A Test on the Systematic Fuzzy Measurement of the Key degree for the Core Employees' Performance Traits

TEST DE LA MESURE SYSTEMATIQUE ET FLOUE DU DEGRE CLE POUR LES TRAITS DE LA PERFORMANCE DES EMPLOYES IMPORTANTS

Liang Xiaowei[1]

Abstract: According to the employees' embedded performance view of organizational social capital and its theoretic analytic dimensions, the core knowledge employees' key performance traits are operationally defined as key degree with seven measuring dimensions. A scale for measuring the key degree is developed and empirically analyzed by means of questionnaire with Cronbach's α >0.7 and significant three-factor-structure validity. And then systematic fuzzy decision theory is introduced to comprehensively measure the key degree indicator (KDI) of the core employees' performance traits with the third party test, and the results initially show satisfied discriminating rate of the core employees (94%) from the sample and significant correlation between KDI and the organizational innovation performance (R=0.82, P<0.001), and the prediction potential of the organizational innovation performance with KDI.
Key words: Core employee, Performance trait, Systematic fuzzy measurement

Résumé: Selon le point de vue des employées sur la performance du capital social organizationnel et ses dimensions de l'analyse théorique, les traits de la performance clé des employées importants sont pratiquement définis comme le degré clé avec sept dimension de mesure. Une échelle pour mesurer le degré clé est développée et empiriquement analysée au moyen du questionnaire avec α >0.7 de Cronbach et la validité de la structure de trois facteurs signifiante. Puis la théorie de décison systématique et floue est introduite afin de mesurer le degré clé indicateur (key degree indicator /KDI) des traits de la performance des employés importants avec la troisième partie de test, et les résultats montrent au début un taux de distinction satisfaiseant des employés (94%) dans un échantillon et une corrélation signifiante entre KDI et la performance d'innovation organizationnelle(R=0.82, P<0.001), et la prédiction potentielle de la performance d'innovation organizationnelle avec KDI .
Mots-Clés: employés importants, trait de performance, mesure systématique et floue

1. INTRODUCTION

According to the organizational social capital ebeddedness-based perspective of the performance[2], a core employee can be recognized as the undertaker and transmitter of high organizational performance, and as the key group in the organizational value creation. But in most literature the core employees' performance traits are taken in the atomistic way with less focus on their social associability that makes organizational intellectual capital in creating the values, lack of the operational definition and measurement of the core employees, and lack of sophisticated understanding of the retention motivation on the core employees. The creation of the organizational value depends on the edge of the organizational social capital from its stakeholders [1], and so the core employees can be defined as the ones who can make doubles of times of the related performance with his influence on the node (other people) in the organizational social networks, and they are usually the knowledge workers with higher human capital and mainly seven key measurable dimensions of their high performance traits [3, 4](see table 1).

If the core employees' traits can be operationally

[1] Management College of Wuhan University of S&T,China.

[2] G. G. Dess & J. D. Shaw. 'Voluntary Turnover, Social Capital and Organizational Performance'. *Academy of Management Review*, no.26, pp. 446-456, 2001.

*Received 8 February 2006 ; accepted 22 July 2006

[3] G. G. Dess & J. D. Shaw. 'Voluntary Turnover, Social Capital and Organizational Performance'. *Academy of Management Review*, no.26, pp. 446-456, 2001.

[4] J. B.Quinn, P.Anderson & S.Finkelstein. Leveraging intellect. *Academy of Management Executive.* Vol.10,no.3,pp.7-27,1996.

defined as the key degree of their key performance edge [1], the comprehensive measurement of the core employees' seven performance traits can hold the decision characteristics of fuzzy system with multipurpose: (1) the boundary between the core and the un-core employees is fuzzy for the key degree's continuum nature; (2) the seven dimensions of the key degree for assessing the core employees are cross linked, requiring comprehensive measurement; and (3) the weights for the seven dimensions of the key degree can be dynamic in different organizational terms, requiring reflecting the structure of the performance traits in order to get fitter motivation for the high performance employees. In this paper, we apply the systematic fuzzy assessing approach to the key degree of the core employees' performance traits and expect to set a measuring model for organizational talent management.

