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Discuss in Senior Executives Performance Assessment Methods Based on Fuzzy Decision

[1]Liu Baoping, [2]Rong Lishan and [1]Hu Shuai
[1]College of Economics and Management, University of South China, P.O. Box 421001, Hengyang City, Hunan Province, People's Republic of China
[2]City Construction College, University of South China, P.O. Box 421001, Hengyang City, Hunan Province, People's Republic of China

Abstract: In this study, we come up with the senior executives performance assessment method based on fuzzy decision, which combines the concept of fuzzy decision and the analysis in the defect of the traditional assessment methods. Performance assessment is the basic and key process of human resource management and senior executives are the core of the organization. Therefore, it is of great significance of evaluating the performance of them effectively. The core innovation of this research is that this kind of assessment method makes full use of the concept of the fuzzy decision. The previous work in this field is discussed theoretically mostly on the viewpoints, principles or superficial data evaluation. Compared with previous work, we propose a senior executives performance appraisal methods based on fuzzy decision. Finally, we analyzed the performance by implementing specific numerical experiments to verify the proposed models.

Key words: Fuzzy decision, senior executives, performance assessment

INTRODUCTION

Performance appraisal is the basis and key of human resource management. Fierce market competition puts forward new demands for human resources management. The implementation of performance appraisal and performance improvement is the important guarantee for the enterprise to achieve strategic objectives and obtain continuous self-improvement (Fan, 2010). Senior executives are the core of the organization, which play a decisive role in the organization's development. The full play of the role of senior executives has a direct impact on the development of enterprises (Liu and Peng, 2011). Therefore, the effective performance appraisal for senior executives becomes particularly important. At present, some domestic performance evaluation and performance management for senior executives are discussed theoretically mostly on the viewpoints, principles or superficial data evaluation, in which the importance of the issues is raised, but it unable to carry out in-depth study on the executives performance index set, weight determination, assessment modeling and conclusion reliability (Liu and Bai, 2006). The proposed set of assessment methods on how to apply performance management usually lack the maneuverability, therefore its effectiveness is naturally greatly reduced (Zhang, 2007).

To overcome this drawback, we propose a senior executives performance appraisal methods based on fuzzy decision. First of all, this method assesses the overall quality of senior executives through fuzzy synthetic evaluation method. Then fuzzy centralized decision method is applied to sort the comprehensive assessment test scores. The effective application of fuzzy centralized decision method can give qualitative analysis and quantitative analysis effectively on senior executives so that senior executives know their performance levels and performance capabilities, which helps to understand their own inadequacies comprehensively and improve their level of performance.

FUZZY DECISION

Fuzzy comprehensive evaluation decision: Fuzzy comprehensive evaluation regards the evaluation targets as a fuzzy set composed of a variety of factors (called the factor set U) and then set these factors into different evaluation grades to assemble into the fuzzy set for evaluation (called the evaluation set V). After this, the attribution grade level (called the fuzzy matrix) of each single factor is calculated and then get the quantitative solution value (called fuzzy matrix synthesis) by calculating according to the weight distribution of various factors in the evaluation target. The model and the steps:

Corresponding Author: Liu Baoping, College of Economics and Management, University of South China, P.O. Box 421001, Hengyang City, Hunan Province, People's Republic of China

- The evaluation targets is defined as the factor set U, U = {u_1,u_2,…,u_n}, the evaluation set V, V = {v_1, v_2, …, v_m}
- Fuzzy relation matrix is obtained by calculating each evaluated things' attribution grade level to fuzzy subset through membership function, R = $(r_{ij})_{n\times m}$, r_{ij} represents the attribution grade level of the evaluated fuzzy set which is judged on the j-th level by the i-th factor
- The fuzzy vector of evaluation factors, A = [α_1, α_2, ...α_n]:

$$\sum_{i=1}^{n} a_i = 1$$

- Then, Comprehensive evaluation is carried out as:

$$\underset{\sim}{B} = \underset{\sim}{A} \circ \underset{\sim}{R} = = [a_1, a_2, \cdots, a_n] \circ \begin{bmatrix} r_{11} r_{12} \cdots\cdots r_{1m} \\ r_{21} r_{22} \cdots\cdots r_{2m} \\ \cdots\cdots\cdots\cdots \\ r_{n1} r_{n2} \cdots\cdots r_{nm} \end{bmatrix}$$

$$= [b_1, b_2, \cdots, b_n]$$

$\underset{\sim}{R}$: Transformation matrix of fuzzy relation
$\underset{\sim}{A}$: Input fuzzy vector, Weights matrix
$\underset{\sim}{B}$: Output modulus vector
α_1, α_2, ..., α_n : Fuzzy weights, Required to meet:

$$\sum_{i=1}^{n} a_i = 1, a_i \in [0,1]$$

$\circ$: Synthesis operator, It can be ($\vee$, $\wedge$), (+, .), ($\vee$, .) etc

