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Critical success factors of knowledge management systems: a multi-case analysis

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Abstract

Purpose – To date, critical success factors for design and implementing knowledge management (KM) system in a multi-case study research have not been systematically investigated. Most of existing studies have derived their critical success factors from single company perspectives and have not considered all factors in an integrated way in a multi case study research. This paper is aimed to bridge this gap.

Design/methodology/approach – A qualitative case study technique has been used in this paper for data collection to gain insights into the topic being investigated. For that, "grounded theory" research approach has been selected by which the collected data from real case studies (successful organizations in KM adoption) are categorized and analyzed through specific stages. The extracted concepts can demonstrate critical success factors of KM system within organizations.

Findings – The overall results from the real case studies were positive, thus reflecting the appropriateness of the proposed critical success factors. Also 16 concepts and a conceptual framework are the other findings of this research that clarify how to design and implement a KM system in an organization. The conceptual framework presents a roadmap for success of KM programs in the organizations.

Practical implications – The set of critical success factors can act as a list of items for organizations to address when adopting KM. This helps to ensure that the essential issues and factors are covered during design and implementation phase. For academics, it provides a common language for them to discuss and study the factors crucial for the success of KM program in an organization.

Originality/value – This study is probably the first to provide an integrated perspective of critical success factors for implementing KM through a multi case study research. It gives valuable information and guidelines which hopefully will help the leaders to accomplish KM through their organizations in an effective way.

Keywords Knowledge management, Knowledge sharing, Qualitative research, Critical success factors

Paper type Case study

Introduction

Knowledge management (KM) is an integrated, systematic approach to identify, manage, and share all of the department's information assets, including databases, documents, policies and procedures, as well as previously unarticulated expertise and experience resident in individual officers (Jones, 2003).

KM is also known as a systematic, goal-oriented application of measures to steer and control the tangible and intangible knowledge assets of organizations, with the aim of using existing knowledge inside and outside of these organizations to enable the creation of new knowledge, and generate value, innovation and improvement (Wunram, 2000).

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KM creates a new working environment where knowledge and experience can easily be shared and also enables information and knowledge to emerge and flow to the right people at the right time so they can act more efficiently and effectively (Smith, 2001).

For a deeper understanding of the KM processes, an attempt to express the hidden meaning of data, information and knowledge is necessary. Data means a set of discrete and objective facts concerning events. Therefore, they can be construed as a structured record of transactions within an organization. Information is data with attributes of relevance and purpose, usually having the format of a document or visual and/or audible message. Knowledge is linked to the capacity for action. It is intuitive, therefore, hard to define. It is linked to the users' values and experience, being strongly connected to pattern recognition, analogies and implicit rules (Joia, 2000).

Meanwhile, by the comparison of different definitions of "KM," the following aspects of high relevance are resulted during KM adoption (Wunram, 2000): exploitation of existing knowledge, creation of new knowledge, process orientation, goal orientation, value orientation, improvement orientation, and innovation orientation.

Smith (2004) has also presented a paper about KM strategies in which three KM case studies have been analyzed from strategic point of view. In the other words, this paper has focused on different KM strategies through case analysis. It has been cited in this paper that:

> . . . as one can see from the three case studies, it takes many different forms within different organizations. The justification of KM strategies and specific findings for these corporations can be extended to other companies. Specific data items that do remain essentially the same across the firms are the facts that successful organizations do manage their knowledge through codification processes and they seem to do it very effectively.

Mathi (2004) identifies that the key success factors of implementing KM in organizations are culture, KM organization, strategy, systems and IT infrastructure, effective and systematic processes and measures.

Nowadays the great wish of many organizations is to define a suitable KM system and manage their knowledge successfully. Also we know that some organizations have been successful on this topic, but how did they succeed in design and implementation of KM system?

The main purpose of this research project is to investigate the critical issues in KM system design and implementation in the organizations. Therefore, the main research question is:

RQ1. What are the critical success factors of KM systems in the organizations?

Research methodology and data collection

In the methodological approach for this study, the authors adopted a qualitative research design due to their need for rich data that could facilitate the generation of theoretical categories that could not derive satisfactorily from existing data (Locke, 2001). In particular, due to the exploratory nature of this research and the interest of authors in identifying the main subjects, events, activities and influences that affect the adoption of successful KM in a company, they selected the grounded theory (GT) style

of data interpretation, which was blended with the case study design and with ethnographic approaches.

