The Information System Development Research Based on the Middle Managers Competency Evaluation

Cunbin Li, Haojie Liu, Tingting Liu and Li Fu
North China Electric Power University, School of Business Administration, Beijing, 102206, China
Baotou Power Supply Bureau, Baotou, 014030, China

Abstract: In this study, we have a research of the information system development research based on the middle managers competency evaluation. According to the different factors like work contents, nature and positioning, the enterprise human resources can be divided into three main categories of senior managers, middle managers and general staff, among which middle managers, as backbone elements of the enterprise, play a very important role weather in enterprise decision-making process or in the management process of the daily production and operation. Therefore, it is necessary to take use of advanced information technology to develop evaluation information system for middle manager which is applicable to the development demands of the enterprise, in order to assess competency of middle managers in an objective way from various angles.

Keywords: Competency evaluation, information system, middle managers

INTRODUCTION

Nowadays, it has become the essential basic resources in the process of the enterprise daily production and operation including human resources, financial and material resources and information. All of the enterprise management, whether the senior managers’ decision making about enterprise macro development strategy or the implementation of the general staff’ daily work plan, is inseparable from the support of human resources. So the human resources management is the key of the enterprise management. How to evaluate the human resources competency effectively and how to maximum mining the potential of human resources have become an important problem demanding prompt solution. It is an effective and directly means to solve this problem through the establish of human resources development platform which take the work performance and competency as its core, and maximize the utility of human resources as its goal to motivate their enthusiasm and initiative and promote the optimal allocation of the enterprise human resources.

According to the different factors like work contents, nature and positioning, the enterprise human resources can be divided into three main categories of senior managers, middle managers and general staff. Among them, the senior managers as the policymakers are the final target makers of enterprise macro development strategy and the enterprise production and operation goal, the middle managers as the middle layer bear a double function that to aid the senior managers’ decision making and to supervise, guide, help the general staff finish their regular work, besides the general staff as the company’s directors is the final performer to make sure the enterprise decision come true. If the enterprise compared to a ship which is voyaging in the boundless sea, then the senior managers as the captain decide the finial destination of the ship, the middle managers as the pilot control the driving course of the ship, and the general staff as the mariners is the ultimate performers of the captain’s commands. Only through the close cooperation of these three categories can ensure that the ship get to its final destination trumping various difficulties in the process of sailing. Wang (1998) have a reseach of the system engineering theory, method and application. Qiu and Yu (2010) study the Hierarchi cal structure model of IT capacity based on interpretative structural modeling. Pan and Deng (2011) analyze the Competency model building. Chen et al. (2004) have a research of the advanced course of human resource management and development. Liu (2011) study the management information system theory and development.

In this study, we study the information system development research based on the middle managers competency evaluation. According to the different factors like work contents, nature and positioning, the enterprise human resources can be divided into three main categories of senior managers, middle managers and general staff, among which middle managers, as backbone elements of the enterprise, play a very
important role in enterprise decision-making process or in the management process of the daily production and operation. Therefore, it is necessary to take use of advanced information technology to develop evaluation information system for middle manager which is applicable to the development demands of the enterprise, in order to assess competency of middle managers in an objective way from various angles.

THE ESTABLISH OF MIDDLE MANAGERS COMPETENCY EVALUATION MODEL

From here we see that the middle managers as the backbone of the enterprise, whether in the process of enterprise decision making, or in the management process of the daily production and operational activities, are playing a great important role. The competency and work performance of the middle managers will have a direct impact on the process of enterprise development strategy coming true. So it is very significant for the optimal allocation and the utility maximization of the middle managers that evaluating their competency, analyzing their performance and understanding their ability to mine their potential from various angles timely.

Competency model is to point the total of competency characteristic to bear in a given job role. It is a way of the definition and the act descriptions about the core ability of one staff from different levels (Pan and Deng, 2011). The common methods used in the competency evaluation is including questionnaire method, interview method, experience method, multivariate analysis, 360 feedback and so on. The 360°feedback (Chen et al., 2004), as shown in Fig. 1, is a method that to evaluate the staff’s ability from different angels through the direct supervisor, junior, customers , colleagues, employees and other evaluation bodies. Because this way takes consideration of the different level staffs’ opinions comprehensively and can reflect the examined person’s characteristics from various angels objectively, it is commonly used in the enterprise human resources management.

Combined with the 360° feedback method and in view of the middle managers, the procedure of building the competency evaluation model can be divided into seven parts, including clearing evaluation purpose, determining evaluation body, building competency evaluation indicators system, determining the weight, implementing competency evaluation, aggregating and analyzing evaluation result and evaluation result application.

