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FUZZY MATHEMATICAL APPROACH FOR EFFECTIVE GENERALIZATION OF PERFORMANCE EVALUATION

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ABSTRACT

Evolution of employee performance is one of the most important responsibilities of managers. Yet performance evolution has been the source of considerable dissatisfaction for both managers and employees because of the many shortcomings that have plagued evolution systems. On the basis of Drawing on research, experience and court rulings, in this paper Fuzzy mathematical solution for establishing an effective performance evolution system. Some of the guidelines cover the design of a system and others its administration. Performance evolution systems are the butt of many jokes and the source of considerable dissatisfaction.

INTRODUCTION

Completing effective performance evaluation serves many important functions within an organization, and doing so is essential in virtually every managerial job. An effective employee performance evaluation system can play an important role; motivating peak individual performance and improving organizational productivity. It's important for managers to know what performance evaluations are, understand why they are important, and be able to conduct them effectively and efficiently[1,2and 7].

What is a Performance Evaluation?

By definition, a performance evaluation is a formal evaluation of an employee's job performance. To conduct a formal performance evaluation, the manager must complete an evaluation document and conduct an oral review with the employee who is being evaluated.

This process involves providing the employee with feedback regarding how well he or she is performing the essential functions of his or her job. Performance evaluations usually assess how well the employee executes job duties, overall efficiency, as well as the outcomes, or results, of his or her activities.

Importance Of Effective Performance Evaluations

Communication Link

Having an effective performance evaluation system in place can improve the flow of communication between supervisors and their employees. Performance evaluations provide a vital communications link between managers and employees. Every employee needs to know how he or she is doing on the job. Timely evaluations build respect and trust and when done well can dramatically improve performance."

Improved Feedback Mechanism

Providing feedback to employees on an ongoing basis is an important part of any manager's job. However, all too often, managers overlook the importance of consistent feedback unless there are specific problems that need to be addressed.

The performance evaluation process provides an important mechanism for much needed feedback—both positive and negative-which can easily be overlooked without the presence of a formal employee evaluation system. Employees may grumble about performance evaluations, but most of them actually appreciate feedback from their supervisors. The majority of employees want to get accurate information regarding how they are performing, and they value suggestions on ways to improve [3,4].

Identification of Competency Gaps

Employee performance evaluations can be the best way for managers to become aware of gaps in employee competency. Without sitting down and speaking directly with employees about their job performance, supervisors often have no way of recognizing what their employees really don't know how to do. The performance evaluation process is beneficial in helping managers and workers identify gaps in competency, and can lead to the development of training action plans to fill in the gaps.

Goal Setting Tools

The action plans developed through the performance evaluation process can become specific goals for performance improvement. Setting concrete goals is the most beneficial outcome of conducting effective performance evaluations.

The defined goals can form the basis of a written action plan for the employee and the manager, and provide the foundation for future performance evaluation discussions. When managers and employees are able to agree on performance improvement goals that tie directly to competency gaps, the end results include greater organizational productivity and enhanced employee engagement.

Providing Necessary Documentation

In addition to providing managers with many tools and techniques for helping employees become more productive, performance evaluations also serve the important purpose of presenting the documentation necessary to take adverse actions regarding poorly performing employees. Supervisors who have team members performing below standard (and can point to accurate performance evaluation documentation) may be able to justify employee terminations based on weak performance.

Improving the Performance Evaluation Process

Even though conducting employee performance evaluations is an important part of every manager's job, most supervisors don't look forward to sitting down with their employees and going through the formal evaluation process. But there are several things managers can do to improve their ability to conduct effective performance evaluations with a minimal level of stress.

