simple and convenient, and the calculation is convenient. It not only saves the time of evaluation committee members, but also improves work efficiency. Moreover, through the use of fuzzy comprehensive evaluation, the qualitative evaluation of evaluation committee members is effectively converted into the quantitative calculation, and the evaluation results of evaluation committee members are effectively integrated, thus obtaining a more accurate result.

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