Knowledge Evolution Research on Enterprise Human Resources Management Based on Knowledge Mapping

Liu Bin¹; Ma guang²; Jiang Hong³*; Zheng Jigui ⁴

¹School of information systems and management, National University of Defense Technology, Changsha, Hunan Province, 410073, China.
²Aerospace Wanyuan Industrial Co., Ltd., Beijing, 100076, China.
³* Capital University of Economics and Business, Beijing, 100070, China.
⁴Beijing Institute of Precise Mechatronics and Controls, R&D Center, Branch 77 of Mailbox 9200, Beijing, 100038, China.

*Corresponding author’s e-mail: makaka@163.com

Abstract. In this paper, the knowledge mapping based enterprise knowledge system is analyzed objectively, and some problems and deficiencies in the current enterprise knowledge system are studied and found. Meanwhile, we make most use of more effective human resources implementation plan and human resources management to achieve optimization and improvement on the current enterprise knowledge system. Thus, we come up with KM-HS knowledge evolution models of enterprises based on human resources in order to provide construction of enterprise knowledge system with detailed methods. On this basis, the paper emphasizes on knowledge acquisition, mapping construction, knowledge mapping benchmark analysis and human resources implementation plan to offer methods and references for enterprises relying on human resources management knowledge evolution of knowledge mapping.

1. Introduction

Knowledge mapping is a kind of technical method that uses a graphic model to describe the connection relationship between knowledge and everything modelling in the world. A knowledge mapping consists of nodes and edges, which can be regarded as an entity or an abstract concept, and edges represent attributes of entities or relationships between entities. The complex relationships between things and concepts can be identified, discovered and inferred from the data by using the knowledge mapping. However, the construction of enterprise knowledge system is the development progress of enterprise internal knowledge from scratch to existence, from weak to strong, from mutual encouragement to close integration, from disorder to order, which is essentially the evolution and development process of enterprise knowledge.

At present, the enterprise mostly utilizes the data base to store data and information in the progress of human resources knowledge management. In the meantime, the enterprise sorts out data and information by tree structure and search for and apply knowledge via some certain tools with searching functions. At this point, we can generally search for some knowledge we needed, but some searching problems have existed such as unsystematic searching engine, unprocessed searching engine and moment by moment system update. Therefore, we are supposed to research deeply on methods
and tools for human resources knowledge management. In the course of the research, the knowledge mapping will be applied and gradually innovated so as to play more important role in the practice.

2. Knowledge Mapping and Knowledge Evolution

2.1. Research on Evolution Manner

In the era of knowledge-driven economy, the update of knowledge and technology changes with each passing day, which means its update, evolution and iteration has conducted at a very fast pace. K.R. Popper believed that selection for scientific theory was just a progress of natural selection which was like Darwin's natural selection. The selection of scientific theories is also a process of natural selection, which can eliminate the fake and retain the truth through continuous practice in the life [1]. K.R. Popper applied the theory of biological evolution to explain the process of scientific development and illuminate how scientific knowledge is reasonably evolved in the process of human understanding and exploring nature, which is the theory of knowledge evolution. Ander thought that knowledge evolution was a process in which knowledge was constantly improved and developed by constantly refreshment and replacement [2]. Tang deemed that scientific development was similar to biological evolution, and the evolution process of scientific knowledge was a process in which errors were continuously found, errors were corrected, and corrected knowledge was temporarily retained [3]. In general, knowledge evolution is the process of replacing old knowledge with new knowledge and old thoughts with new thoughts.

Geroski mentioned that desire for human to learn knowledge was extremely strong and instinctive [4]. Senge thought that people can improve its capability of acknowledging relationships among everything in the world and understanding the world through learning [5]. Hendrik pointed that knowledge group made great impact on knowledge evolution and also deemed that knowledge group should be assigned and cooperated in accordance with the acknowledged knowledge difference by knowledge individuals so as to boost knowledge development [6].

