

Developing Knowledge Management System for Public Higher Learning in Collaborative Environment

^aRusli Abdullah, ^bShamsul bin Shahabudin, ^bRose Alinda Alias, ^aMohd Hasan Selamat

^a*Faculty of Computer Science and Information Technology
Universiti Putra Malaysia, 43400 UPM Serdang*

^b*Faculty of Computer Science and Information Systemt
Universiti Teknologi Malaysia
81310 UTM Skudai*

Summary

Knowledge management system (KMS) becomes a common medium to distribute knowledge of these days by using the IT as enabler tools for everyone to reach, share with among the members, and used it from any workplace in world at any time. In the higher learning institution sectors, the collaboration tools of KMS explore the opportunity to create, gather, access, organize, distribute and disseminate the knowledge to their community of practice for many purposes such as learning process, R & D and others. This paper describes on the theoretical concept and approach of KMS that could be implementing in the public higher learning institution (PHLI) by showing on how the framework of KMS model is developed using Lotus Notes software. PHLI is considered the learning organization that fully supported by the government. The achievement in conducting this framework of the KMS is an added value for the any PHLI that need to implement the KMS, which can help them to achieve their aims and mission statements. The emphasis also will be given to the activities that may concern for each stage in the KM life cycle including the critical success factor (CSF) in order to make sure that KMS initiatives will delivered competitive advantage to the organization.

Keywords

Knowledge, Critical Success Factor, Knowledge Management, Knowledge Management System Framework, and Lotus Notes.

1. INTRODUCTION

Knowledge management (KM) has been a buzzword in a range of subject disciplines for many years, and has latterly been applied to higher learning institution. With the growth of this concept, there has also been a need to develop ways of understanding knowledge processes within this context and to select KM systems that can help in knowledge creation, storage and sharing. In terms of definition, KM is the systematic, explicit, and deliberate building, renewal, and application of knowledge to maximize an enterprise's knowledge-related effectiveness and returns from its knowledge assets (Wiig, 1997).

KM is a discipline that provides strategy, process and technology to share and leverage information and expertise that will increase our level of understanding to more effectively solve problems and make decision (Satyadas, *et. all*, 2001). The objectives of KM are to make the organization act as intelligently as possible to be secured in term of viability and overall process, and to realize the best value of its knowledge assets.

A PHLI considered the learning organization that fully supported by the government. and its environment seems to be by its nature especially suitable for the application of knowledge management principles and method. The main reasons are, this institution usually posses a modern information infrastructure, its professors and teachers generally love to share their knowledge with others, and the students desire are to acquire knowledge from accessible sources as fast as they could. In the education industry, KM can be defined as a systematic process that creates, captures, shares, and analyzes knowledge in ways that directly improve performance.

