Performance Appraisal of Enterprise Middle-Level Management Based on Fuzzy Comprehensive Evaluation

Liu Bo[1, a], Zhang Li[2,b]

[1] Business School, Hohai University.Nanjing, China

[2] Business School, Jinling Institute of Technology.Nanjing, China

[a] jsliubo@yahoo.cn, [b] nj.teacher@163.com

Keywords:fuzzy comprehensive evaluation; performance appraisal

Abstract. Based on the study of enterprise middle-level management performance appraisal index, this paper sets up the fuzzy comprehensive evaluation model of middle-level management performance and carries out the empirical study, which offers theoretic and realistic basis for strengthening middle-level management performance appraisal.

At present, the effective performance appraisal on enterprise middle-level managements is playing an increasing important role in human resource management and determines the basis of promotion and reward for enterprise middle-level managements. Therefore, building a scientific detection, inspection and evaluation system, which is used for enterprise managers, is a key for effectively managing enterprise middle-level managements.

The Principles For The Performance Appraisal Of Enterprise Middle-Level Managements

In order to achieve the expected performance appraisal management skills, we should abide by the following basic principles in the performance appraisal:

A. The Principle of Openness

The standards, procedures and responsibilities of enterprise performance appraisal should be open to the staff.

B. The Principle of Objectivity

According to the standards of performance appraisal, performance appraisal should objectively carry out examinations[1].

C. The Principle of feedback

The result of performance appraisal should be sent back to the evaluated person to play the education and development function of performance appraisal.

D. The Principle of work-focus evaluation

Performance appraisal index refers to the output from which to assess the work, and it is to solve what question is evaluated[2].

The Performance Appraisal Index System Design of Enterprise Middle-Level Management

The performance appraisal index system of enterprise middle-level management includes: (1) one' own quality, including physical quality and ideological quality; (2) work attitude, including responsibility awareness and enterprising spirit; (3) actual achievement of work, including achievement of goal and team construction; (4) work ability, including profession competence, leadership, innovation ability and the ability of handling the emergency. the index set is divided into two levels by us: the first-level and the second-level index set are : $U=\{U_1, U_2, U_3, U_4\}$, $U_1=\{V_{11}, V_{12}\}$, $U_2=\{V_{21}, V_{22}\}$, $U_3=\{V_{31}, V_{32}\}$, $U_4=\{V_{41}, V_{42}, V_{43}, V_{44}\}$.

The fuzzy comprehensive evaluation in performance appraisal of enterprise middle-level management

E. Construction of fuzzy comprehensive evaluation in the performance appraisal of enterprise middle-level management

(1) Determination of the facts in comprehensive evaluation

Total numbers of the f irst-level evaluation index and the second-level evaluation index are four and ten respectively. The score of every level is as follows: $v_i(i=1,\cdots,5)$, v_1=100(Excellent), v_2=80 (Good), v_3=70 (Moderate), v_4=60 (Bad), v_5=40 (Worse), so, $V=(v_1,v_2,v_3,v_4,v_5)$ [3].

(2) Determination of index weight

1. Construction of important judgment matrix

We adopt the AHP method to determine the index weight of main factor and sub-factor levels[4]. The estimated value of the relative im portance of index i to index j is denoted by a_{ij}, thus, the comments of all the experts make up a group of fuzzy judgment matrixes as follows:

$$A=\begin{bmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{bmatrix},\quad a_{ii}=1, a_{ij}=1/a_{ji},\ \text{plus}\ a_{ij}>0.$$

Construction of judgment matrix mainly relies on 1-9 scaling.

Take the ev ery factor weight of wo rk ability in Table II as the ex ample, according to experts' consultation scores, we can construct the important judgment matrix:

$$A=\begin{pmatrix} 1 & 3 & 5 & 7 \\ \frac{1}{3} & 1 & 3 & 4 \\ \frac{1}{5} & \frac{1}{3} & 1 & 3 \\ \frac{1}{7} & \frac{1}{4} & \frac{1}{3} & 1 \end{pmatrix}$$

2.Calculate the weight value of every factor

We can use the method of $W_i=\frac{1}{n}\sum_{j=1}^{n}\frac{a_{ij}}{\sum_{k=1}^{n}a_{kj}}$ (i=1, 2, …n)

and get as follows: w_1=0.0631, w_2=0.1101, w_3=0.6171, w_4=0.2097

3.Consistency Check

According to the formula $\lambda_{\max}=\frac{1}{n}\sum_{i=1}^{n}\frac{(AW)_i}{W_i}$, we can obtain the most obvious feature of matrix A: $\lambda_{\max}$=4.2298, then we put the numerical value into the formula $CI=\frac{\lambda_{\max}-n}{n-1}$=0.0766, and RI indices the average coefficient of random one-time.