Data used in this paper comes from a longitudinal study during a two-year period (2003-2005) examining knowledge establishment processes in different companies. Finally some more famous corporations which were successful in KM adoption were selected. This research paradigm, which was based on an in-depth qualitative study, has some similarity to ethnography (Atkinson and Hammersley, 1994) and other forms of research that derive their theoretical insights from naturally occurring data including interviews or questionnaires (Marshall and Rossman, 1989). Especially, the researcher should intervene in the results of project on a matter of genuine concern to them on which they have a genuine need to take action. Research data and insight are gained alongside or on the back of the intervention.

The data collected over the two years of the intervention have derived from different papers, journals, books, reports and also through browsing the internet. During these interventions, the expressed experiences, views, action-centered dilemmas, and actual actions of selected companies have been recorded as research data. The data analysis for the research consists of four stages:

(1) accumulating different data;

(2) developing an in-depth case history of the company activities from the raw data that provided all the information;

(3) open coding and subsequent selective coding the in-depth case history for the characteristics and origin of KM process in the company; and

(4) analyzing the pattern of relationships among the conceptual categories.

In the first stage of the data analysis, chronological descriptions of the project's activities were constructed with respect to KM process in the companies, describing how it came about, when it started, who was involved (rank of authority in the company), the level of involvement, and the major outcomes. Through this work, an in-depth case history of the project was completed. The second stage of analysis involved coding the in-depth case history with respect to its characteristics, origin and effects. This was a highly iterative procedure that involved moving between the in-depth case history, existing theory, and the raw data (Glaser and Strauss, 1967).

The data were subjected to companies, cyclical, evolving interpretation and reinterpretation that allow patterns to emerge. The GT approach is based upon the researchers' interpretation and description of phenomena based on the actors' subjective descriptions and interpretations of their experiences in a setting (Locke, 2001). This "interpretation" strives to provide contextual relevance (Silvermann, 2000).

For each case, many reports and data were collected. After reviewing all data, some of them were selected. In this analysis we were to answer:

- Why did these companies have to apply a KM program?
- What are the essential issues of KM program in these companies?
- What are the critical success factors of KM program for a company?

For that, data from six successful companies in KM program were collected; Ernst & Young (E&Y), Hewlett-Packard, BusinessEdge Solutions, Microsoft, Teltech, and Siemens were our selected companies.

In the next step, through selected input data and by categorizing and combining them, main concepts were understood and their specifications distinguished.

Concepts are the basic units of analysis since it is from conceptualizations of data. Corbin and Strauss (1990) state:

> Theories can't be built with actual incidents or activities as observed or reported; that is, from "raw data." The incidents, events, happenings are taken as, or analyzed as, potential indicators of phenomena, which are thereby given conceptual labels. If a respondent says to the researcher, "Each day I spread my activities over the morning, resting between shaving and bathing," then the researcher might label this phenomenon "pacing" as a main concept. As the researcher encounters other incidents, and when after comparison to the first, they appear to resemble the same phenomena. Only by comparing incidents and naming like phenomena with the same term can the theorist accumulate the basic concepts for theory.

Distinguishing the relations between concepts and axial and selective coding are the next stages of this step. Literature comparison with the results of each stage, is the main mechanism of emerging and appearing new ideas and concepts. This will be continued until saturation stage. In this stage new cases will not add any new concept to the findings. Table I shows the specifications of this research.

Knowledge management at Ernst & Young

E&Y (www.ey.com), one of the world's largest professional service firms, was formed by Arthur Young and Ernst and Whinney in 1989. E&Y company offered a variety of services to clients, the most important of which were audit, tax, and management consulting. In 1993, Roger Nelson, managing partner of E&Y's US management consulting practice, announced a new strategic plan for consulting that was designed to propel the firm into the forefront of the consulting industry called "Future State '97 (FS'97)," the name of the plan referred to the future vision of E&Y's consulting processes, and the date by which the vision was to be achieved. The plan envisioned $1 billion in 1997 revenues (roughly doubling the 1993 figure) and described operational visions in five key processes: sales, service, delivery, people, and knowledge.

The emphasis on knowledge processes was new to E&Y. Some of the knowledge process goals in FS '97 included capturing and leveraging knowledge from consulting engagements, having every consultant contribute to the firm's stock of knowledge, and becoming known by clients as a valued source of knowledge and thought leadership.

