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Research on fuzzy comprehensive evaluation of knowledge management capability of governmental organization-take a governmental organization for example

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ABSTRACT

As the society has stepped into the era of knowledge economy, the implementation of scientific and effective knowledge management is of great realistic significance to the development of governmental organizations. Based on precedent theories of knowledge management capability, and referring to knowledge management practices of governmental organizations, a knowledge management capability evaluation system of a (governmental organization) is established. Moreover, through using the fuzzy comprehensive evaluation method, a comprehensive evaluation of knowledge management capability of A is made so as to provide guidance and reference to governmental organizations for the improvement of their knowledge management capabilities.

Key words: Governmental organization; knowledge management capability; index system fuzzy comprehensive evaluation

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INTRODUCTION

In the context of ceaseless economic growth and rapid technological innovations, and confronted with an ever-changing environment and situation, an enterprise or organization is increasingly aware of the significance of talent resources. Therefore, how to make full use of, integrate and give full play of talents with limited resources have increasingly become a topic of great urgency.

As a highly specialized and professional public sector, governmental organization is endowed with abundant knowledge resources. Against this background, using scientific methods to measure and evaluate knowledge management capability of governmental organization so as to make it understand the importance of knowledge management and realize its own capabilities as well as weaknesses are of profound realistic significance and practical value.

LITERATURE REVIEW OF KNOWLEDGE MANAGEMENT CAPABILITY AND THE ESTABLISHMENT OF THE EVALUATION SYSTEM

2.1 Connotation of knowledge management

Since the concept of knowledge management was put forward, more and more relevant studies have been carried out, yet the academia has not reached a consensus on the definition of knowledge management. Nevertheless, some representative scholars Wiig(1993), Masie (1998), Quitas(2001)and Bassi(2004) have made respective definitions. For instance, Quitas (2001) regarded knowledge management as a continuous process which managed all sorts of knowledge to meet present and future needs, determine and explore existing knowledge and develop new opportunities [1]. Bassi (2004) held that knowledge management was a process to create, obtain and use knowledge with a view to enhancing the organization's performance[2]. Besides, with the social progress, many scholars began to pay attention to knowledge innovation. For instance, Francisco & Guadamillas (2002) asserted that knowledge

management would contribute to constant innovations of enterprises[3].

2.2 Literature review of knowledge management capability index system

Through reviewing the literature, we find out that some scholars define knowledge management capability as the management capability of knowledge management process. For example, Nonaka (1994) held that knowledge management capability was the integration of knowledge internalization, externalization and socialization [4]. Teece et al (1997) said that knowledge management capability was the ability to create, obtain, integrate and allocate knowledge [5]. Nevertheless, more scholars asserted that knowledge management capability included capabilities to manage the knowledge management process as well as capabilities of influential factors of knowledge management. For example, Wiig (1993) regarded knowledge management as the process to create and maintain knowledge infrastructure, upgrade its organization and transform knowledge assets and finally make use of knowledge to improve its value [6]. Tanriverdi (2005) dissolved knowledge management capability into product knowledge management capability, client knowledge management capability and operation knowledge management capability [7]. Gold(2001) held that knowledge management capability consisted of knowledge management infrastructure capability and knowledge management process capability [8].

In terms of empirical study of knowledge management capability, many scholars have carried out research on knowledge management practices of enterprises, including Ma Xiaoyong, Guan Jiancheng (2001) [9],Zhen Jingli (2003) [10], Zhang Xinxiang (2006) [11], Wang Yanqiu, GeHongyan(2010)[12] and so forth. But when it comes to knowledge management capability of governmental organizations, only a few scholars have made relevant research, domestically including BaiQingli (2006) [13], Zhang Xue (2010) [14], KuangZewei (2006) [15].

2.3 Connotation of knowledge management capability of governmental organization

Compared with enterprises, governmental organizations have distinctive characteristics in terms of knowledge management capability, among which the most significant one is that a governmental organization is a social administrative unit without being driven by economic profits. As has been illustrated above, it is held that knowledge management capability of a governmental organization includes process management capability and basis support capability: the former includes knowledge acquisition, integration and application capabilities whereas the latter includes infrastructure support, organizational structure support and culture support capabilities.