Tips for Preparing for Performance Evaluations

- Review the job description and make sure you understand it
- Verify that you know the specific job duties and requirements
- Consider each duty and job requirement individually
- Focus on what is expected of the employee in the current position
- Don't allow personality characteristics to factor into the evaluation process
- Focus the review on actual performance, not on expectations for the future

- Do not fall into the trap of the "halo" or "horn" effect, which leads to assuming that outstanding or poor performance in one area indicates the presence of the same in other aspects of the job
- Reflect on performance throughout the entire rating period, not just the most recent events

Tips for Leading Performance Evaluation Meetings

Filling out the necessary paperwork for effective performance evaluations is only part of a manager's responsibilities. In order to complete the performance evaluation process, the manager must sit down with the employee and discuss his or her performance face to face, using the completed evaluation form as a guide [4, 5 and 6].

- Allow sufficient time for your meeting with the employee
- Do not allow other employees to interrupt the evaluation meeting
- Ask the employee open ended questions and really listen to his or her responses
- Remain open minded throughout the conversation
- Be prepared to offer concrete suggestions for performance improvement as needed
- Praise an employee's achievements
- Focus on changes that can be made for future improvement rather than on past failures
- Clearly state your expectations for future performance
- Verify that the employee clearly understands what is expected of him or her

Benefits of Effective Performance Evaluations

Most employees want to do a good job, and it's up to managers to recognize their strengths and provide them with the feedback and tools they need to overcome their weaknesses. Following these suggestions, preparing for and delivering performance evaluations to your employees can enhance the value of the process for you, the members of your team, and the organization as a whole.

Evaluating project performance is one part of the theory of industrial measure. How to give an objective evaluation of the project performance of a employee is an unsolved question. Usually, when we appraise project qualities, we often use words' good"/fairly good'/mediocre" or "bad", but they are all blurred. If we want to make a quantitative evaluation of project work performance, using fuzzy mathematics is one of the effective ways. In this article, we combine the fuzzy synthetically judgment with the fuzzy recognition to give a way to evaluate the project evaluation of a employee [1, 3, 5and 7].

SETTING UP AN EVALUATION INDEX SYSTEM

Project performances of employees are affected by many factors, such as project aims, project requirements, project contents and technology, project methodology and so on. So we must choose evaluation factors and set up an evaluation index system scientifically and reasonably if we want make an objective evaluation of project performer.

We suppose that project performances of employees are affected by factors as follows: u_1, u_2, ..., u_n. Let field U= {u_1, u_2, u3, ……, u_n} be a set of evaluation index. Grade the factors that affect the project work according to their affecting extent: v_1 v_2, ...,v_m. Let V= {v_1, v_2, v_3, ……, v_m} be a set of the grade . In order to guarantee that the evaluation results tally with the actual situation, and have

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more reference value, we invite k project specialists to pass a judgment of weight number respectively on each factor in field U as follow list:

u_i / weight number / specialist	u_1	u_2	...	u_n	Σ
specialist 1	a_{11}	a_{12}	...	a_{1n}	
specialist 2	a_{12}	a_{22}	...	a_{2n}	
:	:	:	:	:	:
specialist k	a_{k1}	a_{k2}	...	a_{kn}	
$\frac{1}{k}\sum_{i=1}^{k} a_{ij}=t_i$	$\frac{1}{k}a_1$	$\frac{1}{k}a_2$	...	$\frac{1}{k}a_n$	

In the list a_i (i=l, 2, . ..,n) is $\sum_{i=1}^{K} a_{ij}$, the sum of all the rows. The weight number of a_i corresponding to index factor u_i is

$$t_i = \frac{1}{k}$$

The weight number distributive set corresponding to the evaluation factor set $U=\{u_1,u_2,...,u_n\}$ is $\underline{A} = (t_1, t_2,t_3, ..., t_n)$

Where $t_i \in (0, 1)$ and $\sum_{i=1}^{k} t_i = 1$.