- Clearing evaluation purpose. The purpose of implementing middle managers competency evaluation aims to find the their capacity characteristics, mine their work potential, build a fair and impartial position adjustment and skill training platform to equal the personnel competency with the job demands for the middle managers. And its basic goal is to maximum develop their professional abilities for company service.
- Determining evaluation bodies. The great advantage of using the 360°feedback method is taking consideration of the different level staffs’ opinions comprehensively and reflecting the examined person’s characteristics from various angels objectively. So it is an essential part to choose evaluation bodies which has direct or indirect business relationship with the examined person from various angels and comprehensive selection.
- Building competency evaluation indicators system. The competency of the staff can be divided into obvious skills with education background, professional title and job performance as representative, and recessive skills with innovation sense, ways of thinking and resilience as the symbols. Thence, in the design of middle managers’ competency evaluation indicators system, not only should the obvious skills assessment be considered, but also should the recessive skills be excavated. In this way, could the evaluation objects’ overall competency be assessed in a targeted, systematic and comprehensive way.
- The factors which have great influence in the competency development of the middle managers are various. According to the iceberg model, these factors can be divided into the dominant factors and the hidden factors. Specifically, according to the different factors like work contents, nature and positioning, there are nine main factors, such as the academic degree, professional level, work performance, the organizational capacity and so on, as shown in the Table 1.

---

**Fig. 1: 360° feedback model**

---
To establish the adjacency matrix. The second step is to establish the adjacency matrix $$A = (a_{ij})_{9 \times 9}$$ shown as the formula. 1. according to the inner links between the factors. Where in:

$$a_{ij} = \begin{cases} 
1 & s_i R s_j \\
0 & - s_i R s_j 
\end{cases},$$

the $$R$$ means that there is direct correlation between the factors, $$a_{ij} = 0, i = 1, 2, 3, ..., 9, j = 1, 2, 3, ..., 9$$:

$$A = \begin{pmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 1 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\
1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\
0 & 1 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 
\end{pmatrix} \quad (1)$$

Computing the reachable matrix. On the basis of determining the adjacency matrix, we can compute the reachable matrix $$M$$ shown as the formula 2 through the use of exponentiation computation. The calculation rules is dealing with the matrix $$A$$ using the formula:

$$M = (A + I)^n, \text{ until } (A + I)^n = (A + I)^{n-1}$$

where in,

$$m_{ij} = \begin{cases} 
1 & s_i R s_j \\
0 & - s_i R s_j 
\end{cases}$$

the $$R$$ means that there is direct or indirect correlation between the factors, $$m_{ij} = 0, i = 1, 2, 3, ..., 9, j = 1, 2, 3, ..., 9$$:

$$M = \begin{pmatrix}
1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
1 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\
1 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\
1 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\
1 & 1 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\
1 & 1 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\
1 & 1 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\
1 & 1 & 1 & 0 & 0 & 0 & 1 & 0 & 0 
\end{pmatrix} \quad (2)$$

To divide the hierarchical structure. The Interpretative Structural Model (ISM) as a qualitative model, has an important function that to make the complex relationship between the elements of one system orderly and clearly (Wang, 1998). So we can use the interpretative structural model to establish the hierarchy structural model based on the competency of the middle managers. This step contains two main parts, the regional decomposition among the regions means to divide the system elements into some certain parts which has less relation between the elements and the regional decomposition within the region means to divide the hierarchical structure of the elements which is attached to the same region. The basic method is the iterative algorithm (Qiu and Yu, 2010). Hypothesis that the $$L_0, L_1, L_2, ..., L_p$$ is the layer of the system from top to bottom, if $$L_0 = \phi, j = 1$$, then the iteration algorithm of each level is:

$$L_j = \left\{ s, s \in S-J_{L_j-1}, J_{L_j-1} \right\}$$

Fig. 2: The hierarchical structure
until \( \{ S - L_n - L_{n-1} - \ldots - L_1 \} = \phi \). Wherein, the \( L(s_j) = \{ s_j \in S | m_{s_j} = 1 \} \) is the reachable set of the \( s_j \) and the \( D(s_j) = \{ s_j \in S | m_{s_j} = 1 \} \) is the preceding set of the \( s_j \). We can perform the algorithm with the help of the Matlab, and the result is shown in Fig. 2. Wherein, the \( L_1 \) is mainly the set of the hidden factors, which can directly reflect the work performance of the middle managers, the \( L_2 \) reflects the development potential of the human resources utility in the future, the \( L_3 \) and the \( L_4 \) reflects the human resources utility which has been developed.

- Implementing competency evaluation. This is the implementation stage of competency assessment. Based on the finished preliminary preparation, the scoring rules details shall be designed. Then, collecting evaluation subjects’ opinions through questionnaires, interviews, meetings and other methods, the competency evaluation can be completed.

