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To cite this article: Li Ran *et al* 2019 *IOP Conf. Ser.: Mater. Sci. Eng.* **563** 042025

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Design of Enterprise KB Assessment System Oriented to Operating Process

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Abstract: Enterprise KM has the characteristics of complexity and long-term. Periodic self-assessment of KB system becomes the basis of self-innovation and continuous progress. In this paper, based on the process of KM, a four-dimensional assessment system of enterprise KB for assessing the operating and management of enterprise KB is constructed by combining qualitative analysis with quantitative statistical calculation. The four dimensions of systematization, knowledge precipitation, link rate, persistence and several sub-indicators are extracted from the four levels covering the platform, basis, means and objectives of enterprise KB and operating. An analysis method for cumulative results of assessment is also derived. Through the investigation and analysis of KB in four enterprises, the value of the assessment system is proved.

1. Introduction

In the era of knowledge economy, the only sustainable competitive advantage of enterprises is knowledge, and knowledge capital is the primary capital in the era of knowledge economy, it is also the source of enterprise core competence^[1]. More and more enterprises build KB(knowledge base) system, large data wealth is accumulated. However, the operation of KB is a systematic project with complexity and arduousness. It is necessary to periodically assess the enterprise KB system in order to promote the construction of KB and the improvement of management system. Therefore, from the perspective of operating management, a set of universal assessment system is very necessary.

2. Relevant literature and research significance

Enterprise KB is a complex knowledge management system. Scholars mainly study the assessment of enterprise KB from four aspects.

(1) Research on the assessment of enterprise knowledge value. Le C Y^[2] stated an automatic assessment method of enterprise knowledge based on user behavior statistics, which reflects the value of knowledge and promotes knowledge ordering through three indicators of reading, download and share. Davenport^[3] designed a assessment system based on five dimensions: KM project, KM resources, knowledge utilization efficiency, KB benefits and staff's KB acceptance. These assessment studies only aimed at the assessment of knowledge entities and promote the continuous value of knowledge.

(2) Research on performance-oriented KM assessment. KM performance has always been the focus of research. Dai B B^[4] has constructed a comprehensive assessment system of three-dimensional performance coordination degree of KM in the implementation of enterprise ERP. Luo H Y^[5] stated a performance assessment system of KM based on technology, knowledge and behavior. These studies have common characteristics.



(3) Research on user-oriented evaluation of enterprise KM. Le C Y^[6] designed an assessment model and algorithm of knowledge contribution degree based on enterprise employees by counting user's contribution, recommendation, knowledge and feedback information. Qiu Q L^[7] used the principle of user evaluation to analyze the game relationship between knowledge providers and evaluators. These studies only focus on the value association between users and KM.

(4) Research on assessment of KB construction technology. Sun P S^[8] stated the evaluation framework of KB construction effect by qualitative and quantitative methods from two aspects of utility and value. In the opinion of Riedel L and Adelman S L^[9], the KB assessment framework covers KM requirements, KB system structure, hardware and software, availability, and operating performance. These studies belong to the assessment of the construction of enterprise KB, which is static and phased.

To sum up, the existing research has positive significance in promoting the construction of enterprise KB, performance assessment and knowledge mining. However, it is necessary to systematically explore enterprise KM in order to lay a foundation for the construction of assessment system. The construction, management and operation of enterprise KB is a systematic project. It is a process of multi-factors, multi-cooperation and gradual progress. It is difficult to guide the development of enterprise KB only by one-time assessment from a specific angle of KM. Focusing on the whole system of KM, this paper has set up four dimensions(4D) and several sub-indicators to periodically assess the enterprise KB. 4D involve systematization, knowledge precipitation, link rate, persistence. This paper has also stated an operation method of universal significance.