In 1990, E&Y had created a center in Boston to perform early-stage research into issues of technology and management originally called the Center for Information Technology and Strategy, it became the Center for Business Innovation under FS'97. The center had worked on such issues as business process reengineering, organizational change management, and KM, and had helped to establish E&Y's

Methodology	Research type: qualitative Analysis method: GT
Input data	Case studies information: E&Y, Hewlett-Packard, BusinessEdge Solutions, Microsoft, Teltech, Siemens
Results	Sixteen concepts One conceptual framework

Table I.
Specifications of the research

reputation for thought leadership. The Center for Business Technology, based in Dallas, had for several years developed methodologies and automated tools to support consulting engagements. It maintained, for example, the firm's navigator methodology for system development, and supported its fusion methods for integrating technology and business change. Finally, the Center for Business Knowledge (CBK) had its origin in the firm's Management Consulting Information Center in Cleveland, which served as a library for consulting methods and techniques as well as engagement documents. The idea behind the three centers was that the Center for Business Innovation would create new knowledge, the Center for Business Technology would structure knowledge into methods and automated tools, and the CBK would gather and store both the firm's acquired knowledge and external knowledge and information.

Several new positions and oversight committees were also created as an outgrowth of FS '97. John Peetz, who had previously led the firm's Western Region Performance Improvement Consulting Practice, became the firm's first Chief Knowledge Officer. The role involved overseeing the processes and technologies of the firm that related to knowledge. He and the directors of the three centers were advised by a Knowledge Process Committee consisting of senior consulting partners from around the US practice. At roughly this same time, the Center for Business Innovation was beginning substantial research into KM topics. Together with the Strategic Issues Forum, center researchers held three conferences on KM, all of which were well-attended. At the same time, E&Y was also organizing a consulting practice around KM.

With Ralph Poole's arrival, the CBK quickly expanded its functions and became critical to E&Y knowledge strategy and tactics. By the end of 1996 the CBK would have more than 100 professionals. It included a library, a call center for answering consultant requests, and a database of consultant skills.

Another key task of the CBK was developing a knowledge architecture and taxonomy. The purpose of this architecture was to focus knowledge acquisition and retrieval efforts. As the initiatives matured, however, it was important to focus KM in specific domains. The knowledge architecture would specify the categories and terms in which E&Y needed to gather and store knowledge. The architecture would also be used by consultants and knowledge facilitators in searching databases and document files.

There were also some issues in terms of the culture for KM and use. Senior management support for knowledge as a key competitive advantage was high, and high levels of resources were being directed at KM (Davenport, 1997a).

Knowledge management at Hewlett-Packard

Hewlett-Packard (www.hp.com) is a large famous company which competes in many markets, including computers and peripheral equipment, test and measurement devices, electronic components, and medical devices.

HP is known for its relaxed, open culture. All employees, including the CEO, work in open cubicles. Many employees are technically-oriented engineers who enjoy learning and sharing their knowledge. The company is perceived as being somewhat benevolent to its employees, and fast growthhas obviated the need for major layoffs. All employees participate in a profit sharing program.

The company is also known for its decentralized organizational structure and mode of operations. Business units that perform well have a very high degree of autonomy.

There is little organized sharing of information, resources, or employees across units. HP managers feel that the strong business-specific focus brought by decentralization is a key factor in the firm's recent success. Although culturally open to sharing, few business units are willing to invest time or money in "leveraged" efforts that do not have an obvious and immediate payback for the unit. It is common, however, for employees to move from one business unit to another; this mobility makes possible some degree of informal knowledge transfer within HP.

In mid-1995s it became apparent that several KM initiatives were underway in various HP business units. Some had been in place for several years; others were just beginning. Noticing this phenomenon, Bob Walker, HP's CIO and Vice President, and Chuck Sieloff, Manager of Information Systems Services and Technology (ISST), decided to attempt to facilitate KM at HP by holding a series of workshops on the topic. Their idea was to bring together a diverse group of people within the company who were already doing KM in some form, or who were interested in getting started. The corporate ISST group had previously sponsored similar workshop initiatives in the areas of reengineering and organizational change management. Key objectives for the workshops included the facilitation of knowledge sharing through informal networking, and the establishment of common language and management frameworks for KM. Walker and Sieloff appointed Joe Schneider, an ISST staff member who also focused on web-based systems, to organize the workshops.

Bruce Karney is a member of the infrastructure team for the corporate education organization, part of HP's personnel function. Karney estimates that there are more than 2,000 educators or trainers distributed around HP, most of whom work within small groups and find it difficult to share knowledge. About two years ago, in response to complaints by the education community that, "we don't know what's going on," Karney began work on approaches to knowledge sharing for HP educators. He hoped to make the group more of a community; until this effort, it had no shared history, process, or tool set.