2. METHOD AND RESULT

The core employees' performance traits stand for the key organizational behavior performance variables as uneasily directly quantified indicators. But they can be effectively measured with descriptive measuring items providing base for the empirical analysis [5, 6]. So, our research work is designed in three periods for realizing the above goal: (1) a semi-structure review with the key employees is adopted using the seven dimensions of the performance traits to grasp and collect the typical and new items of the variables; (2) larger sample is taken with questionnaire (self-report) to gather the data for statistics analysis (alignment test and factor structure detection); (3) the comprehensive indicators of the employees' key degree (KDI) are standardized with systematic fuzzy process and then let the third party to assess the indicators for confirmation and analyze the correlation between the KDI and the subjects' organizational innovation performance to test the KDI's validity.

2．1 Data collection and the key degree's measurement

The subjects of our study are the employees in the municipal hospitals of eight lager cities in Chinese Main Land which are typical of knowledge-intensified organizations. In April of 2004 we had reviews, in the help of the HRM departments of the hospitals, with the choice people (N=32) who are in the position of sectional directorship or academic leadership of their professions to grasp and collect the items subjected to the seven dimensions of the key degree, and with feedback from the subjects, theoretical discriminating test and integration[7, 8], we got the scale of key degree indicators formulated which are made up of 18 items subjected to the seven dimensions (see the appendix table at the back of this paper).

Then by using the scale (Likert 7degree value) with questionnaire we randomly selected a sample of 140 among the people in eight working groups who are in the high time of their career (including the professionals and the administrators with 15-20 people per group in eight hospitals, aged from 26-46, 38.7% of the females, all married, college education and above, more than 5 years of their professional life and 3-13 years in their present position). In the investigation process, with the help of the HRM departments' supportive easy tea-talking for the subjects, we first explained the easily-mistaken items and made promise of the privacy, and let the subjects answer the questionnaires naturally and then got back on the spot, and achieved the effective return rate of 92% (129 effective questionnaires). By using SPSS11.0, we made the test on the internal alignment confidence degree (Cronbach α value) of the items and the factor analysis. The α value for each dimension of the key degree indicators are all above 0.7(see tab.1), and the seven dimensions respectively have their most loading coefficients in three factors (see tab.2) with total explanation of 60.86% of the variance of the employees' performance traits. We can define the three factors as f1 the structure factor, f2 the relationship factor and f3 the recognition factor based on the organizational social capital theory[9, 10].

[5] T. Ritter. 'The networking company: antecedents for coping with relationships and networks effectively'. *Industrial Marketing Management*, no.28, pp. 467-479, 1999.

[6] T. Ritter, H. G. Gemunden. 'Network competence: its impact on innovation success and its antecedents'. *Journal of Business Research*, vol. 56, pp. 745-755, 2003.

[7] N. Hayes. *Successful team management*. International Thomson Business Press, 1997.

[8] R.C.Mayer, J.H. Davis & F.D. 'Schoorman. An integrative model of organizational trust'. *Academy of Management Review*, vol.20, no.3, pp. 709-734, 1995.

[9] J. Nahapiet & S. Ghoshal. 'Social capital, intellectual capital, and the organizational advantage'. *The Academy of Management Review*. Vol.23, no.2, pp. 242–266, 1998.

[10] P. Moran. Structural vs. relational embeddedness: 'social capital and managerial performance'. *Strategic Management Journal*, vol. 26, pp. 1129-1151, 2005.