3. ESTABLISHMENT OF THE INDEX SYSTEM OF KNOWLEDGE MANAGEMENT CAPABILITY OF GOVERNMENTAL ORGANIZATION

3.1 Index establishment of knowledge management capability of governmental organization

According to the definition of knowledge management capability of governmental organization, this paper takes A for example to analyze the connotation of knowledge management capability, and establishes a knowledge management capability evaluation index system of governmental organization with 55 indexes from 7 perspectives: knowledge acquisition capability, knowledge integration and transformation capability, knowledge application and innovation capability, knowledge protection capability, infrastructure support capability, organizational structure support capability and culture support capability.

3.2 Revision of the knowledge management index system of governmental organization

Theory and practice experts have been invited to revise indexes and thus determine the index system. In this round of research, a total of 80 questionnaires were distributed, among which 60 were recovered, 46 were valid and the efficiency rate was 77%.Then, the membership analysis method was adopted to calculate the membership degree of indexes. Through the statistical analysis of 46 valid expert questionnaires, the membership degree of 55 indexes was obtained. Whenα=10%, the critical value of the expert number was chosen to be 22 and the membership degree was thus 48%. Therefore, evaluation indexes whose membership degree was below 48% were deleted. Meanwhile, a round of expert seminars was held, and division level cadres were invited to discuss the evaluation system. Consequently, a knowledge management capability evaluation system of governmental organization with 7 second-level indexes and 39 third-level indexes was established.

4. FUZZY COMPREHENSIVE EVALUATION MODEL OF KNOWLEDGE MANAGEMENT CAPABILITY

After the index system was constructed, the fuzzy comprehensive evaluation method was adopted to make a comprehensive evaluation of governmental organization's knowledge management capability.

4.1 Determination method of evaluation index weight

On the basis of Analytic Hierarchy Process (AHP), experts were invited to compare and score the importance of every two indexes of the same hierarchy. After the judgment matrix was obtained, it underwent the normalization process and consistency test.

4.2 Introduction of the fuzzy comprehensive evaluation

(1) Main steps of the fuzzy comprehensive evaluation are [16]: ①establish the index set, ②establish the evaluation set, ③determine the weight set, ④establish the fuzzy membership matrix, ⑤fuzzy comprehensive evaluation

4.3 AHP-based fuzzy comprehensive evaluation of knowledge management capability of governmental organization

Take A for example:

(1) according to AHP ideas, the fuzzy evaluation matrix of knowledge management capability of governmental organization is established as*U*= { u1, u2,…un } = { knowledge acquisition capability, knowledge integration and transformation capability, knowledge application and innovation capability, knowledge protection capability, infrastructure support capability, organizational structure support capability and culture support capability }

(2) establishing the evaluation set: In this paper, to achieve the evaluation goal, governmental organization's knowledge management capability is classified into five categories as excellent, well-done, good, normal and poor,that is *V*= { v1, v2, v3, v4, v5 } = { excellent, well-done, good, normal, poor }

(3) determining index weight: Through the expert seminar, second-level and third-level index judgment matrixes were obtained. Meanwhile, weight analysis of first-level indexes was also carried out so as to finish the calculation of weights of all the indexes.

(4) mathematic formula of assessment method

$$S = \sum_{i=1}^{7} q_i * w_i \tag{1}$$

S: tax organization's knowledge management capability evaluation value. q_i :second-level comprehensive index evaluation value. w_i :the weighted score of the corresponding level.

In the fuzzy matrix composition, the maximum membership method ("∧,V") and weighted average method ("×,+") can be adopted [17].