Centralized fuzzy decision: In order to sort the factors of the set U = {u_1, u_2, …, u_n}, the expert group composed of m experts (|M| = m) sort the elements of the set U, respectively and M kind of advice is obtained V = {v_1, v_2, …, v_m}. However, these views are often fuzzy and "centralized fuzzy decision" aims at concentrating these views into a more reasonable opinion.

The expert group composed of m experts will give m kinds of advices by sorting the elements of the set U, U = {u_1, u_2, …, u_n}. V = {v_1, v_2, …, v_m}, v_i is the i-th sequence of opinions, namely a certain sort of the elements of set U.

u∈U, B_i (u) represents the number of elements ranked after u in the i-th opinions sequence. If u ranked first in the i-th opinions sequence (Vi), B_i (u) = n-1; If u ranked second in the i-th opinions sequence, B_i (u) = n-2; If u ranked k-th in the i-th opinions sequence (Vi), B_i (u) = n-k. As the following:

$$B(u) = \sum_{i=1}^{m} B_i(u) \quad (1)$$

It is the Borda count of u. Obviously, B (u) is the sum of u's scores in the all opinions sequence v_1, v_2, ..., v_m. Thus, all the elements of U can be sorted by the size of the Borda count and the new sequence is a more reasonable opinion in the centralized opinions.

When the centralized ideas and people's intuition do not coincide, it is sorted by the size of the weighted Borda count:

$$B(u) = \sum_{i=1}^{m} a_i B_i(u) (\sum_{i=1}^{m} a_i = 1) \quad (2)$$

EXAMPLE

The overall ability of seven senior executive's year-end scores (Table 1) in the same company is evaluated by using fuzzy comprehensive evaluation decision method and centralized fuzzy decision method. u_i (i = 1, 2, ..., 7) of Table 1 represents the i-th senior executive and represents the j-th specific assessment criteria and the weighting of the indicators (Table 2).

Senior executives comprehensive quality assessment based on fuzzy comprehensive evaluation method: First of all, the overall quality of senior executives is determined by the fuzzy comprehensive evaluation method and the degree of personal overall quality is ranked.

Based on the above steps of fuzzy comprehensive evaluation method we determine the factor set of objects at first. The factor set includes decision-making capacity, emergency handling, employee recognition level, net profit, investment income and other specific assessment indicators. U = {u_1, u_2, ..., u_{16}}, judge set V = {v_1, v_2, ..., v_5} (best, good, average, pass and fail); Second, determine the membership function:

$$\mu A_{\underset{\sim}{\text{best}}}(X) = \begin{cases} 1, x \geq 90 \\ \dfrac{x-6}{30} 60 \leq z < 90 \\ 0, x < 60 \end{cases}$$

$$\mu A_{\underset{\sim}{\text{good}}}(X) = \begin{cases} 1, 80 \leq x < 90 \\ \dfrac{x-6}{20} 60 \leq x < 80 \\ -\dfrac{x-100}{10} 90 \leq x < 100 \end{cases}$$

$$\mu A_{\underset{\sim}{\text{average}}}(X) = \begin{cases} 1, 70 \leq x < 80 \\ \dfrac{x-60}{10} 60 \leq x < 70 \\ -\dfrac{x-90}{10} 80 \leq x < 90 \\ 0, x < 60 \text{ or } x \geq 90 \end{cases}$$

Table 1: Senior executives performance assessment

Executives	v_1	v_2	v_3	v_4	v_5	v_6	v_7	v_8	v_9	v_{10}	v_{11}	v_{12}	v_{13}	v_{14}	v_{15}	v_{16}
u_1	85	86	91	87	93	86	88	95	92	91	84	91	88	92	85	89
u_2	88	83	95	90	91	84	86	87	82	94	87	88	84	88	78	92
u_3	87	85	86	84	89	91	83	78	84	90	80	86	89	94	79	86
u_4	90	88	89	94	85	90	85	79	85	88	86	87	91	93	86	87
u_5	84	87	82	89	94	87	77	96	86	92	74	85	81	74	82	81
u_6	96	84	87	81	90	89	90	77	80	83	75	90	79	81	88	90
u_7	92	82	94	78	92	88	95	84	76	87	88	89	85	90	87	85

