Study on the Maturity of People Capability in Innovative Enterprises

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Abstract

The characteristics of innovative enterprises are high-growth and high-risk, enterprises in the fast growing are easy to neglect human resource management focus and the potential risks. This paper applied PCMM and AGBA evaluation model to evaluate maturity of people capability for innovative enterprises, and an indicators system of innovative enterprise is built. It is proposed that innovative companies can effectively overcome low maturity of people capability and innovation deficiency by employing PCMM, it can also continuously improve management and innovation capability of innovative enterprise.

Key words: Innovative enterprises; People capability; PCMM; AGBA evaluation model

1 Introduction

Innovation has proven to be a comprehensive national strength in the knowledge economy. Can a country Maintain a competitive advantage in the fierce international competition in long-term competitive advantage, fundamentally depends on its rate of technological progress and independent innovation ability[1]. Chinese companies less efficient use of resources, it mainly shows high input, high consumption, high pollution and low output of extensive economic characteristics. This predatory use of resources, lead China's resources driving stress, part of the strategic resources have been drying up. Also make China the world's richest countries, human resources facing a "labour shortage", China's environment under enormous pressure this situation. Due to lack of innovation, China does not master core technologies and intellectual property rights, the interests of Chinese enterprises in many international games at a distinct disadvantage. In order to enhance the capability of independent innovation and core competitiveness of China, China formally launched the innovative enterprise pilot work in July 2006. Proposed to use 15 years or so that the 2020 contribution rate of China's scientific and

technological progress to be from 30% to 70%, Society R & D investment in GDP more than 20% dependence on foreign technology from 54% to 30%. To July, 2009, China's Ministry of Science, the SASAC, the ACFTU, etc., have released 356 innovative companies. Currently, the world recognized innovation-oriented country, more than 20, including the United States, Britain, France, Germany, Japan, Denmark, Finland, Sweden, Korea and Singapore. China needs to play to the strengths, the implementation of innovation and development strategies, vigorously cultivate innovative talents.

2 Literature Review of Innovative Enterprise

The pioneer of innovation theory, Joseph Schumpeter believes that innovation is the combination of raw materials and power production of other things, or the means of production of new combinations. Lance Davis and Douglass North believe that institutional innovation is the innovator in order to obtain additional income and additional to the existing system to change. Mansfield studied technology innovation from diffusion and transfer of technology innovation and market structure and the relationship between technological innovation. Freeman summarized 10 innovative characteristics of successful enterprises. Zhang Ming proposed an innovative concept of corporate culture and the need for institutional innovation. Treven S, Mulej M. believes that companies from the knowledge-based enterprises to innovative enterprises to change, the need for human resources management system control model. Chen Chun-ming, Jin Da-wei believe that innovative companies face in the process of growing environmental risk, technology risk, market risk and management risk. Cai Qi-xiang, Zhang Wei, Lu Xia studied evaluation criteria for innovative enterprises, innovative enterprises to determine the meaning and purpose of the standard of innovative enterprises. Wang Wen-liang, Wang Dan-dan from the identification of innovative pilot enterprises evaluation and performance evaluation of innovative business growth perspective of two innovative companies to build up the evaluation index system. Li Hao-tian, Zhou Yuan, Wang Wei-guang used of corporate life cycle theory, the growth of innovative enterprises stages of analysis. Wang Ya-ping his dynamic model of innovation-oriented enterprise the power mechanism, operating mechanism, binding mechanism were analyzed. He Jian-hong, He Chang-zheng believe that the innovative capability of enterprises should evaluate resources for innovation and investment, encourage innovation and culture, innovation and performance, the ability of independent innovation, innovation activities of the organization and management of five core indicators study. Xiang Gang, Chen Xiao-Li, Li Xing-kuan described the dynamic evaluation of continuous innovation innovative companies in the importance of evaluation. How to deal with the high-growth innovative companies, how to scientifically measure and continue to enhance the innovative capacity of human resources business, how to more effectively attract, develop, organize, motivate and retain innovative companies in human resources, how human resource management from the perspective of continuous innovation won the company's core competitive advantage, etc. these issues are in urgent need of innovative companies to strengthen the problem.