(5) These levels constitute the score set as $V = \{v_1, v_2, \ldots, v_n\}$, and the target set is $U = \{u_1, u_2, \ldots, u_m\}$. To begin with, single factor evaluation of $u_i (i = 1,2,3,\ldots\ldots,m)$ was made, based on which membership r_{ij} of the corresponding $v_j (j = 1,2,3,\ldots\ldots,n)$ was determined, then the single factor evaluation set of u_i was achieved: $r_i = \{r_{i1}, r_{i2}, \ldots, r_{in}\}$, which was a fuzzy sub-set $(i = 1,2,3,\ldots\ldots,m)$ of V. The evaluation set of m factors in U constituted an overall judgment matrix R, which was a fuzzy relationship between U and V.

$$R = \begin{Bmatrix} r_{11} & r_{12} & \cdots r_{1j} & \cdots & r_{1n} \\ r_{21} & r_{22} & \cdots r_{2j} & \cdots & r_{2n} \\ \cdots & \cdots & \cdots\cdots & \cdots & \cdots \\ r_{i1} & r_{i2} & \cdots r_{ij} & \cdots & r_{jn} \\ \cdots & \cdots & \cdots\cdots & \cdots & \cdots \\ r_{m1} & r_{m2} & \cdots r_{mj} & \cdots & r_{mn} \end{Bmatrix} \tag{2}$$

During the evaluation process, the influence of elements in U is actually a matter of fuzzy priority and the standing point for evaluation can be regarded as a fuzzy sub-set of U, namely $A = \{a_1, a_2, \ldots, a_m\}$, in which

$a_i(i=1,2,3,.....,m)$ refers to the membership of u_i to the fuzzy sub-set A. In conformity to actual problems, a_i can be an adjustment coefficient, limitation coefficient or normal weight coefficient. A refers to the factor significance fuzzy sub-set of U and a_i refers to the significance coefficient of factor u_i, shortly weight coefficient. Then a fuzzy comprehensive evaluation can be made through fuzzy transformation between A and R.

(6) Evaluation step: firstly, establish the evaluation factor table according to the index system contents of the government organizational knowledge management capacity. The first-level evaluation factor set is $U=\{u_1,u_2.u_3,u_4,u_5,u_6u_7\}$ and the second-level evaluation factor set is $U_{ij}=\{u_{11},u_{12},\cdots u_{ij}\},(i,j=1,2\cdots n)$; secondly, determine the review set. With respect to the review of the government organizational knowledge management capacity, five levels of international management are adopted: excellent, better, good, fair and poor, namely the review set V= excellent, better, good, fair and poor [18].

Tab.1: Correspondence table of evaluation result and review level

level review	excellent	better	good	fair	poor
Comprehensive evaluation value	[5,4]	[4,3]	[3,2]	[2,1]	[1,0]

(7) Evaluation result: After statistical analysis, the judgment matrix and index weights of evaluation indexes at all levels are obtained. The weight matrix of second-level index is shown in the following table 2:

Tab.2:The judgment matrix of second-level indexes

U	U1	U2	U3	U4	U5	U6	U7	wi
U1	1	1/3	1/3	3	2	2	2	0.1314
U2	3	1	2	3	3	4	4	0.3000
U3	3	1/2	1	5	4	3	4	0.2648
U4	1/3	1/3	1/5	1	1/3	1/4	1/5	0.0369
U5	1/2	1/3	1/4	3	1	1/2	2	0.0849
U6	1/2	1/4	1/3	4	2	1	3	0.1142
U7	1/2	1/4	1/4	5	1/2	1/3	1	0.0678
$\sum$	8.8333	3.0000	4.3667	24.0000	12.8333	11.0833	16.2000	1.0000

By the same token, the judgment matrix of all third-level indexes can be obtained and the consistency test is conducted as shown in the following table:

Tab.3:The consistency test

The matrix of second-level indexes	C.I.= 0.0346 ,C.R.=0.0309
U1	C.I.= 0.0000 ,C.R.=0.0000
U2	C.I.= 0.0147 ,C.R.=0.01590
U3	C.I.= 0.0136 ,C.R.=0.01113
U4	C.I.= 0.0135 ,C.R.=0.0121
U5	C.I.= 0.0329 ,C.R.=0.0143
U6	C.I.= 0.0138 ,C.R.=0.0112
U7	C.I.= 0.0134 ,C.R.=0.0122
C.R.<0.1: the consistency test passed	

