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Investigating Knowledge Management Practices in a Successful Research and Development Organization

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Abstract

In this paper after a review on the concept and literature of knowledge management, the conceptual model of a successful knowledge management system that is currently being applied in a research and development (R&D) aerospace organization is presented and discussed. The main contribution of the paper is presenting the model in its useful and practical status without becoming involved in theoretical discussions that have different shapes but similar meanings.

***Keywords**:* Knowledge management, knowledge model, knowledge map, knowledge distribution.

1. Introduction

Sustainable competitive advantage is dependent on building and exploiting core competencies (Prahalad & Hammel, 1990). So resources which are distinctive and difficult to transfer are required (Grant, 1991). In recent years, knowledge is being considered as a critical organizational resource (Carneiro, 2000; Alavi & Leidner, 2001; Drucker, 1993) and is known as the foundation for stable development (Allameh et al., 2011) especially in hyper competitive environments (Alavi, 1999; Davenport & Prusak, 1998; Zack, 1999) or in environments experiencing radical discontinuous changes (Malhotra, 2000).

Schultze & Stabell (2004) noted that defining knowledge management (KM) is challenging because a complete and agreed-upon definition of knowledge remains elusive. The definition of knowledge is one that has attracted a significant amount of conjecture (Davenport & Prusak, 1997). While information is often considered as interpreted data of descriptions, knowledge is considered as action oriented information that makes possible the transition from information into instructions. Many organizations are drowning in information overload and yet starving for knowledge (Kanter, 1999). Simply knowledge has been defined as an understanding awareness, or familiarity acquired through study, investigation, observation and experience over time (Borg et al., 1993) to improve the quality and success ratio of the actions (Alavi & Leidner, 1999a and 1999b).

Nonaka (1994) distinguishes between explicit and tacit knowledge. In an organization, examples of explicit knowledge are strategies, methodologies, processes, patents, products, and services (Agrawal, 2010) that are stored in textbooks, software products and documents (Polyani, 1966) and those of tacit are skills and competencies, experiences, relationships within and outside the organization, individual beliefs and values, and ideas (Agrawal, 2010) that are stored in the minds of people (Polyani, 1966). According to literature there is also another class of knowledge called implicit knowledge that is believed to be tacit but can in fact be transformed into explicit knowledge. In other words tacit knowledge is a type of knowledge that is hard to articulate, whereas implicit knowledge can be articulated but has not yet.

There is no universally accepted definition for KM, although they are extremely similar. So this study categorizes them in 5 categories as follows, on the basis of the main point that is to be conveyed. It is again to be noted that all the following definitions are correct and they may have some overlaps but each category tries to bold a specific characteristic of KM that is maybe mentioned by another category but with less emphasis. And since all of the definitions are correct, combination of the following definitions is the most complete definition of KM.

1. Creating value: The process of creating value from an organization's intangible assets (Wigg, 1993) or the process by which knowledge needed for an organization to succeed, is created, captured, shared and leveraged (Rumizen, 2002).
2. Collecting knowledge: A process to recognize and archive knowledge assets within the organization and even other organizations of similar specialization (Firestone, 2001) or a discipline for identifying and leveraging the collective knowledge in an organization to help the organization compete (Von Krogh, 1998; Von Krogh et al., 2005; Hedlund, 1994).
3. Distribution of knowledge: The Process that is concerned with making the right knowledge available to

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the right processor such as human or computer, at the right time in the right presentations for the right cost (Holsapple & Joshi, 1999; Aranganathan & Lakshmi, 2010; Kidwell et al., 2000).

4. Sharing knowledge: The process that makes knowledge usable for more than one individual, e.g. for an organization as a whole; that is, to share it (Kucza, 2001) or the system that makes the knowledge inside people's heads widely available (Swan et al., 1999). The system should be able to communicate the derived information to those who can act on it (Davenport & Prusak, 1998).

5. Creating knowledge: The system that turning data (raw material) into information (finished goods) and from finished goods into knowledge (actionable finished goods) (Kanter, 1999).