Table 2: Detailed assessment indicators

Assessment content		Detailed assessment indicators	Weights
Ability			
v_1	Leadership	Decision-making capacity, emergency handling, motivating force, etc.	0.09
v_2	Plan execution ability	The accuracy of planning, organization, etc.	0.08
v_3	Communication and coordination skills	Communication, teamwork, etc.	0.06
v_4	Learning ability	Professional knowledge, ability to accept new knowledge	0.06
v_5	Innovation	New ideas, new initiatives, etc.	0.06
Attitude			
v_6	Employee satisfaction	Employee recognition, recognition degree	0.07
v_7	Responsibility	Whether responsible, carry out business decisions, etc.	0.06
v_8	Positive	Proactive, working with passion, etc.	0.06
v_9	Discipline	Self-discipline, caution, etc.	0.06
Performance			
v_{10}	Profit target completion rate	Completion of finance goals	0.06
v_{11}	ROE	Net profit, investment income, etc.	0.06
v_{12}	Sales growth rate	Sales volume, sales ratio	0.05
v_{13}	Others satisfaction	Governments, communities, shareholders, customers, etc.	0.06
v_{14}	Core staff growth	Technology backbone, management backbone	0.07
v_{15}	Completion rate of new business	New products, new markets	0.05
v_{16}	Safety and environmental protection target completion rate	energy conservation, safety, etc.	0.05

$$\mu A_{\sim pass}(X)=\begin{cases}1,,x=60\\ \dfrac{x-50}{10}\;60\le x<60\\ -\dfrac{x-70}{10}\;60\le x<70\\ 0,x<50\text{ or }x>70\end{cases}$$

$$\mu A_{\sim afail}(X)=\begin{cases}1,x<40\\ -\dfrac{x-70}{10}\;40\le x<70\\ 0,x\ge 60\end{cases}$$

Determine the membership degree of the evaluated indicators to fuzzy subset through the membrship function, then, we get fuzzy relation matrix as: $R = (r_{ij})16\times5°$:

$$R_{\sim u_1}=\begin{bmatrix}0.833 & 1 & 0.5 & 0 & 0\\ 0.867 & 1 & 0.4 & 0 & 0\\ \vdots & \vdots & \vdots & \vdots & \vdots\\ 0.967 & 1 & 0.1 & 0 & 0\end{bmatrix}$$

$$R_{\sim u_2}=\begin{bmatrix}0.933 & 1 & 0.2 & 0 & 0\\ 0.767 & 1 & 0.7 & 0 & 0\\ \vdots & \vdots & \vdots & \vdots & \vdots\\ 1 & 0.8 & 0 & 0 & 0\end{bmatrix}$$

$$R_{\sim u_3}=\begin{bmatrix}0.9 & 1 & 0.3 & 0 & 0\\ 0.833 & 1 & 0.5 & 0 & 0\\ \vdots & \vdots & \vdots & \vdots & \vdots\\ 0.867 & 1 & 0.4 & 0 & 0\end{bmatrix}$$

$$R_{\sim u_4}=\begin{bmatrix}1 & 1 & 0 & 0 & 0\\ 0.933 & 1 & 0.2 & 0 & 0\\ \vdots & \vdots & \vdots & \vdots & \vdots\\ 0.9 & 1 & 0.3 & 0 & 0\end{bmatrix}$$

$$R_{\sim u_5}=\begin{bmatrix}0.8 & 1 & 0.6 & 0 & 0\\ 0.9 & 1 & 0.3 & 0 & 0\\ \vdots & \vdots & \vdots & \vdots & \vdots\\ 0.7 & 1 & 0.9 & 0 & 0\end{bmatrix}$$

$$R_{\sim u_6}=\begin{bmatrix}1 & 0.4 & 0 & 0 & 0\\ 0.8 & 1 & 0.6 & 0 & 0\\ \vdots & \vdots & \vdots & \vdots & \vdots\\ 1 & 1 & 0 & 0 & 0\end{bmatrix}$$