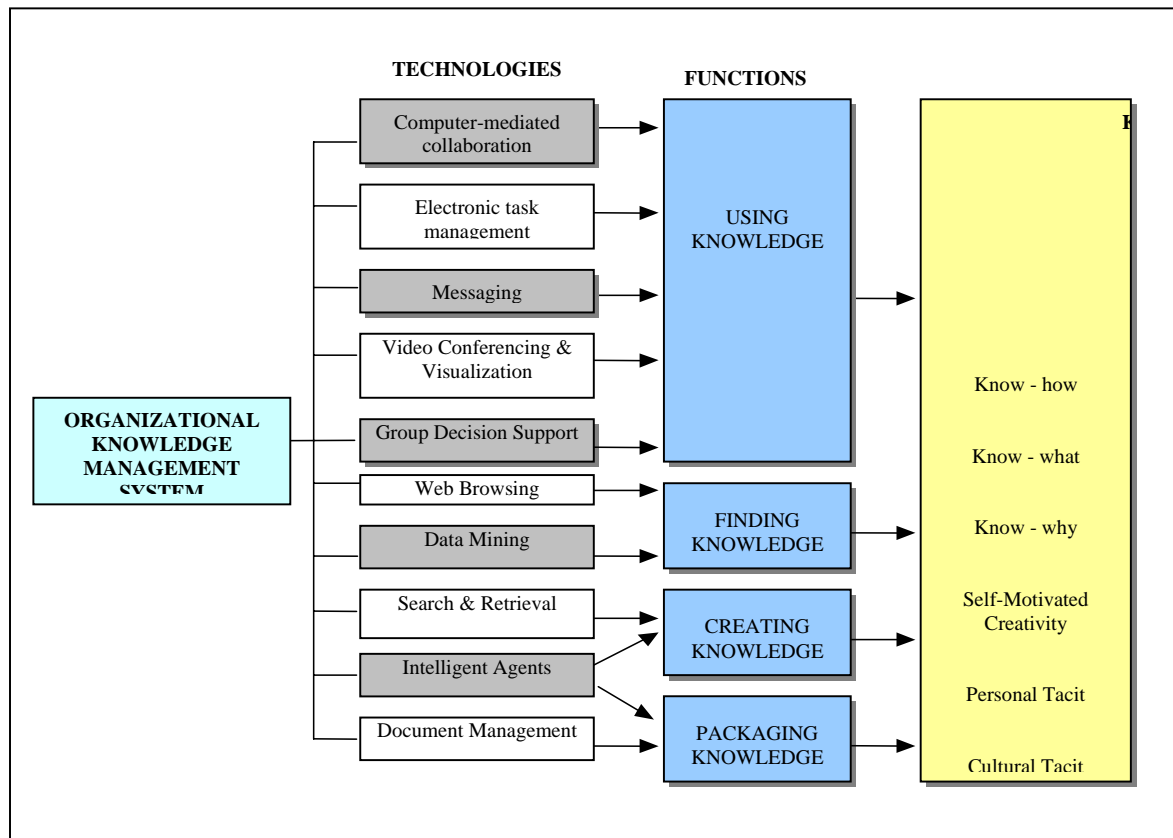


Figure 1: The technical perspective of a knowledge management system

From a theoretical standpoint, Knowledge Management Systems (KMS) refer to the information systems adopted and designed which efficiently and effectively leverage the collective experience and knowledge of employees to support information processing needs as well as enabling and facilitating sense making activities of knowledge workers (Wickramasinghe, 2002). KMS can include of any type of information, including both quantitative and qualitative. Qualitative information may be in the structured or semi structured text format and often takes the form of reports from prior project leaders on what they have learned during the project. Figure 1 simplifies the technical aspect of a knowledge management system. (Meso, 2000). A well designed of KMS should be considered and concerned about these four core features so that the system will bring a lot of benefits to the organization. The four core features are:

- Infrastructure, Content and Portal
- Collaboration & Learning
- Social Capital and Expertise

- Communities, Business Intelligence and Integration

The development of KMS involved a number of technologies. The combination of these technologies will produce a system that can collect, sort, store, and share the information throughout the organization. These technologies can be:

- *Intranets* – secure internal networks, to provide an ideal environment for sharing information accessed using a standard browser.
- *Information Retrieval Engines* – search engines are an absolute necessity and are the integral part of KMS.
- *Groupware* – to facilitates information sharing via e-mail, online discussions, databases and related tools. Its collaborative features can result in the creation of stores of untapped knowledge.

- *Database management systems* – computer databases are common repositories of information. KMS can be constructed to incorporate the information that is stored in the organization and accessible by all.
- *Data warehousing and data mining* – Data warehouses are centralized repositories of information. Data mining refers to specialized tools that allow the organization to convert increasingly complex sets of data into useful information.
- *Document management system* – A collection of tools that facilitate electronic document management, including storage, cataloging, search, analysis and routing.
- *Push Technologies* – Delivering of appropriate information to individual based on specific criteria.
- *Collaboration* – expert modeling and decision making analysis that lead to more collaboration, information expertise and insight sharing among knowledge workers.
- *Visualization and navigation system*- Relationship between knowledge elements and holders of knowledge.

2. THEORETICAL ASPECT OF KNOWLEDGE MANAGEMENT

There are six theoretical aspects that will be discussed in this paper and they are: framework, technology, process, methodology, life cycle, and people.

2.1 Knowledge Management Framework

There are ten knowledge management (KM) frameworks that have been identified. Table 1 summarizes and compares these tens KM frameworks.

2.2 Knowledge Management Technology

KM System is also defined as the collection of technologies that can collect, sort, store, and share the knowledge throughout the organization. Based on that

definition, the technologies that can be used in the development of KMS are:

- *Intranets* – secure internal networks, to provide an ideal environment for sharing information accessed using a standard browser.
- *Information Retrieval Engines* – search engines are an absolute necessity and are the integral part of KMS.
- *Groupware* – to facilitate information sharing via e-mail, online discussions, databases and related tools. Its collaborative features can result in the creation of stores of untapped knowledge.
- *Database management systems* – computer databases are common repositories of information. KMS can be constructed to incorporate the information that is stored in the organization and accessible by all.
- *Data warehousing and data mining* – Data warehouses are centralized repositories of information. Data mining refers to specialized tools that allow the organization to convert increasingly complex sets of data into useful information.
- *Document management system* – A collection of tools that facilitate electronic document management, including storage, cataloging, search, analysis and routing.
- *Push Technologies* – Delivering of appropriate knowledge to individual based on specific criteria.
- *Collaboration* – expert modeling and decision make analysis that lead to more collaboration, information expertise and insight sharing among knowledge workers.
- *Visualization and navigation system*- Relationship between knowledge elements and holders of knowledge.