3. Enterprise KB and its operating system

Knowledge is a regular understanding of the objective world formed by intelligent processing of information. KM is the management process of acquiring, storing, sharing, communicating, applying and innovating knowledge. Enterprise KB is the specific practice of enterprise KM. It stores explicit or implicit knowledge and information, such as enterprise front-line business, project cases, special subject, internal management, and so on. It shoulders the mission of realizing knowledge capitalization, atomization and systematization.

Enterprise KB is a complex KM system. Its architecture can be abstracted into four levels as shown in Figure 1. Systematic software tools and supporting services are platform; Accumulated knowledge is the object of management and the basis of knowledge application; Linking knowledge with knowledge, linking knowledge and users, coupled with long-term operating management mechanism, is the means of KM. The specific content of KB operating system includes platform, knowledge system, KM business framework, culture, system, organizational structure, tools, operating strategy and so on. Only by the interaction of many elements and the formation of a complete system, it has been achieved the goal of sustainable value.

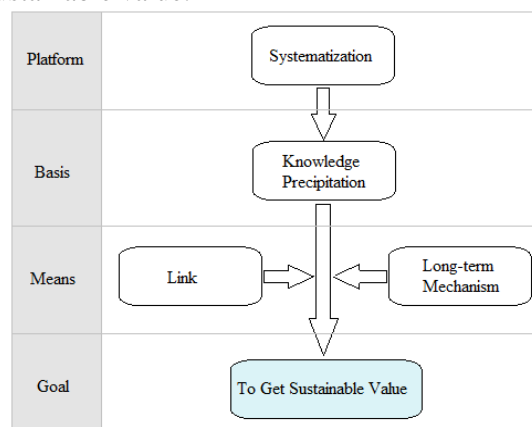


Figure 1. Enterprise KB and Its Operating System

The construction of the operating system of enterprise KB needs a process of gradual development from application to innovation. Therefore, the assessment of enterprise KB is introduced into the construction and operating system. Assessment is done through statistics and calculation. For one thing, it is conducive to finding deficiencies in management in time. For another thing, it is also conducive to know their work status and the direction of efforts for employees.

4. 4D assessment system of enterprise KB for management and operation

From the four levels of platform, basis, means and objectives covering enterprise KM and operating, 4D of systematization, knowledge precipitation, link rate, persistence, and several sub-indicators are extracted. Quantitative calculation and qualitative analysis are combined to assess the operating and management of enterprise KB.

4.1. Assessment model

The function of enterprise KB is to accumulate knowledge and inherit knowledge. With the rapid development of IT and the constant change of business, the KB system must also be self-checked and improved rapidly. Therefore, it is necessary to evaluate a KB system. The 4D assessment system proposed in this paper is mainly valuable for regular implementation, cumulative results, self-analysis and comparison. The assessment model is shown in Figure 2.

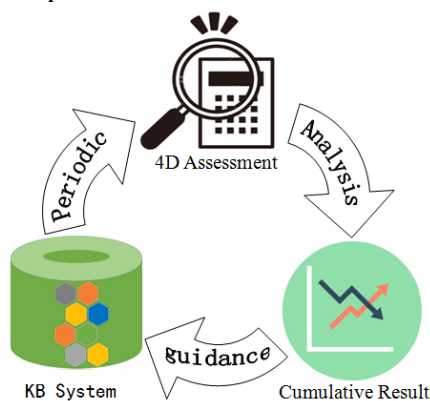


Figure 2. Assessment Model

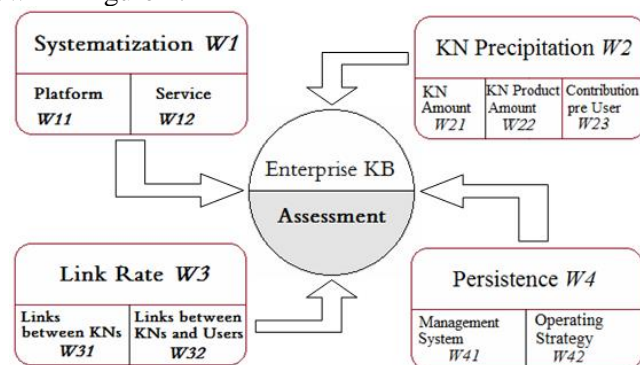


Figure 3. 4D Assessment System

4.2. Assessment dimensions and indicators

According to the operating category of enterprise KB, this paper abstracts 4D assessment system, dimension and sub-indicator system are shown in Figure 3.