Schneider believes that the company has both internal expertise and external sources of knowledge on KM. At the corporate level, Schneider is using the workshops as one mechanism to understand who needs this knowledge and how best to transfer it. He also wants to get the workshop participants involved in an ongoing KM network that shares best practices and transfers emerging knowledge (Davenport, 1996).

Knowledge management at Microsoft

Since its founding in 1975, one of the competitive advantages of Microsoft Corporation (www.microsoft.com) has been the quality of its people. The highly successful software firm goes to extraordinary lengths to hire people with strong intellects and capabilities.

This unusual attention to human resource capabilities, however, is not restricted to product-oriented personnel. Microsoft's internal information technology (IT) group, for example, faces the same pressures to produce software and to adapt to rapid industry change.

Therefore, the IT group has focused heavily on the issue of identifying and maintaining knowledge competencies. Chris Gibbon, the current IT director, hired Susan Conway as a program manager to take on the issue of knowledge competencies.

Conway's goal is to create an online competency profile for jobs and employees within Microsoft IS. A pilot in an 80-person application development group was

completed in November 1995, and full implementation is proceeding. The project, called Skills Planning "und" Development (thus affectionately known as "SPUD"), is focused not on entry level competencies, but rather on those needed and acquired to stay on the leading edge of the workplace.

The SPUD initiative is being managed by the "Learning and Communication Resources" group within Microsoft IT, which also has responsibility for training and education for IT personnel. The goal is to use the competency model to transfer and build knowledge, not merely to test it. The project is also expected to lead to better matching of employees to jobs and work teams. Eventually the project may be extended throughout Microsoft and into other companies.

The pilot for the SPUD project had gone well, and then implementation was proceeding with all people and their jobs in the Microsoft IT group. Implementation was proceeding across geography and function, starting with the operations function, then the applications function, and all jobs in Europe.

Some aspects of the role of the competency model within Microsoft could only be determined over time. Susan Conway hoped, for example, that the model would become a vehicle for institutionalizing innovation in this fast-changing industry. If Bill Gates, for example, determined that employees at Microsoft needed to master a new form of knowledge (e.g. web-based application development), then he could force development of the competency by insisting upon its presence in all job competency requirements. A means by which needed innovations could be identified and rapidly implemented would seem to be critical in Microsoft's business and industry.

Conway also realized that the success of the project depended upon the behaviors of the individuals who would use it. "This won't go anywhere unless people feel they are getting something from it," she commented. She felt that it is critical for employees and supervisors to feel that they contributed to the development of templates for jobs. Then they will buy into the competency model because they had a hand in the design and implementation of it, she hopes. Ultimately, this ambitious attempt to advance knowledge by focusing on individual knowledge competencies requires the active involvement by everyone in the organization (Davenport, 1997b).

Knowledge management at Teltech

Teltech company (www.teltech.com), based in Minneapolis, offers instructive lessons to companies wishing to better manage their knowledge and information assets. The company has built a successful business on helping companies get access to external technical expertise and information. However, some of its strategies and services could be adopted by firms wanting to take better advantage of all types of internal knowledge.

Teltech maintains a network of thousands of experts in technical fields. The experts, over 3,000 of whom can be found in Teltech's online system, are typically academics, recent retirees from industry, or consultants. When a client calls Teltech, they engage in a dialogue with a Teltech "knowledge analyst" about their problem, or they are given one or more names of experts who can speak knowledgeably on the customer's issue. Teltech also offers access to over 1,600 online databases. Searches are assisted by Teltech knowledge analysts.

Teltech has more than 150 employees. A large proportion is knowledge analysts in the expert network, assisted search, and vendor services. The company also has a group of "knowledge engineers" who structure the information in Teltech's databases.

Teltech was founded on the assumption that people are effective guides to information and knowledge. Expert, database, and vendor searches are all mediated though the Teltech knowledge analyst.

The useful lesson here is that KM is best accomplished not through copying the knowledge from the heads of people to put it in computers. Instead, computers can store databases of names and locations of individuals, who have not only raw information but also experience and expertise. Perhaps the most difficult aspect of Teltech's services to emulate would be the structure it has established for categorization and later searching of knowledge. The difficulty comes in the level of initial and ongoing investment in the knowledge databases and biographies that serve as the basis of Teltech's services.

Until recent years, Teltech's approach to structuring knowledge had been hierarchical (rather than thesaurus-based). Its hierarchical database was called the Teltech "Tech Tree" and had several key knowledge branches, including scientific/technical, medical, chemical, etc. However, both clients and knowledge analysts found it difficult to navigate through the previous hierarchical database, and new terms tended to be added at inappropriate levels of the old system. Teltech has found the thesaurus approach to be much more satisfactory than the old hierarchical system.