Synthetically Judgment of the Model

On basis of setting up the index system of evaluation, we'll pass a judgment on the model that will be evaluated. Invite k project specialists, adopting specialists evaluation method, we get weight number distributive set $\underline{A} = (t_1, t_2,t_3, ..., t_n)$. On the other hand, we pass a judgment on each $u_i \in U$, i= 1, 2... n, as follow list:

	v_1	v_2	...	v_n
u_1	x_{11}	x_{12}	...	x_{1m}
u_2	x_{21}	a_{22}	...	x_{2m}
:	:	:	:	:
u_n	x_{n1}	x_{n2}	...	x_{nm}

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There upon we get the matrix of fuzzy relation. The evaluation matrix

$$\underline{R}=\begin{bmatrix} x_{11} & x_{12} & \cdots & x_{1m} \\ x_{21} & x_{22} & \cdots & x_{2m} \\ \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot \\ x_{n1} & x_{n2} & \cdots & x_{nm} \end{bmatrix}$$

Adopting the set operation of fuzzy matrix $\underline{B} = \underline{A} \bullet \underline{R}$ and using operation M($\bullet$, $\oplus$) , we obtain the results of synthetically judgment $\underline{B}$ = (b_1,b_2,…..,b_m) where $b_i \in (0,1)$, and $\sum_{i=1}^{m} b_i = 1$.

Example

We want to evaluate project performer of employee A_1, A_2, A_3 of an organization. First of all we must fix the set of evaluation factors U= {u_1, u_2, u_3, u_4, u_5, u_6, u_7, u_8} where u_1: project aims and requirements; u_2: project contents; u_3: **scientifically**; u_4: basic concept, elementary knowledge; basic technique; u_5: focal point, difficult point; u_6 project methodology; u_7: project state, language, project execution plan; u_8: project effect. Adopt the set of evaluation grade V= {v_1, v_2, v_3, v_4}, where v_1: outstanding, v2: exceed expectation, v3: Meet expectation, v_4: Need improvement. Eight members including Business unit head,

Project manager, Director of project and research section and employees with project performer make up the evaluation group. The eight people adopt specialist evaluation method to get the weight number distribution set A= {1.2, 1.3, 0.9, 1.9, 1.5, 1.15, 0.85, 2.05} and appraise employee A_1 by passing judgments respectively on factor {u_1, u_2,..., u_8} as follows:

{(0.4, 0.1, 0.2, 0.3),(0.6, 0.2, 0.1, 0.2),(0.3, 0.7, 0 , 0), (0.6, 0.2, 0.1, 0.1),(0.2, 0.4, 0.1, 0.3), (0.3, 0.3, 0.2, 0.2), (0.4, 0.3, 0.15, 0.15), (0.5, 0.25, 0.2, 0.05)}, then we get the evaluation matrix

$$\underline{R_1}=\begin{array}{c} \begin{matrix} v_1 & v_2 & v_3 & v_4 \end{matrix} \\ \begin{bmatrix} 0.4 & 0.1 & 0.2 & 0.3 \\ 0.5 & 0.2 & 0.1 & 0.2 \\ 0.3 & 0.7 & 0 & 0 \\ 0.6 & 0.2 & 0.1 & 0.1 \\ 0.2 & 0.4 & 0.1 & 0.3 \\ 0.3 & 0.3 & 0.2 & 0.2 \\ 0.4 & 0.3 & 0.15 & 0.15 \\ 0.5 & 0.25 & 0.2 & 0.05 \end{bmatrix} \end{array} \begin{matrix} u_1 \\ u_2 \\ u_3 \\ u_4 \\ u_5 \\ u_6 \\ u_7 \\ u_8 \end{matrix}$$

Adopting the set operation of fuzzy matrix to give an evaluation result to employee A_1

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$$\underline{B_1}=\underline{A}\cdot\underline{R_1}=(1.2,1.3,0.9,1.9,1.5,1.5,0.85,2.05)\begin{bmatrix}0.4 & 0.1 & 0.2 & 0.3\\ 0.5 & 0.2 & 0.1 & 0.2\\ 0.3 & 0.7 & 0 & 0\\ 0.6 & 0.2 & 0.1 & 0.1\\ 0.2 & 0.4 & 0.1 & 0.3\\ 0.3 & 0.3 & 0.2 & 0.2\\ 0.4 & 0.3 & 0.15 & 0.15\\ 0.5 & 0.25 & 0.2 & 0.05\end{bmatrix}$$