- Aggregating and analyzing evaluation result. After the scoring process is finished, it is necessary to aggregate and analyze the scoring result and finally reflect the results with figures or lists, so as to make it convenient for enterprise managers to make human resources decisions.

- Evaluation result application. Implementing the competency evaluation of middle managers, is to assess the current working condition, ability and performance of the staff, and more importantly, is to find out the middle managers’ ability characteristics and excavate their potential professional capabilities. As a result, job position adjustment and skill training at right time can be performed. Thus, middle managers can maximize their competency efficiency and they can play the core role to work for the enterprise.

**Competency evaluation information system development:** With the advent of the Internet age, the computers have gradually entered into more and more households and it has come to the information and digital age. For enterprises, this is an opportunity as well as a challenge. Whether an enterprise can take advantage of information technology has become the key to success. As a coin has two sides, the enterprise management with information technology is a double-edged sword. It can be a catalyst for enterprises to grow and develop, and can also be a time bomb of corporate demise. Introducing advanced information technology to develop competency evaluation information systems and replacing manual labor with online operation, can significantly reduces the workload of competency evaluation participates to a large extent, and realize the competency evaluation process with information technology in a convenient way.

**SYSTEM DEVELOPMENT PRINCIPLES**

As the enterprise administrators, middle managers have direct or indirect business relations with the enterprise staff, including higher mangers, and involving general employee and employee of relating external collaboration company as well. Therefore, when competency evaluation information system is being designed, both the practical demands of enterprise development and job position, and technology and skill levels of evaluation participants should be taken into consideration. In general, the development of the system should the simple and easy principle, practical principle, process principle and reliability principle (Liu, 2011).

- Simple and easy principles. During the design of competency evaluation information systems, to take full account of the user's ability to understand and technical level, the system interface design possible clarity, the mode of operation is simple, as far as possible to avoid unnecessary or additional workload to the user.

- Practical principle. Competency evaluation information systems should be designed under consideration of the enterprise development demands, current technology level, enterprise software and hardware configuration condition, user operational requirements and other factors, in order to achieve harmonization between the information systems and the actual needs of enterprise and to ensure the system's utility.

- Process principle. The system design shall follow the process and systematic principle. Specifically, in design of middle managers’ competency evaluation information systems, the design of system functional modules and operating procedures should be consistent with middle managers’ competency evaluation program.

- Reliability principle. The reliability principle of system design refers to stability of system operation, security of data storage, and accuracy of data collection.

**Function modules design of competency evaluation system:** Taking comprehensive consideration of evaluation subject, method and process and other factors of user demands, the main function modules of middle
managers’ competency evaluation information system as shown in Fig. 3. contain five parts, obvious skills scoring module, recessive skills scoring module, competency scores aggregation, system maintenance module and assistance module:

- **Obvious skills scoring module.** The module takes advantage of reasonable indicators quantification rules to complete the obvious skills scoring process of middle managers, the representative indicators of which could be academic level, professional title level, work length and vocational experience. The main functions includes realizing obvious skills indicators information input, quantification rules input and maintenance, and scoring results’ aggregation statistics and query.

- **Recessive skills scoring module.** The module uses 360° feedback method to finish the recessive skills scoring process of middle managers, the representative indicators of which can be work attitude, resilience, innovation sense, and ways of thinking. The main functions include: based on system user’s roles positioning, to realize the corresponding assessing object’s recessive skills indicators scores information input, calculating rules input and maintenance, and scoring results’ aggregation statistics and query.

- **Competency scores aggregation.** This is the module for query, aggregation and analysis of middle managers’ competency evaluation results, which mainly implements the calculation function of obvious and recessive skills, and function of calculation and classified summation of the final competency scores results.

- **System maintenance module.** Competency evaluation process contains indicators system design, weight design of different types of evaluation subjects, weight design of different levels of indicators, calculation rules of evaluation result scores and so on. System maintenance module mainly realizes the obvious and recessive skills indicators maintenance, different levels of indicators weights maintenance of different types’ evaluation subjects, user authorities’ settings and user roles management function.

- **Assistance module.** By introducing all the functional modules and using methods of the system, the module helps users to get familiar with system architecture and operating process, and mainly assists in downloading and viewing the materials, including system modules introduction, system development technology and user instructions.

**CONCLUSION**

Middle managers’ vocational skills level and business management level have the direct impact on the realization of enterprise development strategy and production and operation goals. It is of important significance for enterprise management to develop competency evaluation information system for achieving the work abilities’ evaluation and potential work utilities’ excavation of middle managers so as to strengthen middle managers’ competency management. Rather than a static process, the development of competency evaluation information system is a dynamic process. That means the information system should be updated and maintained timely according to many factors like information technology development level and enterprise strategy changes, in order to keep the consistency with enterprise requirements.

**REFERENCES**