Teltech's efforts in creating a structure for knowledge are instructive for other types of firms. If knowledge is going to be captured and leveraged, it must first be categorized. The thesaurus-based approach employed by Teltech may be promising for many situations, since knowledge is usually communicated and sought in words, and words are the primary unit of knowledge in a thesaurus (Davenport, 1998).

Knowledge management at Siemens

Siemens' Information and Communication Networks Division (www.siemens.com) is a global provider of telecommunication solutions, active in more than 100 countries. The company's traditional business used to be quite simple and straightforward, it dominated its home market by means of a close relationship with a regulated national telecom monopoly. Since mid-1990s, however, the market environment has undergone a massive transformation and the Siemens ICN business model has been superseded by wholesale market change.

The company was forced to rely more than ever on the front lines of the organization, who are more knowledgeable about the latest developments. Sales people had to act more and more like consultants. Skills like business analysis, business development, network planning, outsourcing and so on were suddenly in high demand, albeit dispersed globally. Solution selling had become an important value-adding activity. Doing this right meant identifying best practices quickly, sharing them on a global scale and making sure that they were reused for profit in similar settings. The idea of ShareNet as "global knowledge sharing network" was born.

ShareNet covers both explicit and tacit knowledge of the sales value creation process including project know-how, technical and functional solution components, and the business environment. ShareNet has a strong focus on experience-based

knowledge; you will rarely find official "brochureware" but rather personal statements, comments, field experience of sales projects or the real-life solution. In addition to structure questionnaires on the above mentioned topics, ShareNet provides less structured spaces such as chat rooms, community news, and discussion groups on special issues.

Related knowledge of any kind can be dynamically linked to, for instance, a sales project description, thus giving a comprehensive picture of the business. This includes other knowledge on ShareNet and any other web-based system with or outside Siemens. Furthermore, every contribution is "commentable" by the whole community, in a similar approach to the book reviews in online bookstores. Collaborating virtually via a web site complements traditional ways of co-operation, like telephone conferences and personal meetings, and can be used to provide even richer exchange of knowledge and to build trust and a sense of teamwork among members of communities.

Although ShareNet is integrated in the daily work, it does not mean that no additional support is required. New roles were created to support and foster the development and operations of KM efforts in the organization. Every local company has at least one "ShareNet Manager," who is responsible for supporting the members in his organization and ensuring that ShareNet becomes and remains an integral part of their work, by training new users, fostering intra-organizational re-use, promoting the "philosophy" of ShareNet with all stakeholders in his country, and promoting success stories to attract more "power users". A global editor is the main contact partner for the ShareNet Managers, coaching them for success, triggering the content quality review process and serving as a community manager with regular news and updates.

The Siemens experience shows that combinations of individual and organizational measures drive knowledge contributions.

Members reap benefits from ShareNet for their daily business, they save time, they receive a quick answer for a pressing problem and so on. As such, they have an inclination to give something back to the community.

Often, the real subject matter experts are not identifiable on a simple organizational chart. They work hidden somewhere in the world without much publicity. With their personalized contributions, ShareNet makes these "hidden champions" visible to the global organization and to the board, who regularly check the system to find and promote these experts.

Also a web-based incentive system has been developed. For any valuable contribution, members receive ShareNet "Shares" or bonus points, much like in an "air miles" system. Both contributors of knowledge, as well as re-users are rewarded for sharing their experiences. The shares can be redeemed for prizes that foster their individual knowledge, such as participation on an international conference or courses and seminars they want to attend even if these are not closely related with their day-to-day job (Pudlatz, 2002).

Knowledge management at Business Edge Solutions

BusinessEdge Solutions (www.businessedge.com) was founded in 1999. As an industry-focused consulting and integration firm, BusinessEdge combines its in-depth industry knowledge with expertise in leading-edge IT to deliver high-impact solutions to its clients. Its industry focus includes communications, financial services, life sciences and insurance.

BusinessEdge Solutions is driven by its unwavering commitment to formulate industry-leading, visionary solution strategies for its client's challenges and then use highly experienced world-class teams to deliver industrial-strength solutions.

Since inception, BusinessEdge Solutions is on track with its growth and profit goals and has positioned itself as one of the top industry consulting and integration firms. The firm continues striving to deliver unprecedented business results by decisively responding to new and aggressive demands and enabling the rapid deployment of new technologies and industry solutions for our clients.

Considering the facts of real competitive era, BusinessEdge has struggled with defining a common understanding and value proposition of KM for its research and development organization.