Using M (•, ⊕), we get $\underline{B}_1 = \underline{A}_1 \bullet \underline{R}_1$ = (4.666, 3.2075, 1.5475, 1.79), after normalization,

$$\underline{B}_1^{*} = (415626, 0.286383928, 0.138169642, 0.169821428)$$
$$= (0.41, 0.29, 0.14, 0.16)$$

The members of the evaluation group adopting the same method that we have used to employee A_1, using the weight number distributive law $\underline{A}$ = (1.2, 1.3, 0.9, 1.9, 1.5, 1.5, 0.85, 2.06) to give evaluation to employee A_2, A_3 respectively and get the result of synthetically judgment.

THE COMPARE OF THE MODEL'S EVALUATION

By the above-mentioned analysis, we can see that the project performer of employee A_1, A_2, A_3 have been quantified and the proportions they hold in the evaluation grade have been fixed. But we can't show the order of employee A_1, A2, A_3 about their performance. We must compare the models so that we can make out the order of the employees about their performance.

"Only by comparing can one distinguish.' And we must have a criterion when we compare. We choose an acknowledged excellent employee with good performance as a standard model. Using fuzzy synthetically judgment we can get the evaluation result. Using fuzzy recognition, we can find the approach degree of the evaluation models with the standard model. Then we can make out the order of evaluated model according to their approach degrees.

Adopting the above-mentioned example and same method we can find the evaluation result of the standard model $\underline{B}$ = (0.75, 0.20, 0.05, 0). Using the computational formula of approach degree, according to the characters of the factors that affect the project performance and application range of all kinds of the approach degrees, we use computational formula of degree.

$$N_H(\underline{A},\underline{B})=1-\frac{1}{n}d(\underline{A},\underline{B})$$
$$=1-8(\underline{A},\underline{B})$$

To find the approach degrees of $\underline{B}_1$, $\underline{B}_2$, $\underline{B}_3$ with $\underline{B}$ respectively.

$N_H(\underline{B},\underline{B}_1)=1-\frac{1}{4}(|0.75-0.41|+|0.29-0.20|+|0.05-0.14|+|0-0.16|)$

$=1-\frac{1}{4}(0.34+0.09+0.09+0.16)$

$=1-0.17$

$=0.83$

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$N_H(\underline{B}, \underline{B}_2) = 1 - \frac{1}{4}(|0.75-0.39| + |0.31-0.20| + |0.15-0.05| + |0-0.15|)$

$= 1 - \frac{1}{4}(0.36+0.11+0.10+0.15)$

$= 1-0.18$

$= 0.82$

$N_H(\underline{B}, \underline{B}_3) = 1 - \frac{1}{4}(|0.75-0.40| + |0.20-0.27| + |0.05-0.25| + |0-0.08|)$

$= 1 - \frac{1}{4}(0.35+0.07+0.20+0.08)$

$= 1-0.175$

$= 0.825$

We can find from the approach degree that the sequence of the project performance of the three employees is A_1 is the best, A_3 is second and A_2 is the last.

CONCLUSION

Fuzzy mathematical modeling technique provides a solution in area of performance measurement techniques and its evaluation. An effective performance evaluation system can play a crucial role in an organization's efforts to gain competitive advantage like motivating peak individual performance and improving organizational productivity. It's important for managers to know what performance evaluations are, understand why they are important, and be able to conduct them effectively and efficiently. This process involves providing the employee with feedback regarding how well he or she is performing the essential functions of his or her job. Performance evaluations usually assess how well the employee executes job duties, overall efficiency, as well as the outcomes, or results, of his or her activities. The above model can apply anywhere to evaluate the performance.

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