For the enterprise, enterprise knowledge system construction simply relied on natural knowledge evolution manners such as knowledge individual evolution and knowledge group mutual learning is a long-term progress in which enterprise technology introduction and self-dependent innovation connect together. From the angle of knowledge mapping, enterprise knowledge evolution mainly shows that points, numbers of knowledge groups, connection points, numbers of relationships, densities of knowledge mapping which represents enterprise knowledge system have increased and the knowledge mapping structure has turned into be more orderly, and will further represent some professional knowledge fields that more close to all-fields knowledge mapping.

2.2. Human Resources Impacting on Knowledge Evolution

Establishing human resources management system in the center of knowledge and knowledge personnel has become a new tendency, which regards knowledge management more important part of enterprise human resources management and its aim to improve enterprise management efficiency and innovation level through discovering, combing, innovating knowledge, transmitting and sharing knowledge. Human resources management makes direct or indirect impact on enterprise knowledge system construction, etc. by the manners of achieving enterprise external knowledge introduction and motivating enterprise internal knowledge evolution. Modes on human resources management mainly include recruitment, training, position allocation, remuneration and performance index, etc. Meanwhile, human resources management can bring in knowledge individuals from enterprise externalities via combing and use these modes. For example, recruitment can achieve that knowledge individuals of enterprise internal knowledge obtain new external research knowledge; and training can motivate enterprise self-learning capability of the knowledge individuals of enterprise internal knowledge so as to enhance communication among the knowledge individuals of enterprise internal knowledge; utilize position allocation or remuneration for motivation.
From the angle of knowledge mapping, we apply to human resources management to increase numbers of nodes in the knowledge mapping and to achieve enterprise knowledge evolution. For instance, we compare knowledge mapping of enterprise knowledge system with all-fields knowledge mapping to discover shortages in knowledge contents of enterprise knowledge system. As chart 1 showed, if, chart 1 (b) represents knowledge mapping of one certain enterprise in which we can easily find that enterprise knowledge system divides into two isolated groups with dispersed structure and efficient combination between contents. However, we can acknowledge that the cause for that problem is the loss of key node A in the enterprise knowledge mapping through comparison with all-fields knowledge mapping 1 (a). At this point, we are able to introduce new knowledge node A in the enterprise internalities to achieve converting enterprise knowledge mapping into all-fields knowledge mapping to further complete enterprise internal knowledge evolution.

In addition, from the angle of knowledge mapping, enterprise knowledge evolution can also be achieved by improving relationships among enterprise internal knowledge nodes. We mainly depend on enterprise knowledge management strategy implementation with enhancing internal knowledge share and communication of enterprise personnel to finish this target. Specific human resources management basically counts on such management modes as position allocation management, performance index implementation and remuneration management to motivate knowledge communication between personnel and departments. As Chart 2 showed, A and B represent respectively two business departments and internal knowledge od A and B combine together well in the assumption Chart 2 (a). But through comparison with all-fields knowledge mapping, we can understand that A and B two departments only achieve valid knowledge combination that will be more perfect knowledge system. Under such circumstances, human resources management may accomplish
cross-hiring for a part of personnel in A and B departments which will break the knowledge communication gap between two departments to carry out valid combination between two designated departments, just as Chart 2 (b).

Except for position allocation management mode, on larger scope, human resources can also rely on such management modes as specific performance index implementation and remuneration management to encourage enterprise personnel to share knowledge and promote knowledge communication among all enterprise personnel and drive forward better enterprise knowledge system. As Chart 3 showed, Chart 3 (a) reflects that dispersed structure exists in enterprise knowledge system and the system lacks of necessary communication and combination. On this occasion, enterprise must set specific performance index and remuneration management to motivate enterprise internal personnel to share own knowledge and strengthen share and communication of dispersed knowledge nodes in the enterprise internalities so as to realize combination of enterprise internal knowledge and complete enterprise knowledge system evolution. As Chart 3 (b) showed, we can also promote optimization of that enterprise knowledge system and finally achieve the enterprise knowledge evolution in a more advanced form.

