Enterprise Knowledge Map: An Essential Technique for Development

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Abstract. With the development of science and technology, knowledge has become a vital source. How to find, share and use knowledge effectively and efficiently is a problem that all enterprises want to solve. Knowledge resources are the foundation of every enterprise, for which effective management of knowledge becomes the key to business management. Knowledge map is an effective management tool of business management. The effect of knowledge map is analyzed in this paper, and a knowledge map model which based on knowledge units, tags, matrix and calculation to better collect, organize, analyze and use explicit and tacit knowledge is proposed and constructed. The new enterprise knowledge map will assist staffs to solve problems timely and help companies transfer knowledge and skills.

Keywords: enterprise management, knowledge base, knowledge map, tacit knowledge

1. Introduction

Nowadays, knowledge management has been the core capability of enterprises. Kevin Coin from McKinsey Company suggested that: core competence is a combination of all knowledge of staffs. This concept emphasizes the knowledge attributes of core capability. In other words, the traditional factors of production can no longer help enterprises maintain its competitive advantages, it is knowledge management that become critical for enterprise development. As intangible assets tend to be more and more important, the current management should not only focus on tangible assets and current assets, more attention should be paid on the technical staff, skills, and knowledge management.

At the present, in order to improve enterprise competitiveness, a lot of hardware and software should be used to collect, transfer and share tacit knowledge and explicit knowledge. It is easier to transfer explicit knowledge, but whether tacit knowledge could be transferred effectively will determine the future of enterprises. Especially in knowledge-intensive industry, if tacit knowledge could not be shared, considerable resources will be wasted and efficiency will reduce.

2. Enterprise's Tacit Knowledge

The concept of tacit knowledge was first stated by Michael Polanyi from the field of philosophy in 1958. He said: "Tacit knowledge (as opposed to formal or explicit knowledge) is knowledge that is difficult to transfer to another person by means of writing it down or verbalising it."

Tacit knowledge is the product of mind or intellect which cannot be use language, text and graphics to express. Tacit knowledge is always about processes, behaviors and personal capabilities. Most tacit knowledge is hidden in practice which is various from person to person, but it constitutes the major part of enterprise knowledge system.

In practice, tacit knowledge is often more valuable than explicit knowledge, because it is hard to be imitated by competitors. As the foundation of business, if tacit knowledge can be transferred and shared effectively, both employees and the company will benefit a lot.

(1) To improve the professional skills of employees.

(2) To promote the development of enterprises.

(3) To propel the progress of industries.

If tacit knowledge cannot be used or transferred timely, many opportunities will miss. While tacit knowledge cannot be conveyed as clearly as explicit knowledge, how to transfer and share tacit knowledge effectively is the problem perplexing many enterprises.

3. Knowledge Map

The concept of knowledge was first stated by Brooks.B.C from a geographical concept, he believed after the analysis of literatures, logical contents which are interrelated will be found and cause people to think and create. The points of logical contents link together and make up a knowledge map. This map reveals the relationship among the knowledge structures and each link can point to the related knowledge.

After the propose of "knowledge map", many experts and scholars gave their own definitions. European and American scholars define "knowledge map" from the management perspective while Chinese from the view of knowledge retrieval. Overall, the essences of all these definitions are no more than two aspects: the contents and functions of knowledge map.

In short, knowledge map is a guide to tell users the location and relationship of knowledge, show what resources are available and help users find the necessary knowledge quickly and easily. In enterprises, knowledge map is a tool combining knowledge base management system technology with new Internet technology knowledge management technology to better manage the knowledge resources and to save time and improve efficiency.

4. Enterprise Knowledge Map

4.1. Propose of Enterprise Knowledge Map

As more and more customers hold critical attitude toward products and services, more and more individual requirements are brought out. This requires companies to innovate, to shorten processing periods, to broaden sales channels and improve service. But according to "iceberg theory" by Wilfried Kruger:" Managers focus only on the explicit knowledge resources which in the external of 'iceberg', while tacit knowledge which play an decisive role in enterprise development are neglected." For an enterprise, the ability to find and use tacit knowledge is vital to maintain its competitiveness. Therefore, "Enterprise knowledge management" was put out, "Enterprise knowledge map" is an overview of knowledge catalog, it gets all knowledge resources together, integrate and provides a uniform entrance to users.

The basic function of enterprise knowledge map is to indicate the location of business resources, to find new knowledge, to make clear of relationship among staffs and to improve the efficiency of knowledge sharing.

(1) Indicate the location of the enterprise knowledge resources.

The knowledge map can indicative the position of knowledge and guide the user to get the knowledge. It also can clearly depict the relationship between knowledge and its owner, and reveal the contents and objects of knowledge. When the user searches knowledge, the knowledge map also can offer contact information of experts and consultants in this field, users will exchange ideas with experts. While knowledge can be found in the knowledge map easily and quickly, it can be better used to work.