Tab. 1 Investigation of the KDI scale and the statistics analysis (N=129)*

Dimension	Linking organizational networks (3 items)	Transmitting organizational memory (2 items)	Elastic confidence (4 items)	Team synergy (2 items)	Uneasily substitutable (2 items)	Innovation trait (3 items)	Performance chain influence (2 items)	Average / Total
$\overline{X}_i$	5.23	4.50	4.96	5.27	4.09	4.84	4.90	4.83
S_i^2	1.48	2.04	1.79	1.54	2.40	2.14	1.94	13.33
W_i	0.11	0.15	0.13	0.12	0.18	0.16	0.15	1.00
α	0.76	0.71	0.92	0.82	0.72	0.80	0.83	0.81

* $\overline{X}_i$ is average score of each dimension from the KDI scale investigation; S_i^2 is variance of each dimension; W_i is the variance weight of each dimension ($W_i = S_i^2 / \sum_{i=1}^{n} S_i^2$); and α is Cronbach's confidence coefficient.

Tab.2 Factor analysis (N=129)

KDI variables (x_i)	Organizational social capital construction factors		
	Structure（f1）	Relation （f2）	Recognition （f3）
Linking organizational networks	**0.632**	0.230	0.371
Transmitting organizational memory	**0.590**	0.312	0.324
Elastic confidence	0.187	**0.665**	0.364
Team synergy	0.192	**0.771**	0.188
Uneasily substitutable	0.146	0.209	**0.702**
Innovation trait	0.186	0.212	**0.785**
Performance chain influence	0.294	0.189	**0.693**
Explained total variance	60.86%		

2．2 Fuzzy standardization of variables of the employees' key degree

According to the systematic fuzzy theory and for comprehensive measurement and comparability of the key degree above from the scale, the indicators of its seven dimensions are required to standardize [11,12]. We can define indicator *i* of the key degree x_i as $h_i = h(x_i)$, and define indicator *i* of the non-key degree as oh_i, and let: h_i, $oh_i \in [0,1]$. Here the types of the variable h_i can exist as:

① for the larger the better one：

$h_i = (x_i - \min\{x_i\})/(\max\{x_i\} - \min\{x_i\})$

or $h_i = x_i / \max\{x_i\}$,

② for the less the better one：

$h_i = (\max\{x_i\} - x_i)/(\max\{x_i\} - \min\{x_i\})$

or $h_i = 1 - x_i / \max\{x_i\}$,

and ③ for the continuum nature of indicator *i* of the key degree, there exist： $h_i + oh_i = 1$

And there usually may exist three type indicators [9] in this variable set $\{x_i\}$: ① x_i can be directly quantified, ② x_i can be indirectly quantified, and ③ x_i is of the nature of quality and required to measure with scale. So based on the qualitative nature of the variables used in our scale of the key degree, we can define indicator *i* of the employee's key degree x_i as:

$h_i = h(x_i)$ = assessed score / referred up-boundary

[11] Liang Xiao-wei. 'A preliminary study on systematic fuzzy assessment of the regulative market barriers (in Chinese)'. *Journal of Industry Engineering and Engineering Management*, vol.14, no.3, 1-4. 2000.

[12] Chen Shou-yu. *Systematic fuzzy decision theory and application (in Chinese).* Dalian: Dalian University of Technology Press, 1994, pp. 12-81.

score, and let: $oh_i = oh\ (x_i) = 1 - h\ (x_i)$.

2．3 Systematic fuzzy model for comprehensively measuring the key degree

According to the systematic fuzzy nature of the assessed indicators and the structural requirement of the assessment model, we can define the structure of the model in this paper as following:

let the assessment set of the employee's key degree (K.D) as: V={hi-K.D，sub-K.D，low-K.D},

let the relevant level variable set as:

$$L = \{1,\ 0.5,\ 0\},$$

let factor set of the dimension indicators as:

$$F = \{x_1, x_2, \ldots,\ x_n\},$$

let the weight set of the dimension indicators as:

$W = \{w_1, w_2,\ldots, w_n\}$, and let $\sum_{i=1}^{n} w_i = 1$, and we can get the variable w_i by means of the Variance Weight Method[11].