3 People Capability Maturity Model

3.1 The background of PCMM

People Capability Maturity Model (PCMM) is proposed in July 2001 by Carnegie Mellon University Software Engineering Institute (SEI), it is based on HRM related processes to enhance the domain consisting of a hierarchical system model, the organization of People management maturity level, process domain, objectives and practice of organic blending together, so as to effectively attract, develop, organize, motivate and retain human resources. PCMM, as a guide to improvement activities, is to improve people capacity, product quality and shorten the production cycle. It has been applied to many industries in the world and obtains huge success.

3.2 The structure of PCMM

HRM practices can be divided into several phases by PCMM, Other than the initial level, each level can be described in a series of related practices. PCMM of five maturity levels, in addition to the original level, the other four contains 3-7 process domain, domain defines a process maturity level must be institutionalized capacity. When an enterprise to achieve these goals, it set up its People capabilities affect the ability to process domain.

3.3 The function of PCMM

One of the greatest features of PCMM is that it can continue to improve the company's HRM activities. The most influential of its function is to improve the IDEAL model, that the enterprise need to improve human resource management activities are divided into beginning, the diagnosis, the establishment, operation and learning of five stages, it is effective in improving organizational capacity and agility of the ideal model. PCMM another important feature is its evaluation function, it can be a rigorous, standardized approach to assessing the business stage of HRM, HRM practices of the advantages and disadvantages, and HRM activities in the most need of improvement, so as to continuously optimize the HRM.

4 People Capability Maturity Evaluation System Based on AGBA Evaluation Model

4.1 The meaning of AGBA

AGBA based on BP neural network can integrate Analytical Hierarchy Process, Grey Relational Analysis, Back Propagtion Artificial Neural Network and Accurate Evaluation with a whole. And can be used. First, AHP can be constructed the evaluation index system which include ladder of the index system, and can determine the index properties. Second, we can assigned to it by the Delphi method based on fuzzy set theory, and then determine the fuzzy set of indicators of the degree of membership by the gray relational analysis. For the accurate indicators, it can be made by the method of questionnaires, interviews, data collection, precise operation and the dimensionless. Then we can get a reasonable set of optimal weights by the using of fuzzy set theory and BP neural network. Finally, through the trained BP neural network, the target about the capability maturity evaluation of company HR can be evaluated and we can obtain an evaluation result. The five methods which integrate human resources constitute the evaluation model of the People Capability Maturity AGBA.

4.2 The innovative enterprise people capability maturity evaluation index system

Innovative enterprise people capability maturity the establishment of the evaluation index system is complicated system engineering. First of all, using AHP, decomposing complex problems for component factors; then, according to dominating relations of these factors, form the orderly deferred class time structure, divided into target strata, rule layer and scheme layer. Rule layer bases on the level of the manpower resources maturity of innovative enterprise mainly. It designs for five criteria, followed with 20's criteria. Scheme layer is to achieve the goal of selection of specific plan, and here for 56 specific performance indexes, including 22 accurate indexes and 34 fuzzy indexes.

Table 1 - Innovative Enterprise People Capability Maturity Evaluation System

Target layer A	Rule layer B		Program level D	Attributes
Innovative enterprise people capability maturity	Rule layer B	Sub-criteria C		
	Optimizing B5	Individual capacity development C1	Activities to develop personal goals and plans D1	F
			establishment and use of personal process D2	F
			Measurement and analysis of the effect D3	F
			To continuous improvement of process D4	F
		Tutor C2	Choose the right tutor D5	A
			Guidance on how to improve performance D6	F
			To achieve the performance goals of progress D7	F
		Ongoing staff management C3	Establish mechanisms to improve employee D8	F
			Assess the innovative programs and technology D9	F
			implement programs and technical D10	A
	Predictable B4	Instructor C4	Guiding objectives D11	A
			Select the right mentor D12	F
			Establish mentoring relationships D13	F
			Assessment guiding results D14	F
		Team building C5	Knowledge and skills of team members D15	F
			Determine team goals D16	F
			Assessment of team performance D17	F
		Team implementation C6	Mission Performance Standard D18	A
			Effective participation in the work of team members D19	F
			The standards of personal emoluments of the team D20	A
		Organizational capacity management C7	Core competence of the measurable goals D21	A
			Application and improvement of the effectiveness of guidance D22	F
		Coordination of organizational performance C8	Corporate and individual performance indicators D23	A
			Related programs related effects on performance D24	F