*Table 1. Comparative Summary of the Descriptive Framework
(Adapted from Holsapple and Joshi, 1999)*

Dimensions Authors	Focus	Roots/ Origins	Knowledge Resources
Wiig, 1993	Identify management influences on the conduct of KM	Not indicated	
Leonard –Barton, 1995	Manage interaction between organization's technological capabilities and knowledge development activities	Field research	-Employee knowledge -Knowledge embedded in physical systems
Anderson & APQC, 1996	Pride a basis for benchmarking the conduct of KM within and between organization	Consulting experiences	
Choo, 1996	Describe the working of knowing organization	Synthesis of past research	
Van der spek Spijkervet, 1997	Characterize a conceptualize-reflect-act-retrospect cycle for governing the conduct of KM	Not indicated	
Sveiby, 1997	Characterize and measure intangible assets (especially knowledge)	Consulting experiences	-External structures -Internal structures -Employee competencies
Petrash, 1996	Characterize and measure intellectual capital	Practical organizational experiences	-Human capital -Organizational capital -Customer capital
Nonaka, 1996	Characterize knowledge creation through interaction of tacit & explicit knowledge and among individual, group and organizational entities	Not indicated	
Szulanski, 1996	Identify barriers to transferring best practices within an organization	Synthesis of past research and empirical study	
Alavi, 1997	Using technology to accomplish KM at KPMG Peat Marwick	Case study	

2.3 Knowledge Management Process

Knowledge process comprise of knowledge creation, knowledge storage, knowledge distribution and knowledge application, as illustrated in Figure 2. The act of creating knowledge coincides with the act of working through the learning spiral of conceiving, acting and reflecting. Reflection is key to knowledge creation.

Companies must develop the infrastructure to capture, store and disseminate the knowledge created from experience. KM allows organizations to leverage lessons learned to be more effective in the future. In addition, a KMS must help users to get their work done easier and more efficiently.

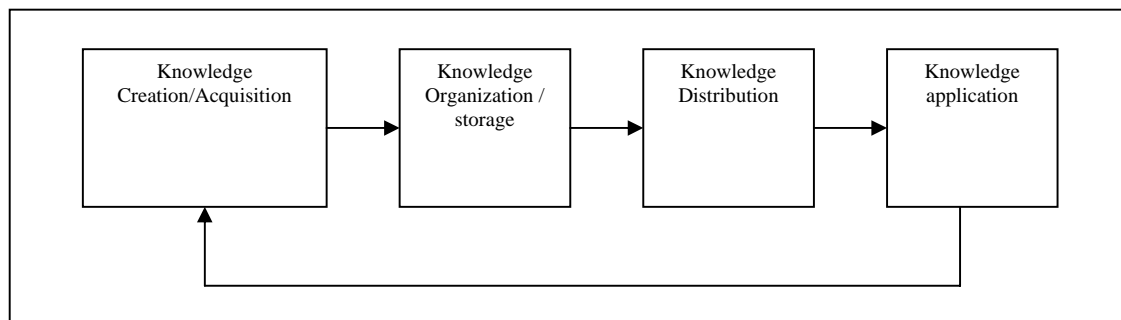


Figure 2: Knowledge Management Process

2.4 Knowledge Management Development

Knowledge management (KM) development involves four steps (Kotnour, *et. all*, 1997).

- Determine the organization's knowledge needs. The aim of this step is to determine the core competencies or focused knowledge needs of the organization (Drucker, 1993). The knowledge needs, are driven by the nature of the business the organization is in and desires to be in.

At an organizational level, the knowledge needs are a function of the organization's product and services and the processes by which the products are produced. At an individual level, the knowledge needs are a function of the things a worker is responsible and accountable for and the decision to be made and actions to be taken.

- Determine the current state of organizational knowledge base or memory. The aim of this step is to determine where and how the organization's current knowledge is assimilated and disseminated. Using the previously identify knowledge needs, the existing sources of knowledge or organizational memory are identified and evaluated for the ease of use and ability to provide accurate, relevant, and timely knowledge.
- Determine the gaps in knowledge and barriers to organizational learning. The aim of this step is to determine why the organization is not creating and applying knowledge that is accurate, timely and relevant. The output of this step is a list of improvement opportunities for the organization learning process.
- Develop, implement and improve proactive "KM strategies" to support organizational learning. The aim of this step is to develop proactive strategies to support the creation, assimilation, dissemination, and application of the organization's knowledge.

2.5 Knowledge Management Life Cycle

Knowledge evolution cycle is consisted of five phases (Rus and Lindvall, 2002):

- Originate/create knowledge-members of an organization develop knowledge through learning, problem solving, innovation, creativity, and importation from outside sources.
- Capture/ acquire knowledge- members acquire and capture information about knowledge in the explicit forms.
- Transform/organize knowledge—in written material and knowledge bases.
- Deploy/ access knowledge –organizations distribute through education, training program, and automated knowledge base system or expert networks.
- Apply knowledge- KM aims to make knowledge available whenever it is needed.