KM is becoming a research priority by the academic community (Salmador & Bueno, 2007) and companies are allocating a greater share of spending for its implementation (Beijerse, 1999; Call, 2005). It is an amalgamation of concepts borrowed from artificial intelligence, software engineering, business process re-engineering (BPR), human resources management, organizational behavior (Beckman, 1999), organizational learning (Argyris & Schon, 1978; Huber, 1991; Nonaka & Takeuchi, 1995) and business reference models (Scheer, 1994).

Software project managers for example often interact with eachother to address problems rather than relying on a formal knowledge repository (Newell, 2004) or managers often prefer telephone calls, meetings, and other personal interactions to obtain information that is timely and often undocumented (Mintzberg, 1989). Although social interaction with colleagues can be an effective way to share and reuse knowledge, there are limitations of this method as well like finding the appropriate person (in spite of any geographical or temporal boundaries) (Adler & Kwon, 2002), effective articulation of knowledge holder mind especially for beginners that need more time (Markus, 2001) and most importantly is loosing knowledge when the expert leaves (Hansen et al., 1999, March & Smith, 1995).

Often, intellectual capital research focused on definitions and classification (Hsu, 2006) so it should not surprise us to see similar models that are named differently. For example, Van Buren (1999) split structural capital into innovation capital and process capital while Bontis (1996, 2001, 2002a, 2002b) and Pike et al. (2002) consider process capital and organizational capital as components of structural capital. Although these wide range of works has many positive points but can hinder the field from more efficient development (Bontis, 2001). On the other hand what is now the most necessary for the literature is kind of combinatorial works of theory and application. In this paper the conceptual model of a KM system (KMS) in an Iranian R&D aerospace organization is going to be demonstrated while its relation with the theory of the field will be discussed.

2. Model

A KMS is distinct from transaction processing systems (TPS), decision support systems (DSS) or executive information systems (EIS) (Alavi, 1999) because of its main mission to transform experiences into explicit knowledge within the organization. Experience is important and critical part of a KMS (Nonaka, 1994) because when individuals receive new information, the information is processed in light of one's past experience to develop and create new knowledge (Prahalad & Hammel, 1990); in better words it connects the past to the present (Davenport & Prusak, 2000). The collective body of knowledge offered by employees of the organizations has emerged as a key point of differentiation, providing a foundation upon which the quality of products and services can be improved (Balthazard & Cooke, 2004; Jashapara, 2004; Andrade et al., 2003).

According to the above mentioned importance of experience and the fact that Knowledge is reusable (Basili & Rombach, 1991); a well-built KM model should have a mechanism for dealing with this critical element. Experience may be deeply personal or can be communicated through storytelling (Denning, 2000), mentoring (Swap et al., 2001), and documentation (Roth & Kleiner, 1998). To document experience, for example business schools use case studies or some knowledge repositories provide knowledge in the form of bullet points and so on. Mathiassen et al., (2003) offer four methods to reuse experience: 1- Applying it from a prior project to solve a current problem; 2- Selecting project members specifically on their prior experiences and projects to jointly address a new problem; 3- Designing procedures and methods to address a specific problem (that can be called instructions) and 4- Using documents, processes, models, methods, or other types of explicit knowledge gained from previous projects within the organization.

After a comprehensive literature review and case studies (the above discussed points), a KMS has been designed and applied in our organization with satisfactory results. In fact it is not claimed that the following introduced model is the most novel and new or the most appropriate system for benefiting from the concept of KM; we just want to introduce the key for the lock of implementing KM as a culture not compulsion in our organization. The system is composed of four modules as follows.

2.1. Knowledge map

The first module relates to the concept of knowledge map. In the organization after each stage the knowledge map is updated. It is a simple initiative to show which knowledge, technical and executive capabilities, unique laboratory abilities and which highly proficient software and hardware are available; where and when.

The stage can be specified on the basis of time or event. A time-based stage means for example the knowledge map being updated quarterly or biannually and an event-based stage means for example recruiting new experts, technologies, business relations or the high qualified and very special courses that the organization experts pass.

Knowledge map must be prepared for present and future. The applicability of present knowledge map is obvious, for example now we encounter a problem and want to solve it; so naturally we refer to the knowledge map for the best portfolio of experts. But its applicability in future helps us in our planning. In better words a planer can do better in planning for the next three years if s/he has a vision about the capabilities of that period.