	Defined B3	Knowledge and skills analysis C9	Enterprise business process D25	A
			Business knowledge and skills required D26	F
			Knowledge and skills inventory D27	A
			Future demand for knowledge and technology D28	A
		Employee programs C10	Strategic staff planning D29	A
			Recent staff development plan D30	A
		Capacity development C11	The development of core competence D31	F
			The key knowledge and capacity development D32	F
		Career Development C12	Personal development plan D33	F
			Personal training D34	A
			The task of promoting employee career goals D35	A
		Implementation capacity C13	Based on knowledge and ability to recruit D36	F
			Knowledge and ability of the candidates D37	F
			Pay based on knowledge and skills D38	A
		Opportunities for participation in cultural C14	Effective channels of communication D39	A
			Employee participation in management D40	F
	Managed B2	Work environment C15	Objective reality in the workplace D41	A
			To ensure that the work normally carried out D42	F
		Communication C16	Effective communication mechanisms D43	F
			Individuals necessary communication skills D44	F
		Staffing C17	Knowledge and skills required for vacant posts D45	F
			The selection of qualified candidates D46	A
			Successful transition to the new job candidate D47	F
		Performance Management C18	Corporate and individual performance standards D48	A
			Methods to improve performance D49	F
			To solve performance problems D50	A
		Training C19	Knowledge and skills required for competent D51	F
			Training needs analysis D52	A
			Employees receive the necessary Training D53	F
		Salaries and benefits C20	compensation strategy D54	F
			Compensation management plan D55	F
			Periodic adjustment Remuneration D56	A
	Managed B1			

4.3 AGBA evaluation model

Thinking about the AGBA evaluation model, we assume that there are four innovative enterprise people capability maturity to evaluate and the constructing evaluation model are as follows:

We will invite four experts to evaluate the fuzzy indexes of four enterprises. And the accurate indexes of four enterprises can be evaluated by the questionnaire and on-the-spot visit. In order to construct innovative enterprise people capability maturity evaluation system, the procedure is as follows:

The first step: using AHP method to establish comprehensive evaluation index system of maturity.

$$N=[NF, NA] \tag{1}$$

The second step: to establish fuzzy evaluation index set. According to the front to establish comprehensive evaluation index system, through the four experts to fuzzy index score of fuzzy evaluation index, we can conclude the fuzzy evaluation index collection:

$$\begin{aligned} N_{if} &= (n_{i1} \quad n_{i2} \ldots n_{i34}) \\ &= (D_1\ D_2\ D_3\ D_4\ D_6\ D_7\ D_8\ D_9\ D_{12}\ D_{13}\quad D_{16}\ D_{17}\ D_{19}\ D_{22}\ D_{24}\ D_{26}\ D_{31}\ D_{32}\ D_{33}\ D_{36}\ D_{37}\ D_{40}\ D_{45}\ D_{47} \\ &\quad\ D_{49}\ D_{51}\ D_{53}\ D_{54}\ D_{55}) \end{aligned} \tag{2}$$

So the fuzzy evaluation index set matrix of four companies is:

$$N_F=[\ n_{1f}\ n_{2f}\ n_{3f}\ n_{4f}\ ]^T \tag{3}$$

The third step: using Delphi method to establish evaluation class degrees set. Each experts need model the evaluation index:

$$k_{if}=(k_{i1}\ k_{i2}\ldots k_{i34}) \tag{4}$$

Evaluation of the level set often used rank evaluation, we use the score evaluation , each factor of score evaluation is between 0~10, the higher score indicts that the large index is better, or the extremely small indicts the index is worse. So the same sample of four enterprises which four experts assessed, the following is the degree of matrix:

$$K_F=[k_{1f}\ \ k_{2f}\ \ k_{3f}\ \ k_{4f}\ ]^T \tag{5}$$

The fourth step : using grey correlation degree analysis to determine membership sets of the fuzzy evaluation model of evaluation index.