In order to gain a common understanding of KM for the organization a common definition and value proposition was developed with an understanding of impact and change for the organization, its operations and technology. In addition, a program was scheduled to mature an evolving KM framework over time.

In crafting the solution, BusinessEdge Solutions' primary objective was to develop a common definition of KM, as well as a framework that consisted of environmental, organizational, procedural and technological considerations. In order to achieve the main objectives of KM program, the research KM team analyzed the current state of organization's culture and structure. In addition an analysis was conducted to examine the existing processes for capturing, organizing and distributing knowledge as well as the enabling technology that was in place to support the requirements.

The team conducted numerous interviews with key business stakeholders to get an understanding of requirements across the new product development lifecycle and to identify potential champion business owners that would be willing to invest resources and realize the value of sharing knowledge across the lifecycle. At the same time workgroup sessions were conducted with the technology organization to help understand current KM projects, enabling technology and business alignment.

The workgroups and interviews allowed the BusinessEdge Solutions team to charter a workshop that introduced a KM framework that BusinessEdge Solutions has developed for organizations in similar situations. A common definition of KM and the framework were accepted after collaborating to assure full context with the organization's current and future requirements. The remainder of the offsite was spent developing a roadmap to create actionable items based on people, process, technology and business alignment views.

Findings

By analyzing input data of selected companies, 16 concepts were found for answering the main question of the research:

RQ1. What are the critical success factors of a KM program in an organization?

The extracted concepts have been shown in Table II. Here, some important concepts will be explained more. Company name/s between the parentheses shows that the related concept has been extracted by case study analysis through that company.

Table II. Critical success factors of KM systems

Critical success factors of KM systems (main concepts)	Microsoft	Hewlett-Packard	Siemens	E&Y	Teltech	BusinessEdge Solutions
Training programs	√	√		√	√	√
Knowledge architecture			√	√	√	√
Network of experts		√	√	√	√	
Knowledge sharing		√	√	√	√	√
Transparency		√				
Knowledge strategy	√		√		√	√
Trust	√	√	√			
Organizational structure	√	√	√		√	√
Business process reengineering (BPR)		√				
Pilot	√	√				
Knowledge storage	√	√	√	√	√	
Knowledge capturing	√				√	√
Knowledge identification	√				√	
Knowledge audit			√	√		
Organizational culture	√	√	√	√	√	√
Support and commitment of CEO	√	√		√		

Knowledge strategy

One of the means for driving the success of KM is to have a clear and well-planned strategy (Liebowitz, 1999). This provides the foundation for how an organization can deploy its capabilities and resources to achieve its KM goals.

In order to attach more significance to a KM strategy, it should support an imperative business issue of an organization. There seems to be common agreement in the literature that it has to be linked or integrated with the enterprise business strategy (Zack, 1999; Cook, 1999; Maier and Remus, 2002) (Microsoft, Siemens, Teltech, BusinessEdge Solutions).

Training programs

For spreading knowledge policies and totality of knowledge in the organization, employees should become completely and deeply familiar with knowledge concepts. So, training programs are very important for an organization which is to conduct KM (Microsoft, HP, E&Y, Teltech, BusinessEdge Solutions).

CEO support and commitment

Success of every program and planning in the organization depends directly on CEO support and commitment. Of course a KM program also needs CEO support for being successful in design and implementing phase (Microsoft, HP, E&Y).

Business process reengineering

The process of "reengineering" involves the breaking of old, traditional ways of doing business and finding new and innovative ways, and from the redesigned processes, new rules emerge that determine how the processes will operate (Hammer, 1990). Considering BPR definition, usually the processes in the organizations have not been well designed. In this way, it is necessary to review the available processes in the organization for possible changes in order to adopt KM efforts successfully. BPR helps the organization decentralize and define a value-oriented structure in a systematic way; in that case KM system can be implemented correctly in the organization (Hewlett-Packard).

Network of experts

For developing knowledge in the organization, there should be some networks for facilitating share of knowledge between experts. These networks can be formed as scientific committees, communities of practice, knowledge teams and knowledge centers (HP, Siemens, E&Y, Teltech).

Knowledge sharing

Knowledge sharing plays an important role on implementing and executing KM system. Knowledge sharing can often be done effectively by regular or event-triggered knowledge sharing occasions. Regular means repeated at specific intervals while event-triggered means at specific events like, e.g. a project's end, coming up of a new technology and so on (Kucza, 2001).

Of course knowledge sharing between employees needs a strong culture, trust and also transparency in all over the organization (HP, Siemens, E&Y, Teltech, BusinessEdge Solutions).