(2) Discover new knowledge

When the knowledge map build a knowledge network, a variety of new knowledge can be found. By build the knowledge map, combining with existing knowledge and the discovery of new knowledge, new creativity, new ideas and new products can be emerged.

(3) Show that the knowledge relationship among staffs

Since many companies' internal relations are very complicated, the knowledge map lays out the net of all employees through which the staff can understand the structure of company better. As knowledge are embedded in the internal, knowledge map can not only build the net map of knowledge but also reflect the diverse multi-layer relationship between the sources and bodies of knowledge..

(4) Improve the efficiency of knowledge sharing.

The role of the knowledge map is to build the net of knowledge, especially to make tacit knowledge explicit, to make explicit knowledge easily recognized, and to make disordered knowledge ordered. Only in this way, can knowledge realize its own value even add value..

4.2. Current Situation of Enterprise Knowledge Map

Currently, there are a lot of companies have tried to build and use enterprise knowledge map. but a large number of knowledge maps don't play their proper role. First is information overload, when draw a knowledge map, the companies often have all the knowledge drawn into the map, the map will be too bloated. Then is weak in pertinence, numerous knowledge maps have a great deal of useless knowledge but without necessary knowledge. Last is low usability, the users use knowledge map only the time they need help, they seldom enrich the map.

5. Establish Enterprise knowledge map

As knowledge map will link experts with their special skills or knowledge, when users search the knowledge map, related knowledge and experts will be present, users can find answers and contact with experts by email or instant messaging tools to get more knowledge.

5.1. Construction of Explicit Knowledge Base

Explicit Knowledge, like policies, regulations, product descriptions, etc., is much easier to collect and deliver than tacit knowledge. Explicit knowledge will be broken down into simple units after being gathered, collated and stored. Every units will be labeled, the knowledge net will be built according to the knowledge tags, including knowledge's keywords, creation time, sources, etc.. Specific see Fig.1.

Knowledge, knowledge units and their labels are all stored in the Knowledge Base and form the knowledge network. Only use knowledge map, can users find knowledge, experts and the relation between knowledge and owners.

Fig. 1: Construction of Explicit Knowledge Base.

5.2. Construction of Tacit Knowledge Base
5.2.1 Structure of Tacit Knowledge Base

Tacit knowledge, like individuals' abilities, skills, experience, is difficult to express by language or image, so it is necessary to make the hidden tacit knowledge explicit through knowledge map. Specifically, knowledge maps have two effects: First is to make tacit knowledge explicit, change tacit knowledge into explicit knowledge which can be present; Second, building correlation between tacit knowledge and explicit knowledge, even the experts.

Personal tacit knowledge should be explicit first, there are three ways to make explicit: self-tag, other-tag and administrator-tag. Self-tag is that the employee fills a form of his basic information including name, department, daily works, strengths and interests, every strength and interest will be graded, the form will become a tag with him. Other-tag means every person can give labels with a score to others to state their specialities and ability level. Administrator-tag refers to the administrators can tag and mark every user according to his or her job and duties. Administrator-tag is different from others because administrators must give labels strictly depend on rules without sensibility, while both self-tag and other-tag cannot be

completely objective and impartial. The knowledge map system can sort and classify staffs' knowledge labels into category automatically.
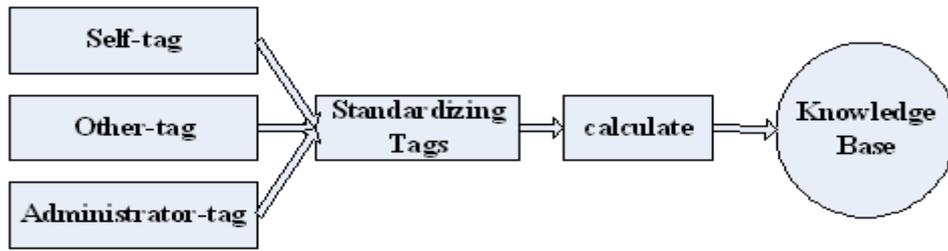

Fig.2 Method of Tag

5.2.2 Algorithm of Tacit Knowledge Base

The expert positioning method which is widely used has some serious flaws, the greatest one is only focusing on capacity (existing tacit knowledge) while ignoring the interest (potential tacit knowledge). This leads to some serious issues, first is some experts with outstanding ability will be very busy because many tasks are waiting for them, they are too busy to finish all works on time or perfectly; at the same time, those who only have interest in one field without ability will have no opportunity to accept tasks, and they will never have chances to exercise and improve. Therefore, tacit knowledge map is drawn in self-tag, other-tag and administrator-tag, "ability + interest" will be used to label everyone' tag.