4.2.1. Systematization W1. A good platform is an important condition for enterprise knowledge sharing, utilization, business integration and mobilization of staff enthusiasm. But the construction of a platform system can not be achieved overnight or in one step. Systematic dimension is the assessment of the operating platform of KB management, which keeps monitoring at a perpendicular angle of its own construction. Systematic dimension includes two sub-indicators:

(1) *Platform systematization W11.* KM business framework is systematized, which reflects the integration of KM and business. Tool systematization and KB are independent each other, which reflects the independence and expansibility of tool system.

(2) *Service systematization W12.* Service systematization reflects the soft environment construction of the platform. It's the propeller of KB operation.

4.2.2. Knowledge precipitation W2. Knowledge is the valuable asset of an enterprise and the basis of all knowledge service tools. Therefore, the dimension of knowledge precipitation is an intuitive parameter to measure the operating effect of KB. In order to reflect the operating performance of enterprise KB, three sub-indicators are set up in this dimension:

- (1) *Total amount of knowledge W21*. The scale of enterprise knowledge assets;
 (2) *Total amount of knowledge products W22*. Number of products in knowledge transformation and application;
 (3) *Knowledge contribution per user W23*. Macroscopically, it reflects the knowledge contribution of pre employee.

4.2.3. *Link rate W3*. Link rate is the embodiment of the systematization of knowledge organization and the participation of employees in knowledge sharing and application. Therefore, this dimension has two sub-indicators:

- (1) *Links between knowledge W31*. Knowledge maps, knowledge topics and so on, it measures the relevance of knowledge and the convenience of application;
 (2) *Links between Knowledge and users W32*. It measures users' application of knowledge.

4.2.4. *Persistence W4*. Persistence includes the persistence mechanism of operating management system and operating strategy. Persistence is the necessary condition of KM and the guarantee of knowledge value. There are two sub-indicators in this dimension:

- (1) *Management system W41*. Management system is the support of KB management, which must be constantly explored and perfected.
 (2) *Operating strategy W42*. Operating strategy reflects the means of KM promotion.

4.3. Acquisition method of assessment indicators

According to the objectives, implementation process and performance requirements of enterprise KB management and operating, the assessment methods of 4D indicators' sub-indicators are summarized, which refines the standards or research contents, as shown in Table 1.

Table 1. Assessment criteria

Dim	Sub-indicators	Criteria or survey contents
W1	•Platform systematization W11	①What is the KM platform system? ②What improvements do you think KM platform needs to make?
	•Service systematization W12	①What is KM Service System? ②What improvements do you think KM service system needs to make?
W2	•Amount of knowledge W21	Query and statistics.(Ignoring knowledge differences, any independent doc counts as a knowledge)
	•Total amount of knowledge products W22	statistics from Operating management dept(assume that doc such as staff training manual, project tutors, user manual, etc. are regarded as products, ignoring product differences).
	•Knowledge contribution per user W23	W21/ (count of staff) (statistics from enterprise KB) 。
W3	•Links between knowledge W31	the number of links between knowledge.(In a tree structure, a link is counted from node A [or knowledge] to node B [or knowledge])
	•Links between knowledge and users W32	The total number of times that knowledge is clicked, read, collected, downloaded, shared and recommended
W4	•Management system W41	①the architecture of KM? ②management system? ③Reward and punishment mechanism? ④knowledge culture?
	•Operating strategy W42	①Long-term mechanism of knowledge operation? ②Strategy of Content Operating? ③Self-evaluation of the operating effect of content.