A questionnaire survey on the cadre system of A system is conducted by distributing 1018 questionnaires and recycling 801 questionnaires with 771 valid ones. According to the survey result, the review set of the government organizational knowledge management capacity is obtained as shown in the following table:

Tab.4: Comprehensive evaluation set of knowledge management capacity

Evaluation factors of knowledge management capacity	weight	evaluation set of knowledge management capacity				
		excellent	better	good	fair	poor
Knowledge acquisition capacity U1	0.1314	0.4305	0.4155	0.1415	0.0099	0.0000
Good at collecting inside information	0.0970	0.4200	0.4600	0.1200	0.0000	0.0000
Good at summarizing and promoting work experience	0.1288	0.4500	0.4300	0.1200	0.0000	0.0000
Emphasize staff education and training	0.1761	0.4900	0.4300	0.0800	0.0100	0.0000
Possess effective mentoring learning mechanism	0.0939	0.3800	0.3800	0.2100	0.0200	0.0000
Internal staff are willing to accept and use new knowledge	0.1605	0.4700	0.4000	0.1300	0.0000	0.0000
Internal staff can exchange knowledge and communicate effectively among themselves	0.1899	0.4100	0.4100	0.1600	0.0100	0.0000
Able to obtain experience and ideas from outside the system	0.0482	0.3700	0.4200	0.1800	0.0200	0.0000
Maintain effective learning cooperation with external peers	0.0418	0.3600	0.3900	0.2100	0.0400	0.0000
Able to learn external experience and knowledge rapidly	0.0413	0.3700	0.4000	0.1900	0.0200	0.0000
Often invite external experts to participate in work	0.0225	0.3700	0.4000	0.1800	0.0400	0.0000
Knowledge conversion capability U2	0.3000	0.4083	0.4268	0.1346	0.0134	0.0013
Good at classifying ,organizing and integrating knowledge	0.2347	0.4000	0.4100	0.1500	0.0200	0.0000
Good at documenting and coding knowledge	0.0511	0.4000	0.4000	0.1600	0.0300	0.0000
Higher degree of workflow and standardization	0.3097	0.4400	0.4400	0.0900	0.0100	0.0000
The key post has efficient operation instruction	0.1348	0.3700	0.4300	0.1700	0.0100	0.0100
Able to conduct system integration on internal knowledge and form operation instruction manual	0.2696	0.4000	0.4300	0.1500	0.0100	0.0000
Knowledge application capability U3	0.2648	0.3863	0.4313	0.1559	0.0196	0.0019
Staff can use new knowledge to solve new problems rapidly	0.3282	0.3800	0.4500	0.1500	0.0100	0.0000
Possess higher team management level	0.2044	0.3900	0.4600	0.1300	0.0200	0.0000
The staff emphasize the use of knowledge to improve business and work efficiency	0.1147	0.4400	0.4300	0.1200	0.0100	0.0000
Able to learn and work innovatively, making the management level and work efficiency continuously increase	0.1641	0.4100	0.4300	0.1400	0.0100	0.0000
Have sophisticated incentive innovation system	0.1885	0.3400	0.3700	0.2300	0.0500	0.0100
Knowledge protection capability U4	0.0369	0.4125	0.4375	0.1325	0.0075	0.0000
Small turnover rate of internal business experts and knowledge staff	0.7500	0.39	0.44	0.15	0.01	0
Have perfect confidential system	0.25	0.48	0.43	0.08	0	0
Infrastructure support capability U5	0.0849	0.4231	0.4148	0.1345	0.0108	0.0046
Possess advanced OA system	0.1093	0.5100	0.4000	0.0700	0.0000	0.0000
Possess effective business process system	0.2825	0.4600	0.4300	0.0900	0.0000	0.0000
Possess effective network learning system	0.0754	0.4900	0.4300	0.0700	0.0000	0.0000
Have effective proprietary knowledge management system	0.1794	0.3900	0.4300	0.1600	0.0200	0.0000
Possess a sound database	0.1472	0.3900	0.4200	0.1600	0.0100	0.0100
Possess convenient query and retrieval equipment	0.1533	0.3700	0.4000	0.2000	0.0100	0.0100
Able to employ external network resources conveniently	0.0529	0.3100	0.3200	0.2500	0.0800	0.0300
Organization structure supporting capacity U6	0.1142	0.3638	0.4366	0.1703	0.0144	0.0039
Organization structure is clear and reasonable and conducive to information exchange	0.2463	0.3700	0.4400	0.1600	0.0100	0.0100
Organization structure tends to be flat	0.1415	0.3600	0.4300	0.1800	0.0200	0.0100
The management model can adapt to the environmental changes rapidly	0.2671	0.3500	0.4600	0.1600	0.0100	0.0000
Specialized knowledge management organization	0.0989	0.3500	0.3900	0.2100	0.0400	0.0000
Able to make the communication and collaboration of internal staff and team smooth	0.2463	0.3800	0.4300	0.1700	0.0100	0.0000
Organization culture supporting capacity U7	0.0678	0.4083	0.4282	0.1423	0.0124	0.0035
The ambience of respecting knowledge and encouraging sharing	0.3929	0.4000	0.4200	0.1600	0.0200	0.0000
Advocate the establishment of learning organizations	0.1016	0.4300	0.4400	0.1100	0.0100	0.0000
Value and respect staff with expertise	0.2745	0.3800	0.4200	0.1700	0.0100	0.0100
Advocate organization culture of staff cooperation	0.1540	0.4500	0.4500	0.0900	0.0000	0.0000
Senior leaders have high approval of knowledge management	0.0770	0.4400	0.4400	0.1000	0.0100	0.0100
Comprehensive evaluation score	$S = \sum_{i=1}^{7} q_i * w_i = 4.18$					