![Chart 3 Motivating Personnel Knowledge Communication and Share to Achieve Enterprise Knowledge Evolution](image)

3. Knowledge Evolution Model Method Based on Human Resources Management

After acknowledging enterprise knowledge and some fields knowledge, we use knowledge mapping tools to construct enterprise knowledge mapping and all-fields knowledge mapping separately. At the same time, we utilize social network analysis method on the basis of all-fields knowledge mapping to build up comprehensive enterprise knowledge mapping model (Knowledge Mapping-Human Resources Model, KM-HS Model) and its analysis method with such management modes as recruitment, training, position allocation, performance index and remuneration in the human resources management.

3.1. KM-HS Knowledge Evolution Model Construction

KM-HS knowledge evolution model to optimize the enterprise knowledge system as the aim and to regard enterprise knowledge mapping as the analysis object by using social network analysis method. The method analyzes some indicators such as points, connection points, numbers of relationships, density, knowledge groups to find the existing problems in the enterprise knowledge mapping and propose the corresponding human resource management plan.

As Chart 4 showed, KM-HS enterprise knowledge evolution model basically makes benchmark comparison between enterprise internal knowledge and enterprise external knowledge to seek and improve problems in order for achieving circulation and evolution of enterprise internal knowledge. The model initiates and counts on enterprise knowledge system to construct enterprise knowledge mapping, and discovers shortages in the enterprise knowledge mapping via benchmark comparison with external knowledge of all-fields knowledge mapping. We put forward some advices on enterprise knowledge system construction to solve those shortages in the knowledge mapping.
3.2. Knowledge Analysis Progress Based on KM-HS Knowledge Evolution Models

KM-HS knowledge evolution models frequently start from enterprise internal knowledge and finally reflect on self-enterprise internal knowledge system to form a cyclic process. Detailed analysis progress is divided into 5 steps as follows: 1) Knowledge Acquisition; 2) External and internal knowledge mapping construction of enterprise; 3) Knowledge mapping benchmark analysis to discover shortages; 4) Putting forward advices on enterprise knowledge system construction; 5) Setting and Implementing Human Resources Plan.

3.2.1. Knowledge Acquisition

Enterprise knowledge include explicit and tacit knowledge. Explicit knowledge refers to those of clear and explicit knowledge that can be clearly expressed by others and can be easily disseminated and communicated through summary, reports, manuals, books and journals, articles, electronic literature and video data. Tacit knowledge means that the knowledge of experience, ideals and beliefs that are hidden in the human brain and not visible to others. Therefore, in KM-HS models analysis, papers can more comprehensively reflect on the knowledge composition of enterprises than patents. Thus, data from CNKI journals are also used for the source of enterprise knowledge acquisition.

3.2.2. Knowledge Mapping Construction

Knowledge mapping construction basically counts on co-occurrence analysis relationship. Main elements of co-occurrence analysis methods contain co-word, co-citation, cooperation, etc. So far, there are four existing common co-occurrence analysis methods such as co-word comparison, literature co-citation, writers co-citation and cooperation. Co-word analysis is more suitable to expose knowledge system construction of enterprise. Therefore, we usually regard co-word analysis as a primary method for knowledge mapping construction of enterprise in KM-HS knowledge evolution models.

Operation of co-word analysis method mainly embodied that all literature key words in a group of literature collection to make comparison to count up frequencies appearing in the group of literature collection. And then, we will build co-occurrence matrix and mapping in order to mirror affinity-disaffinity relationship of research contents between literatures. Co-word analysis generally utilizes three indexes such as tolerance index, proximity index and equivalence index to balance co-word connection.
However, in the practical application, some occurred frequencies of key words are located at median position with important value, which has great significance on digging internal relationship of these key words. Proximity index is a crucial indicator to count and reflect relationship among some unimportant key words and its computing method as follows:

$$P_{ij} = \left( \frac{C_{ij}}{C_i C_j} \right) \ast N$$

In the above method, $P_{ij}$ is regarded as key words $I$ and $J$ of proximity index. $C_{ij}$ is considered as key words $I$ and $J$ of co-frequency. $C_i$ is treated as key words $I$ of word frequency. $C_j$ is recognized as key words $J$ of word frequency. $N$ represents volume of sample set. Nonetheless, volume of sample set is fixed for one time, so $N$ doesn't mean much to the degree of differentiation in a majority of analyses.