2.2. Project team files

Teams documentation: Most of the projects in an R&D organization are done by teams. So what is most important is indentifying experienced teams in the organization. It actually arises from the systemic approach to the problems; that is the expert A may have some individual capabilities an so B, but the AB team may presents much more capabilities or in the other way around the AB team may be incapable of anything. Senge (1990) discussed this very well on the basis of complex balancing processes between the components. So it seems wise to document as much as possible about a team that has already done a project. If team 1 consists of A, B and C and team 2 consists of A, B and D, we can not say for sure that these two teams are 66% the same. In fact because of their different balancing processes they may have completely different outcomes.

To be short, project teams are very important elements and documentation of their abilities more. It is to be noted that if there is any guest expert in the team for example a software expert or a control project expert or even a manager, s/he is going to be documented here.

List of outsourced projects: Here again we have some files but not about our personnel and teams but some external cooperators.

2.3. Documentation of experiences

Documenting technical, scientific and executive experiences of a project with copy right is a valuable source of intellectual capital that can be applied and reused in other situations. Meanwhile, when this experience applies to different situations, it may be altered and/or updated (Hsu, 2006).

As was mentioned previously, for doing the documentation there is no specific format but it is highly believed that a person has the opportunity to learn vicariously through the experiences of others when those experiences are articulated through an oral or written narrative. By expressing experiences via narratives, less experienced managers can understand not only how to solve a problem, but also why the solution works.

Discovering new horizons: The projects results are documented electronically and continuously according to our data base system. What is very important in the system is the copy right for published knowledge and in fact they are considered as precious properties for their owners. The people that have submitted more and better works more likely are referenced and referred more that will help them for better promotes. Each experience before being documented is referred by three trusty referees. This documentation system is welcomed surprisingly by the employees and beside scientific contributions; there are plenty of tacit executive and managerial points, which are recorded explicitly in the system.

Discovering new problems: This part of the system focuses on the problems that hinder the project in any way and the project team is incapable of solving them. The problems can be scientific, executive, technical, managerial or even politic. All the permitted people according to the information protection policies of the organization can see them. The people independent of their position and field of expertise can electronically propose their solutions for the problem. Whenever the problem is solved, it will be added as knowledge to the system with the asker and responder names; while both of them will benefit from it until their created knowledge is referred by others.

This module also covers the recruiting practices of the projects teams. That is the job vacancies first of all are announced in the organization and depending on the project nature and kind of the expertise needed, will be announced publicly (out of the organization) later.

2.4. Publications, theses and patents

Publications: The outputs of any project are considerably rewarded if they appear in best selling books or very credible international journals. More publications, more scores for the project team. That is in this part of the KMS; knowledge is saved in paper and book formats and is accessible to everyone.

Theses: One pillar of the KMS is post graduate theses both MSc and PhD (there is also a plan to admit postdoctoral fellows in 2014, September). This module of the KMS is entitled University Connections and has two main parts. At the first, there are some completed or in process postgraduate theses while in the second part there are applications or general proposals for such theses that are always sent to credible universities of Iran and some contracted universities around the world.

The theses are sponsored by the budget and responsibility of the project leader. On one hand s/he should find this kind of cooperation with the university and the student wise both costly and technically and on the other hand defining such theses brings some positive points for the project leader regarding future promotes.

Patents: The recorded patents are part of the KMS with necessary information for references. The patent owner for always has a considerable share in the patent-based benefits of the organization. In better words patents that are not referred or applied for value creation, neither benefits the organization nor the associated person.

As can be seen in the above model all of the important elements of KM according to the literature including creating, capturing, sharing, distributing, leveraging and archiving knowledge into absolute value for the organization are covered. In this regard the information technology has contributed the most.

3. Conclusion

Although KM literature is full of excellent works and many researchers have developed KM models to maximize satisfaction of the academicians and practitioners, still this field suggests the need for more practical and comprehensive models. Applying the developed KM models is difficult because of the fact that knowledge is intangible and it involves delicate managerial works. On the basis of this point in this paper the conceptual model of a successful and currently applied KMS is presented and discussed. It would be good to try application of the discussed model in a typical organization and present the learned points and tips to all.

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