Let systematic fuzzy comprehensive assessment matrix as: $R = (r_{ij})_{n\times 3}$

Here in the matrix R, r_{ij} stands for the relative belonging degree of the indicator i of the key degree to set V_j and set L_j (i=1,2,3…,7; j=1, 2, 3), and according to the continuum nature of the variable indicator i set, we can let r_{ij} be defined as: $r_{i1} = h_i$, $r_{i2} = h_i \wedge (1- h_i)$, $r_{i3} = 1- h_i$.

As for possible structural analysis of the indicator i set, we can define the variable the comprehensive key degree as: $CKD = \sum_{i=1}^{n} w_i h_i$,

and define the variable the weight of indicator i in CKD as: $dh_i = w_i h_i / CKD$.

According to the improved algorithm of the comprehensive belonging degree set $\{cv_j\}$ by Chen Shou-yu (1994)，cv_j is defined as:

$$cv_j = 1/\{1+ [(1- \sum_{i=1}^{n} w_i\ r_{ij}\ ) / \sum_{i=1}^{n} w_i\ r_{ij}\ ]^2\ \},\ j =1,2,3.$$

According to the decision rule of max$\{cv_j\}$ with the total value of the set $\{cv_j\}$ incorporated into 1, by using the value max$\{cv_j\}$ we can distinguish the belonging type of the employee's key degree of his performance traits. And we can also define the average level of the employee's key degree AKD as:

$$AKD = L \cdot CV = \sum_{j=1}^{3} L_j\, cv_j \text{ and } AKD \in [0，1].$$

From the measurement model above, we can see they can function at least as: (1) distinguishing the key degree of the core employee's performance traits and his position edge in contribution to the organizational value in a more systematic and objective way with the indicators of max $\{cv_j\}$, and *AKD*; (2) making structural analysis on the indicator system of the core employee's performance traits with the indicators of *CKD* and dh_i ; and (3) making the dynamic assessment of the core employee's performance traits with the indicator sets above according to organizational development in order to effectively predict and formulate the strategy for talent management decision.

3. TEST FROM THE THIRD PARTY AND DISCUSSION

It is generally argued for that the application of the third party assessment to the self-reported result can effectively test the feasibility. So, we design a third-party test on the results above with the procedure as that: (1) figure out the subjects from the sample whose *AKD* value is more than 0.5, and we get 41 people taking the proportion of 32% of the total effective questionnaires; (2) make third party assessment (including the subject's director, co-worker and lower level co-worker) on the 41 people with the same questionnaires; (3) figure out the distinguishing rate (*DR*) of the effective core employees from the third party, in which we define the *DR* as:

DR = the number with *AKD* more than 0.5 after the third party assessment / the number with *AKD* more than 0.5 before the third party assessment; and (4) test the correlation (R) or prediction power between from the employee's key degree indicator (*KDI*) to the organizational innovation performance (the scores are usually assessed with multi-indicators of the professional innovations by the supervising agency of the hospitals at end of each year, and we adopted the score data of the year 2004 with full mark of 100) .

To compare the prediction effectiveness of the employees' average *KDI* in working group level between the variable $\bar{x}_i$ from the scale scores of each unit and the variable *AKD* from the systematic fuzzy model, both of the variables were used in the data analysis from the third party assessment (see the results in tab.3).

Tab. 3 The results of the third party test for the feasibility of the KDI

Unit order (sample number)	1(16)	2(14)	3(17)	4(16)	5(18)	6(16)	7(17)	8(15)	Average
DR (%)	100	100	89	100	87.5	100	90	85.7	94.0
Innovation scores*	90	88	86	85	85	80	78	75	R^{**}
Effective scale KD ($\overline{X}_i$)	5.94	5.92	6.02	5.90	5.91	5.90	5.89	5.88	0.5652
Effective fuzzy KD (*AKD*)	0.76	0.73	0.78	0.74	0.73	0.69	0.70	0.69	0.8207