Organizational culture

The political and cultural surroundings are known from the analysis of knowledge culture because effective KM cannot take place without extensive behavioral, cultural, and organizational change (Davenport and Prusak, 1998). This especially aims at creating an environment where knowledge sharing is encouraged.

This arrangement clearly points out the interest of the management in culture openness and knowledge creation, especially regarding innovation, and the company has been successful with this. Since most knowledge processes are on a more or less voluntary basis and knowledge is to a large degree personal, there should be a culture of motivation, a sense of belonging, empowerment, trust and respect within an organization before people really start engaging themselves in developing, sharing and using knowledge. It requires a culture in which people are respected, based on the knowledge they have and the way they are putting it to use for the organization (Microsoft, HP, Siemens, E&Y, Teltech, BusinessEdge Solutions).

Pilot

In an ideal situation, instead of implementing the project immediately across the whole organization, a pilot implementation should be carried out, during which it should be possible to learn from the process and to avoid the pitfalls encountered when extending the implementation process across the whole organization. Also the implementation phase should include a feedback process for amendments. KM system should be executed in a pilot at first stage for taking the best results (Hewlett-Packard, Microsoft).

Knowledge storage

Saving the knowledge of organization (tacit and explicit) is one of the most important elements of a KM system. Skill databases, expertise database, and storage of tacit and explicit knowledge of the organization are as important as the other factors of KM systems. If an organization cannot capture and store its knowledge truly, the most important property of the organization (knowledge), may be missed easily (Microsoft, HP, Siemens, E&Y, Teltech).

Knowledge audit

Knowledge auditing is defined as a survey measuring knowledge re-use and communication, cultural receptiveness to KM and valuing of knowledge, KM opportunities, and deficiencies, gaps and problem areas and is very important in KM systems (Siemens, E&Y).

Knowledge architecture

An organizational architecture can be defined as a complex, multi-dimensional construct expressing principles that guide how the organization is to be designed, that is, how the elements of the business model are actually organized and executed (Babski and Carion, 2003). Knowledge architecture can also be defined as a logically set of principles and standards which guides the engineering (high level design, detailed design, selection, construction, implementation, support, and management) of an organization's KM system infrastructure. So the companies which are to design their

KM system should be really sensitive to construct their knowledge architecture correctly and robustly (Siemens, E&Y, Teltech, BusinessEdge Solutions).

The above-mentioned factors affect on success of KM system directly or indirectly and have also effects on each other. Table II shows these items in a concise way.

These findings show that organizations should design their knowledge architecture in an effective way and align all their knowledge strategies with organizational strategies. Knowledge sharing is necessary and network of experts should be organized in the company for leading knowledge efforts.

CEO support and commitment plays a very important role in KM systems. Some factors such as business process re-engineering, decentralization, trust and transparency are directly dependent to CEO support and commitment.

Knowledge identification, knowledge capturing and knowledge audit are also important in a KM system and storage the knowledge of organization should be applied for both tacit and explicit knowledge.

Continuous training for employees should be applied through seminars, training courses, and conferences. The role of educations should not be forgotten in training programs.

For knowledge sharing, transparency in all over the organization and also a strong culture and good atmosphere of cooperation between employees are necessary. Also, trust factor enables KM efforts and also helps knowledge sharing.

Network of experts are also known as the enablers of KM system. These networks lead knowledge activities through scientific committees, communities of practice, knowledge teams and knowledge centers and drive knowledge efforts in the organization.

Conclusion

Nowadays the importance of KM is clear to many organizations and the leaders search for the main reasons and factors for being successful in KM system design and implementation through their organizations.

In this paper, through studying and analyzing six great companies (real case studies) which were successful in implementing KM system, some main factors were extracted that these factors show how to succeed in KM programs.

A framework can be conceptualized through the findings of this research as shown in Figure 1. This framework shows building blocks for success of knowledge adoption in an organization and is strongly supported by the findings of this research through real case studies.

The framework consists of three main layers. The interior layer includes main concepts and it is the backbone of KM system in an organization. It is composed of knowledge architecture, knowledge strategy, knowledge sharing, knowledge storage and knowledge identification. Knowledge architecture has been demonstrated as a system integrator. It also links between the other main factors.

Knowledge architecture focuses on KM by a systematic approach and integrates all factors related to KM, and also facilitates a balanced state between different factors so as to prepare a suitable architecture for knowledge in the organization.