Equivalence index is a crucial indicator to count and connection intension among co-words and its computing method as follows:

$$E_{ij} = \frac{C_{ij}^2}{C_i C_j}$$

Chart 5 Co-word Knowledge Mapping Schematic Diagram Based on Tolerance Index

Chart 6 Co-word Knowledge Mapping Schematic Diagram Based on Proximity Index
In the above method, Eij is regarded as key words I and J of equivalence index. Cij is considered as key words I and J of co-frequency. Ci is treated as key words I of word frequency. Cj is recognized as key words J of word frequency.

In the KM-HS knowledge evolution model, knowledge mapping play an important role in revealing objectively the theme structure of the enterprise internal knowledge, and reflects on the enterprise knowledge system. Through comparing with chart 5-7, we can find that co-word knowledge mapping based on equivalence and proximity index which clearly reacts the horizontal relationship among knowledge representing by key words. Whereas, some insufficiencies has remained in some aspects such as the knowledge structure, hierarchical relationship and the ability of knowledge community.

3.2.3. Knowledge Mapping Benchmark Analysis
Enterprise knowledge mapping and all-fields knowledge comparative analysis are mainly counted on the benchmark indexes by points, knowledge groups, connection points, numbers of relationships and densities. In mean time, a number of nodes forming enterprise internal knowledge should be taken into consideration with its complex relationships. Therefore, knowledge groups have become an obvious analysis unit of indexes comparison analysis of the knowledge mapping. Moreover, many indexes such as points, connection points, numbers of relationships, and densities will be used to evaluate knowledge groups in the knowledge mapping.

We will regard knowledge groups as main analysis units and compare numbers of knowledge groups in the enterprise knowledge mapping and all-fields knowledge mapping, numbers of internal relationships in knowledge groups, points and connection points. In addition, we will base on the subjected analysis units to discover some existing problems in the enterprise knowledge system.

3.2.4. Setting and Implementing Human Resources Plan
According to construction advices on enterprise knowledge system, human resources will set specific plan. When one enterprise introduces some knowledge, human resources will reasonably set enterprise recruitment or staff training plan based on introduction difficulties. In order to strengthen the enterprise internal knowledge share and communication, human resources will implement objective key performance index and remuneration management method to motivate the enterprise internal staff knowledge communication and share. In the enterprise internal knowledge system, if two knowledge
groups are not perfectly matched, we can set specific position allocation plan to achieve knowledge communication among the departments.

4. Conclusion
This essay expounds the current human resources management knowledge, analyzes the present circumstances and puts forward solutions to the knowledge based on the knowledge mapping and to promote knowledge evolution depend on human resources management. At mean time, the paper also mentions evolution models based on KM-HS enterprise knowledge evolution model of human resources to provide detailed methods on the construction of enterprise knowledge system. On this basis, the thesis emphasizes on knowledge acquisition, mapping construction, knowledge mapping benchmark analysis and human resources implementation plan to offer methods and references for enterprises relying on human resources management knowledge evolution of knowledge mapping.

References
[1] K.R.Popper. Theory of Evolution on Scientific Knowledge [M]. Beijing: SDX Joint Publishing Company, 1987: 130-180.
[2] ANDER R. Implications for product and process innovation [J]. Management Science, 2001(5): 611-628.
[3] TANG L. Competition and innovation behaviors [J]. Research Policy, 2006(3): 68-82.
[4] GEROSKI P A. Modeling the dynamics of industry populations [J]. International Journal of Industrial Organization, 2001(19): 1003-1022.
[5] SENGE P M. The Fifth Discipline: The Art and Practice of the Learning Organization [M]. New York: Doubleday Currency, 1990.
[6] HENDRIK K. Knowledge networks: explaining effective knowledge sharing in multiunit companies [J]. Organization Science, 2002(3): 232-248.
[7] Wang Fanghua. Theory on Knowledge Management [M]. Shanxi: Shanxi Economy Press, 1999.