5. Data collection and judgment

5.1. Representation of assessment result

The value of the 4D assessment system lies in multiple assessment, cumulating result and comprehensive analysis. The assessment cycle can be a quarter, semi-annual or one year, which is decided by the enterprise itself.

Let vector W be the cumulative result of assessment, let vector W_i be the result of assessment for No. i , $i = 0, 1, 2, \dots, N$, then:

$$W = (W_0, W_1, \dots, W_i, \dots, W_n).$$

The vector W_i composed of the results of the No. i assessment of the sub-indicators of each dimension, then:

$$W_i = (W11_i, W12_i, W21_i, W22_i, W23_i, W31_i, W32_i, W41_i, W42_i).$$

When $i=0$, it's means the first assessment, so the complete overview must be made for $W11_i, W12_i, W41_i, W42_i$. When $i>0$, the four sub-indicators only need to be stated for the part of change.

$W21_i, W22_i, W23_i, W31_i$, and $W32_i$ are quantitative sub-indicators, and get specific values from the calculation based on KB system.

5.2. Derivation of assessment sub-indicator

Because $W2$ and $W3$ are quantitative computing dimension, for W_i , its sub-indicators are only objective statistics of KB. In order to reflect the operating status more intuitively, the derived sub-indicators are listed as follows:

- Growth rate of total knowledge $W24_i$: $W24_i = W21_i / W21_{i-1}$, $i > 0$;
- Per capita knowledge contribution growth rate $W25_i$: $W25_i = W21_i / W21_{i-1}$, $i > 0$;
- Knowledge link rate $W33_i$, measuring the degree of knowledge systematization, its value is got from $W31_i$ and $W21_i$, then: $W33_i = W31_i / W21_i$, $i \geq 0$;
- Number of visits per knowledge $W34_i$, measuring Knowledge Utilization Rate, its value is got from $W32_i$ and $W21_i$, then: $W34_i = W32_i / W21_i$, $i \geq 0$;

Incorporating derivative sub-indicators, vector W_i will be modified as follow:

$$W_i = (W11_i, W12_i, W21_i, W22_i, W23_i, W24_i, W25_i, W31_i, W32_i, W33_i, W34_i, W41_i, W42_i).$$

5.3. Statistic and analysis method

In the assessment result vector W , for the sub-indicators of $W1$ and $W4$ dimensions, the summary sample table of cumulative assessment result are established, it's show in the following table 2.

Table 2. Summary sample table cumulative assessment results of $W1$ and $W4$

Times	W11		W12		W41				W42		
	Q①	Q②	Q①	Q②	Q①	Q②	Q③	Q④	Q①	Q②	Q③
No.0											
No.1											
...											

In assessment result vector W , a summary data table is formed based on $W2$, $W3$ and their sub-indicators. For each sub-indicator's cumulative data, the trend figure can be generated.

Assume: Five times of assessment were conducted on the enterprise A, and the cumulative result vector W was formed, the enterprise A has 200 employees, then:

$$W = \{W1, W2, W3, W4, W5\}.$$

For the sub-indicators of dimension $W2$ and dimension $W3$, the summary table of cumulative assessment data is formed, it's show in the following table 3 (fictitious data).

Table 3. The summary table of cumulative assessment data for $W2$ and $W3$

Times	Knowledge precipitation W2					Link Rate W3			
	W21	W22	W23	W24	W25	W31	W32	W33	W34
No.0	9653	236	48.3	0.0%	0.0%	19562	124002	2.03	12.85
No.1	9823	246	49.1	1.8%	1.8%	20241	152631	2.06	15.54
No.2	10586	250	52.9	7.8%	7.8%	20280	113235	1.92	10.70

No.3	11531	271	57.7	8.9%	8.9%	21052	165325	1.83	14.34
No.4	12023	280	60.1	4.3%	4.3%	22065	135682	1.84	11.29

For reference, the trend figures of sub-indicator $W2I$ and sub-indicator $W2$ were drawn and shown as following figure 4 and figure 5.