The other main factor of this layer is knowledge strategy. Strategies show how we can reach objectives. Without a strategy there is no touchstone to assess what has changed and what the implications will be for the KM initiative. What it does mean is

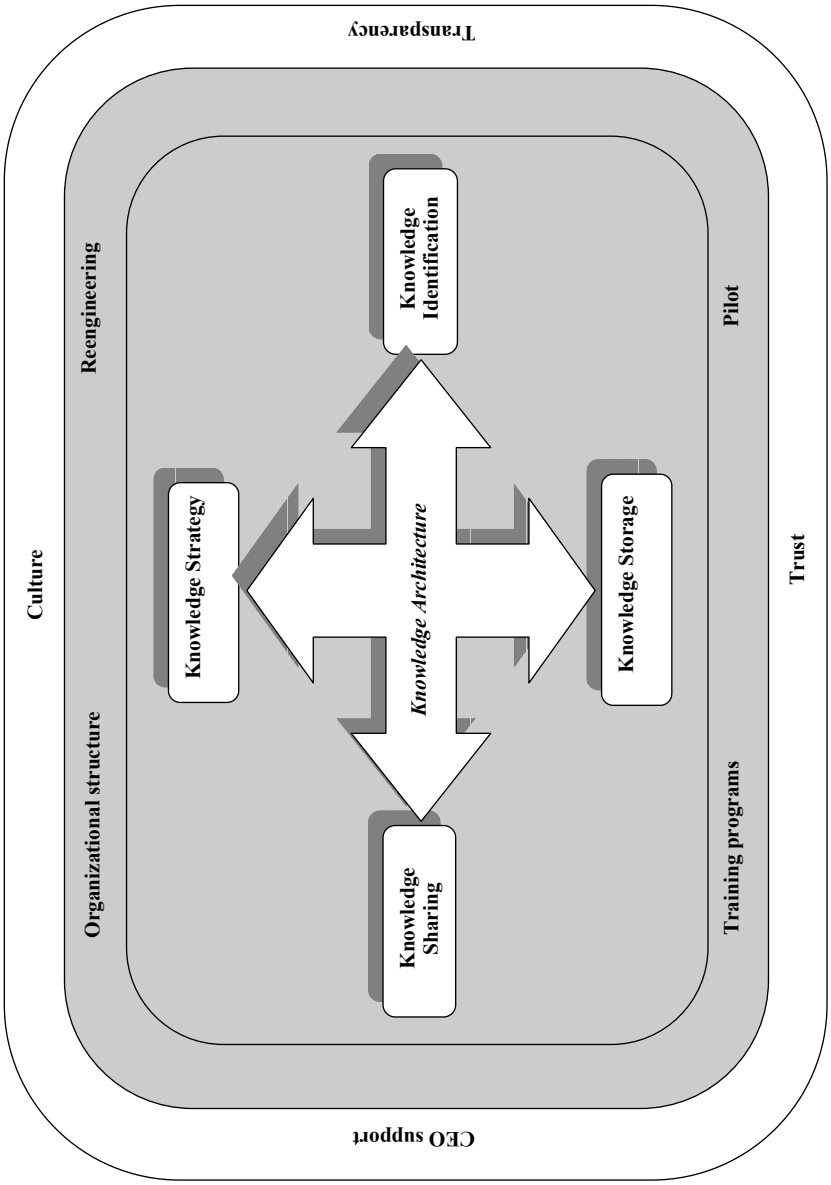

Figure 1.
Conceptual framework of knowledge management system

that the strategy should be concise, developed over a fairly period of time, and a process put in place to monitor the need for revisions to the strategy in the future. For being successful on implementing KM system in the organization, knowledge efforts and knowledge strategies should be aligned by organizational strategy completely and correctly.

Knowledge identification is the other necessary factor for successful KM adoption. Of course, after correct capture and identification of the knowledge in the organization, this knowledge should be stored. Knowledge bases and knowledge repositories can shape knowledge storage factor in the interior layer. The other important factor, knowledge sharing, can be facilitated through network of experts, knowledge committee, and communities of practice. These items are known as some important tools for effective knowledge sharing.

The middle layer consists of some factors that are necessary for success. In other words these factors can guaranty success of KM system and can facilitate it in the organization. These factors are: business process re-engineering, pilot, organizational structure and training programs.

The outer layer includes some factors that are more general in comparison with the other factors. These elements are necessary for successful establishment of every system in the organizations (not only for a KM system). These factors are organizational culture, transparency, CEO support, and trust.

This conceptual framework is strongly supported by the findings of this research through real case studies. This framework can be applied as a roadmap by the leaders that are to establish KM system through their organization.

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