$$R_{\sim u_7}=\begin{bmatrix}1 & 0.8 & 0 & 0 & 0\\ 0.733 & 1 & 0.8 & 0 & 0\\ \vdots & \vdots & \vdots & \vdots & \vdots\\ 0.833 & 1 & 0.5 & 0 & 0\end{bmatrix}$$

$$B_{\sim}=A_{\sim}\circ R_{\sim}=(0.09,\,0.08,\,...,\,0.05)\times R$$

By calculatation, we get:

$$B_{\sim u_1}=(0.929,\;0.909,\;0.213,\;0,\;0)$$

$$B_{\sim u_2}=(0.885,\;0.925,\;0.334,\;0,\;0)$$

$$B_{\sim u_3}=(0.852,\;0.957,\;0.427,\;0,\;0)$$

$$B_{\sim u_4}=(0.912,\;0.946,\;0.258,\;0,\;0)$$

$$B_{\sim u_5}=(0.791,\;0.880,\;0.519,\;0,\;0)$$

$$B_{\sim u_6}=(0.821,\;0.919,\;0.482,\;0,\;0)$$

$$B_{\sim u_7}=(0.875,\;0.898,\;0.333,\;0,\;0)$$

According to the principle of maximum membership degree in fuzzy logic, the assessment results of seven executives: The first one is "excellent", the other six is "good".

The evaluation result assessed by the fuzzy comprehensive evaluation method is realistic and reflects senior executive's overall quality and ability objectively.

Senior executives comprehensive capacity assessment based on centralized fuzzy decision method: You can only divide senior executives into different levels by using fuzzy comprehensive evaluation method but you can't sort the evaluation results of the seven senior executives. Therefore, we apply the centralized fuzzy decision method to sort the evaluation results of the seven senior executives and study into it.

First, determine the seven senior executive's set $U = \{u_1, u_2, \ldots, u_7\}$; Secondly, the decision-making capacity, emergency handling, employee recognition level, net profit, investment income and other specific test results is sorted from high to low as the expert,s expressed opinions sequence $V = \{v_1, v_2, \ldots, v_{16}\}$; then, determine senior executives' appropriate rank u_i and calculate senior executive Borda count according to the test results of each case; Finally, the senior executives are sorted according to the the size of Borda count.

Calculate the seven senior executives Borda count according to Eq. 1: $B(u_1) = 77$, $B(u_2) = 68$, $B(u_3) = 56$, $B(u_4) = 74$, $B(u_5) = 52$, $B(u_6) = 57$, $B(u_7) = 64$. According to the order of the centralized Borda count we sort it: $u_1, u_4, u_2, u_7, u_6, u_3, u_5$.

Calculate the seven senior executives weighted Borda count according to Eq. 2: $B(u_1) = 4.69$, $B(u_2) = 4.19$, $B(u_3) = 3.6$, $B(u_4) = 4.73$, $B(u_5) = 3.26$, $B(u_6) = 3.57$, $B(u_7) = 3.99$. According to the order of the centralized Borda count we sort it: $u_1, u_4, u_2, u_7, u_3, u_6, u_5$.

The sorted results of weighted Borda count is more in line with the actual situation because the sorted results of weighted Borda count includes all the specific evaluation index weight and the senior executive's overall quality and ability is reflected comprehensively and objectively.

EPILOGUE

As we all know, performance assessment is the basis and key of human resource management and corporate senior executives are the backbone of enterprises. Senior executives' enthusiasm, initiative and creativity depends on the fair performance assessment and appropriate incentives. Senior executives performance assessment methods based on fuzzy decision is a more scientific and effective assessment method with strong operability. This paper gives seven senior executives' year-end assessment indicators knowledge mining by applying fuzzy decision method. We determine the overall quality of senior executives by the fuzzy comprehensive evaluation method and also rank the degree of personal overall quality. We apply the centralized fuzzy decision method to sort the evaluation results of the seven senior executives and study into it. Here we also give a performance analysis through specific numerical experiments and experimental results prove that this method has good performance.

REFERENCES

Fan, Z., 2010. Performance evaluation method of corporate middle managers. J. Mod. Finance Econ., 5: 51-56.

Liu, B. and P. Peng, 2011. New progress of organization error research-a study of top management team. J. Persons Efficiency Eng., 1: 88-90.

Liu, S.Q. and J.T. Bai, 2006. The scheme of performance measurement on enterprise top management. J. Commercial Res., 9: 61-56.

Zhang, H., 2007. Performance evaluation index system construction and application of senior managers of private enterprises. J. Financial Econ., 6: 153-154.