According to the form ula, $CR=\frac{CI}{RI}=\frac{0.0766}{0.9}$=0.0851<0.1, judgment matrix has satisfactory consistency. In the light of above methods, we can calculate in Table 1:

TABLE 1 DISTRIBUTION OF EACH FACTOR'S WEIGHT VALUE

U_1		U_2		U_3		U_4			
0.0631		0.1101		0.6171		0.2097			
V_{11}	V_{12}	V_{21}	V_{22}	V_{31}	V_{32}	V_{41}	V_{42}	V_{43}	V_{44}
0.0105	0.0525	0.0551	0.0551	0.4628	0.1543	0.112	0.0499	0.0311	0.0167

(3) Fuzzy comprehensive appraisal

Concrete evaluation adopts the fuzzy calculation m ethod: if A and B are the fuzzy matrices of dimensions n×m and m×l, thus the their product is that C=A· B[5], which is the m atrix of dimension n×l, and its entries are:

$$C_{ij} = \bigvee_{k=1}^{m}(a_{ik} \wedge b_{kj})(i = 1,2,\cdots,n; j = 1,2,\cdots,I)$$

The mark"∨"means a∨b= max(a,b),and the m ark "∧"means: a∧b= min(a,b). Find t he comprehensive evaluation matrix B_i for each U_i (i=1,2,3,4), $B_i = W_i \bullet R_i$ [3],the evaluation matrix (membership matrix) on U is: $B = (B_1, B_2, B_3, B_4)^{\mathrm{T}}$, and the weight vector is $W_{1\times5}$. The comprehensive evaluation matrix of U is A=W·B.

F. *Analysis of examples*

According to the designed index sys tem , we invite ten experts to m ake scores on perfor mance appraisal factors of Mr. /Mrs. Li by using the software Matlab.

TABLE 2 THE FACTOR'S SCORES RESULT OF MR./MRS. LI'S PERFORMANCE APPRAISAL

	V_{11}	V_{12}	V_{21}	V_{22}	V_{31}	V_{32}	V_{41}	V_{42}	V_{43}	V_{44}
W	0	0 0 0 0	0 0 0 0	0						
B	0	0	0.1	0.06	0.08	0.03	0	0.02	0.13	0.07
M	0.16	0.1	0.15	0.21	0.26	0.21	0.3	0.23	0.14	0.16
G	0.42	0.36	0.41	0.36	0.38	0.4	0.42	0.41	0.31	0.36
E	0.42	0.54	0.34	0.37	0.28	0.36	0.28	0.34	0.42	0.41

When we use the model of fuzzy com prehensive evaluation of enterprise m iddle-level management, we can calculate the ef fect of wo rk ability on the perfor mance evaluation is as follows:

$$B_4 = W_4 \bullet R_4 = (0.112\ 0.0499\ 0.0311\ 0.0167) \bullet \begin{bmatrix} 0 & 0 & 0.3 & 0.42 & 0.28 \\ 0 & 0.02 & 0.23 & 0.41 & 0.34 \\ 0 & 0.13 & 0.14 & 0.31 & 0.42 \\ 0 & 0.07 & 0.16 & 0.36 & 0.41 \end{bmatrix}$$

=(0,0.0311,0.112,0.112,0.112)

In a similar way, the comprehensive evaluation results can be obtained:

$B_1 = (0, 0, 0.0525, 0.0525, 0.0525), B_2 = (0, 0.0551, 0.0551, 0.0551, 0.0551)$,

$B_3 = (0, 0.08, 0.26, 0.38, 0.28)$

Therefore, the second –level comprehensive evaluation result of Mr./Mrs Li is as follows:

$$\text{A=W·B=}(0.0631, 0.1101, 0.6171, 0.2097) \bullet \begin{bmatrix} 0 & 0 & 0.0525 & 0.0525 & 0.0525 \\ 0 & 0.0551 & 0.0551 & 0.0551 & 0.0551 \\ 0 & 0.08 & 0.26 & 0.38 & 0.28 \\ 0 & 0.0311 & 0.112 & 0.112 & 0.112 \end{bmatrix}$$

=（0,0.08,0.26，0.38,0.28）

Therefore, Mr. /Mrs. Li got the sc ores of perform ance evaluation: 100*0.28+80*0.38+70*0.26+60*0.08+40*0=81.4, which can be ranked as good. From the prim ary evaluation result, we can see the actual work achievement of Mr. / Mrs. Li is evaluated as good.

References

[1]Geng Liping and Wang Zhijun,The Applicati on Study of Fuzzy Com prehensive Evaluation Method in The Enterprise Staffs Performance Appraisal [J]. Chinese Managem ent Informatization, 2007(2).

[2]Xia Pingjian,Fuzzy Comprehensive Evaluation of Enterprise Management . Study on Question[J], 2010 (63).

[3]Huang Liangwen an d ZhengWuyi,The Principles of Statistics. Beijing: Chinese Sta tistic Press[M], 2010(6).

[4]Zhang Qi,The Study on Constructing perform ance Evaluation System of the enterprise middle-level management [D]. Liaoning Technical University, 2006.

[5]Fang Qiulian, Liu Zaiming,Performance Evaluation of Enterprise Managers Based on the Fuzzy Comprehensive Evaluation [J]. Practice and Cognition of Mathematics 2006 (7).