Fuzzy index of enterprise membership:

$$h_{if}=(\ h_{1f}\ \ h_{2f}\ \ldots\ h_{34f}) \tag{6}$$

Here using the grey close degree analysis to identify the fuzzy index of membership sets of innovative enterprise people capability maturity. Fuzzy evaluation index of the sample enterprise membership set matrix is:

$$H_F=[h_{1f}\ h_{2f}\ h_{3f}\ h_{4f}\ ]^T \tag{7}$$

The fifth step : calculating precision value evaluation index set. According to the above the index system, set up the accurate calculation to the enterprise:

$$\begin{aligned} n_{ia} &= (n_{i1}\ n_{i2}\ \ldots n_{i22}) \\ &= (D_5\ D_{10}\ D_{11}\ D_{18}\ D_{20}\ D_{21}\ D_{23}\ D_{25}\ D_{27}\ D_{28}\ D_{29}\ D_{30}\ D_{34}\ D_{35}\ D_{38}\ D_{39}\ D_{41}\ D_{46}\ D_{48}\ D_{50}\ D_{52}\ D_{56}) \end{aligned} \tag{8}$$

So accurate index matrix of four samples of enterprise is:

$$N_a = [\; n_{1a}\; n_{2a}\; n_{3a}\; n_{4a}\;]^T \qquad (9)$$

The sixth step: Dealing the precision index with dimensionless processing, the outcome is:

$$H_A = [\; h_{1f}\; h_{2f}\; h_{3f}\; h_{4f}\;]^T \qquad (10)$$

So the comprehensive fuzzy index and precise indexes with BP neural network's input is:

$$H = (H_F,\; H_A) \qquad (11)$$

The seventh step: using neural network training to learn from the two enterprises, it is concluded that the optimal weight assembly of evaluation system.

$$P = (p_1\; p_2\; \dots p_{56})\; p_i \in [0,1] \qquad (12)$$

The eighth step: through the trained BP neural network, evaluating other two sample enterprise in recruitment evaluation, get the evaluation results:

$$W = (w1, w2) \qquad (13)$$

4.3 Evaluation of AGBA evaluation model

Using a variety of assessment methods comprehensively, AGBA evaluation model implements the close integration of evaluated objectives and evaluation model effectively, and greatly simplifies the PCMM's over-complicated operation, increases the science and rationality of the evaluation of innovative enterprise human resource capability maturity, what's more, it avoids the deficiencies using some single evaluation method, making a variety of integrated evaluation method being complementary mutually. However, in actual use, we should pay special attention to the selection of the sample enterprises and logical relationships among the various indicators.

5 Conclusion

PCMM not only concerns about the process oriented of human resource management, but also focuses on the result oriented of human resources management. And its ideas of maturity and continuous improvement in stages point out specifically the gravity of the human resources management and the direction for human resource management, meanwhile, map out the road of human capacity improvement and upgrading clearly, which is the major innovation of the theory and practice of human resources management. In some extent, this can effectively address a series of human resources management issues such as low maturity of the human capacity, lack of creativity and innovation risk resulted by too-rapid growth of innovative enterprises. But because of the excessively cumbersome processes and practices of PCMM, and the difficult localization problem, there is an urgent need for process optimization of PCMM and combining with other methods of assessment. This paper puts AGBA evaluation method combined with PCMM for the first time, and makes optimization and reconstruct on processes and practices of PCMM, which are the content and methodological innovation of the paper. Moreover, the author will continue to have an in-depth study on this issue in the future.

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