Assume that the number of experts is "m", the number of abilities is "n" and the number of interest is "k" in company A. Matrix A ($A_{m \times n}$) represents one user's self-tag and other-tag, the rows in Matrix A stand for the score form others and the columns are abilities. Here is a simply example of user q' Matrix A.

$$A_q = \begin{bmatrix} a_{11} & a_{12} & a_{13} & \dots & a_{1n} \\ a_{21} & a_{22} & a_{23} & \dots & a_{2n} \\ a_{31} & a_{32} & a_{33} & \dots & a_{3n} \\ \dots & \dots & \dots & \dots \dots \\ a_{m1} & a_{m2} & a_{m3} & \dots & a_{mn} \end{bmatrix} \tag{1}$$

In A_q, a_{ij} means the data in row i and column j, it stands for the score form user j for user q' ability i.

As the assessment form self is more accurate than from others, the weight of self-tag is higher than other's tag. The weight of self-tag is α, because there are m-1 users will use other-tag to evaluate one user, the weight of other-tag is β/(m-1), the sum of α and β is 1. The weight matrix of user q Matrix D (D_q), in D_q, only the numbecr of column q is α, others are β/(m-1).

$$D_q = \begin{bmatrix} \beta/(m-1) & \dots & \beta/(m-1) & \alpha & \beta/(m-1) & \dots & \beta/(m-1) \end{bmatrix} \tag{2}$$

In this way, the matrix of user q' self-tag and other-tag is Matrix B (B_q).

$$B_q = A_q \times D_q \tag{3}$$

In B_q, row g stands for the score of the ability g of user q including self-tag and other-tag, the overall grade of ability g of user q is b_g^q.

$$b_g^q = \sum_{i=1}^{n} b_{gi} \tag{4}$$

The matrix of administrator-tag is Matrix C (C_q).

$$C_q = \begin{bmatrix} c_1 & c_2 & \dots & c_n \end{bmatrix} \tag{5}$$

The weight of Matrix B is γ, while the weight of Matrix C is δ, the sum of γ and δ is 1.

Through above analysis, the score of user q' ability g is e_g^q.

$$e_g^q = \gamma b_g^q + \delta c_g \tag{6}$$

The calculation method of interest is the same as the calculation ability.

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When a employee has some question to query, the knowledge map will rank all users' e_g of ability and interest. If the questions are emergency, the system will base on the rank of ability to recommend experts, the related tacit knowledge can be more accurate and targeted deliver, and this task will be completed quickly. On the contrary, if the query is not an emergency, the system will recommend the expert ranking by their interest, in this way users with interest can get chance to practice and gain experience.

5.3. The Application of Knowledge Map

The knowledge map system will link tacit knowledge with similar explicit knowledge unit, when a user want to search a problem, the system will present relevant explicit knowledge, if there is no explicit knowledge of this field, the system will guide the user to get in touch with experts who has specialized knowledge on this.
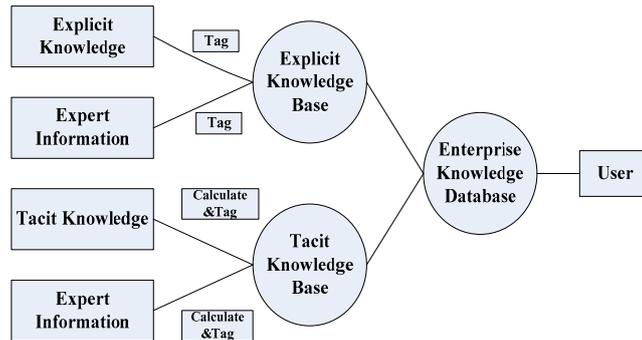
Fig.3 Operating Principle of Knowledge Map

The purpose of building a enterprise knowledge map is to make sure that both tacit knowledge and explicit knowledge can contribute to the development of staffs and company. Only the use of knowledge map is easy can staffs use it frequently and rely on it to improve their competitive power.
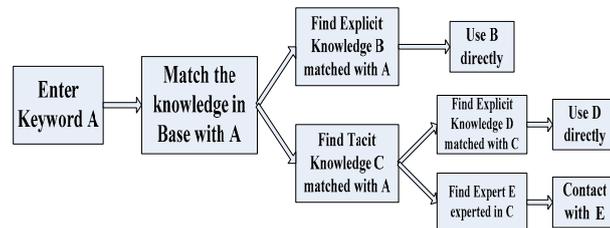
Fig.4 Searching Principle of Knowledge Map

6. Discussion and Conclusion

As we all know, knowledge is not only a valuable resource but also a part of intangible assets and core competitiveness of an enterprise. Knowledge map could associate knowledge with owners and assist staffs to access to knowledge resources easily, meanwhile, it promotes the development of staffs and enterprises. There is no doubt that knowledge is only a tool to manage knowledge, it can't solve every problem. The construction and application of knowledge map system in this paper can help enterprises to better classify and solidify knowledge, to use knowledge efficiently and to keep long-term development, but the operation knowledge map in enterprise still needs further testing.

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