In evaluating the government organizational knowledge management capacity, we divide it into two aspects: the basis support capacity of knowledge management and the process management capacity of knowledge management. The process management capacity of knowledge management which consists of knowledge acquisition capacity U1, knowledge conversion capability U2, knowledge application capability U3 and knowledge protection capability U4 accounts for 73.31% of the weight. The basis support capacity of knowledge management which consists of infrastructure support capability U5, organization structure supporting capacity U6 and organization culture supporting capacity U7 accounts for 26.69% of the weight. According to the comprehensive fuzzy evaluation method, the comprehensive score of a knowledge management capacity is 4.18 and the level is excellent.

CONCLUSION

In the whole knowledge management capacity evaluation, the process management capacity of knowledge management and the basis support capacity of knowledge management in A knowledge management capacity accounts for 73.31% and 26.69% of the weight respectively. Thus, it can be seen that the key to improving the government organizational knowledge management capacity lies in improving the organization's capacity of knowledge management process.

Among the seven dimensions of government organizational knowledge management capability, only the evaluation scores of knowledge application capacity and structural support environment are below the comprehensive score of organizational knowledge management (4.18) and the rating scores of the remaining dimensions are all above 4.18. Therefore, from the perspective of evaluation score, great efforts should be made to improve the organization's knowledge application capacity and structural support capacity in future work. Based on the weight priority of the dimensions of knowledge management capacity, the focus of improving the organization's knowledge management capacity should be knowledge conversion capability, knowledge application capacity, organization structure supporting capacity, organization culture supporting capacity and knowledge protection capacity in descending order.

In terms of knowledge acquisition capacity, that the A organization obtains experience from outside the system needs to be improved. In terms of knowledge integration and conversion capacity, the organization should enhance knowledge classification and improve the capacity of internalizing external knowledge. In terms of the innovation capacity of knowledge application, great efforts should be made to train the capacity of staff to employ new knowledge to solve new problems. In particular, a sound incentive innovation system and database should be built vigorously to provide a convenient platform for the staff knowledge inquiry. In terms of the organization culture supporting capacity, the A organization should strive to establish the organizational culture that respects knowledge and encourages knowledge sharing and create the cultural atmosphere that values and respects the staff with expertise and knowledge, thereby establishing the learning organization.

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