*** The innovation scores are usually assessed with multi-indicators of professional innovations by the supervising agency of the hospitals at end of each year, and the score data of the year 2004 are adopted with full mark of 100. ** Pearson's correlation coefficient is adopted at $P < 0.001$.**

Appendix tab. Scale of the key degree indicators for the core employees' performance traits

Dimension: X_i	**Items: X_{ij}**	**Source**
Linking organizational networks: X_1	1 I have established good relationship with many VIPs both in and out of our unit, and when crossing upon stubborn problems it's mainly me who can invite the VIPs for timely solution. 2 I usually concern very much about the matters (e.g. academic meetings, training, and professional visiting) related to our unit development in order to link the valuable potential co-operative partners. 3 I'm sensible in possible collision with others, and easily take the opposite position to make constructive solution.	Ritter (2002) and Review
Transmitting organizational memory: X_2	4 I often predominate or participate important decision and planning of our unit, but if I'm absent, other people can't make the plan work well as planned before. (reversed score) 5 The knowledge, experience and effective ways of doing things transmitted from me can be usually innovatively applied to our business by others.	Dess (2001) and Review
Elastic confidence: X_3	6 If I get the idea fixed by myself of how to complete the tasks, I won't allow others to make their influence on these things. (reversed score) 7 I'm often authorized by my unit leaders, colleagues or co-workers with full power and commitment to fulfill the tasks. 8 I hope very much that there is the most effective monitoring ways to other's actions when they are doing the things without direct reward. (reversed score) 9 Even in no way to monitoring my unit member's business, I'm inclined to deliver the key tasks to them.	Mayer (1995) and Review
Team synergy: X_4	10 I'm more inclined to work in the unit where I can undertake multi-roles, and enjoy decision-making with others full of co-operation relationship instead of intensified hierarchic atomistic organization. 11The profession I major in is so independent that there is usually no need for me to co-operate with others. (reversed score)	Hayes (1997) and Review
Performance chain influence: X_5	12 More than 60% of my achievements require other's contributions. 13 The reward from my job in my unit is no relation to what others do. (reversed score)	Dess (2001) and Review
Uneasily substitutable: X_6	14 If I want to have turnover from my unit, it will be hard for me to get it down because fewer people can take my place in the unit. 15 Most of my co-workers can often solve the problems I feel stubborn. (reversed score)	Dess (2001) and Review
Innovation trait: X_7	16 I'm inclined to make the working plan and its performance as I did. (reversed score) 17 I'm inclined to argue on the ideas of different view points with my supervisor, co-workers or partners, even which may put me in quandary. 18 I'm inclined to pay more of my time, energy and ask for more organizational supports on the new things valuable.	Hayes (1997) and Review

From the third party's test results, we have found as high as 94% of the effective core employees discriminated with the indicator AKD and higher correlation (R) or prediction to the organizational innovation performance for the systematic fuzzy indicator AKD (0.8207) than that for the scale indicator xi (0.5652) with significance of P<0.001, which may be because of the systematic fuzzy standardization of the scale indicator data with their seven dimensions' weights adjusted by means of the variance weighing (VW) in tab.1. VW method is viewed as one kind of objective weighing and may better explain the differences of the KDI from the different working groups. As far as the statistic VW is concerned in tab.1,

the indicators of the employees' key performance traits — "uneasily substitutable", "innovation trait" and "transmitting organizational memory" get stronger weight, which may be the key influencing factor causing the performance differences in the working groups from the sample and this result fit what we have actually found during the clinical investigation. So the KDIs developed in this paper may have significance in more effectively predicting the organizational performance, but it also needs improvement through empirical study with larger samples from different industries.

THE AUTHOR

Liang Xiaowei, Associate Professor, P.H.D, Wuhan University of Science and Technology.

Add: Wuhan University of Science and Technology, Wuhan, Hubei, 430081, P.R. China.

E-mail: lstar555@sohu.com