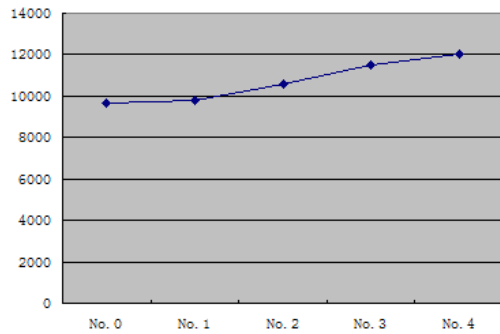


Figure 4. Trend figure of $W2I$

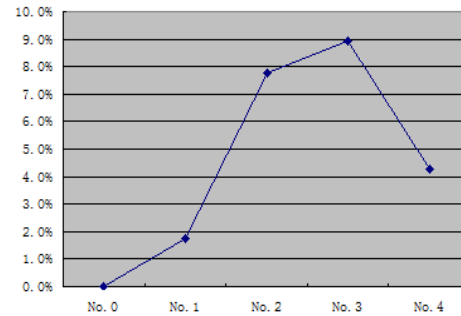


Figure 5. Trend figure of $W2$

5.4. Analysis for assessment result

The cumulative assessment result vector W is a record of the characteristics of the operating and management process of KB. Enterprises can use the statistic and analysis methods shown in sector 4.3 to make reasonable judgments according to their own strategic objectives, performance requires and business development, so as to guide the construction and operating of KB. This paper does not do research and judgment strategy divorced from reality.

6. Case studies

For the assessment system of enterprise KB for operating management, Systematic simulation has no practical significance. It takes a long period to practice and verify if practiced it in some enterprise, the author can't do it for the time being. In order to study the rationality and application value of the system, two automobile companies in Shanghai, one online game company in Beijing and one real estate company in Guangzhou were selected. Mail survey and on-the-spot investigation of KB operating management has been done, these four companies have achieved excellent result in KM and formed a unique management model. The summary information of the survey is shown in Table 4. The "Similarity degree" in the table is the self-report score similar to this system.

Table 4. Summary information sheet of survey

Company	Knowledge Management	Similarity Degree
Automobile company A in Shanghai	①Assessment system based on knowledge community ②Quarterly report of operating status, annual KM forum ③Service monitoring of operating status of KB System	60%
Automobile company B in Shanghai	①Achieving knowledge ordering through assessment. ②Experts periodically assess operating system and KM.	50%
Game company in Beijing	①Knowledge Hierarchical Management by Assessing. ②Regular analysis and summary of management experience. ③Annual performance evaluation.	80%
Real estate company in Guangzhou	①Knowledge Utility Evaluation. ②Operating management Archives System as Decision-making Basis. ③regular KM seminars.	70%

The survey results has shown that the four companies always adheres to the principle of system, link and long-term effect. Through the continuous improvement of the system platform, they systematically provide services to users and persist in the long-term effect of KM. Such excellent achievements and atmosphere are also the result of their growth step by step. The process and achievements of KM about these four companies have well proven the application value of the four-dimensional assessment system proposed in this paper.

7. Conclusion

Based on the operating process of enterprise KB, this paper proposes a 4D assessment system. the concept, expression and analysis method of assessing cumulative results are obtained, which can be used for reference and guidance for the continuous iteration and risk control of enterprise KB in the process of construction and operating management. By investigating the KM of many enterprises, it's proved the assessment system of this paper has great practicability, but it must be practiced and revised in more enterprises, then it could grow into a system with universal guiding significance. The author will try to archive this aim in the future.

Acknowledgments

This paper is financed by the scientific research project of Hubei Province Education Department(No.B2018237).

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