Based on the literature reviewed on Knowledge Management given by (Choo, 1998a; Choo, 1998b; Davenport, 1998; Davenport, *et all*, 1997, 1998; Leonard Barton, 1998; Myers 1996; Nonaka, 1995), the consolidation of the research has derived a KM lifecycle as shown in Figure 3.

This knowledge life cycle is depicted in the simplified way, as it suggests a strict sequence of identifying, creating, transferring, storing, (re)-using, and unlearning language (Rosemann and Chan, 2002).

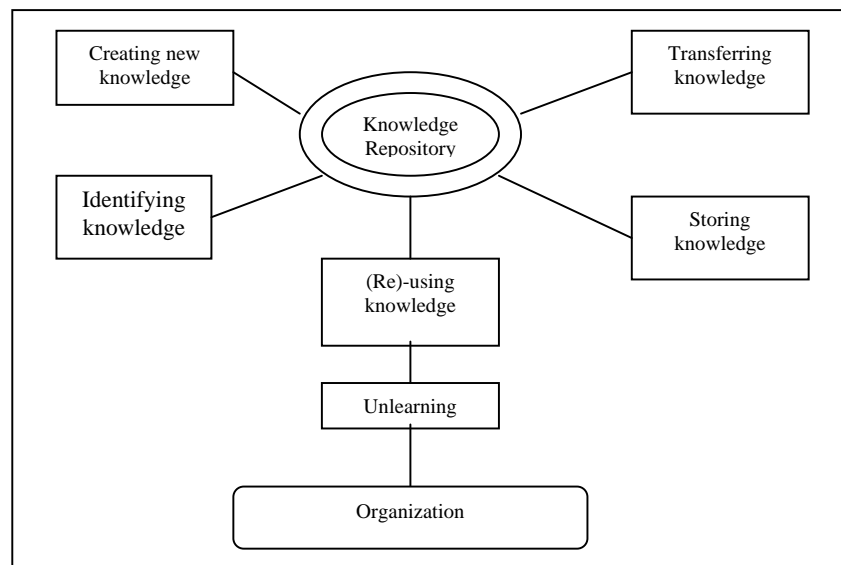


Figure 3: The Knowledge Management Life Cycle

2.6 People in the Knowledge Management Organization

Knowledge won't be well managed until some group within a firm has clear responsibility for the job. Among the tasks that such a group might perform are; collecting and categorizing knowledge, establishing a knowledge-oriented technology infrastructure, and monitoring the use of knowledge.

A task group will be comprised of chief knowledge officer (CKO), Chief Learning Officer (CLO), KM evangelists, Chief Information Officer (CIO), Chief Task Officer (CTO), the program manager, and the chief knowledge architect (CKA) (Satyadas, 2001).

3.A PROPOSAL OF KNOWLEDGE MANAGEMENT SYSTEM IMPLEMENTATION IN THE PUBLIC HIGHER LEARNING INSTITUTION (PHLI)

There are three basic possibilities of how the PHLI can be exploiting the KM ideas and principles. Firstly is the management of knowledge in term of student courses and others related with the academia program. Secondly is how to manage knowledge for decision support, to improve the internal document management and exploitation, to increase the level of information and knowledge dissemination. Lastly is how to make use the

qualitative of change in the educational process itself. Generally, collaboration in PHLI could be involved the people as listed below.

- Academician or lecturers - their roles are as teachers and become designers of learning experiences, processes, and environments. They concerned with identifying and then transmitting intellectual content and more focused on inspiring, motivating, and managing an active learning process by students.
- Researchers – process or generates new ideas by doing research
- Administrators- manages all aspects of the public higher learning institution task such as financial management, security, students' registration and others.
- The student. – They study, accept, review the knowledge at the public higher learning institution.
- The sponsors- the agent who sponsors the students or researchers in completing their studies or research works.

They are working together, hand –in-hand, in their institution to achieve their aim and mission. In this case,

there are three important goals of the KMS implementation in the PHLI. The goals are to serve the community, faculty, and administration of the PHLI. Below is some description about the goal:

- Community

One of the most important objectives is to support and encourage interaction between the PHLI and local community. Both individuals and community-based organizations may want to investigate an issue, drawing upon the expertise of PHLI faculty and staff. PHLI involvement includes diverse activities such as public presentations, guidance, research projects, and educational outreach. The use of the Internet is an obvious deployment strategy for the community and any underlying database design should support intuitive browsing and topic-based search capabilities. In fact, the Internet can extend the notion of "local" community to include a geographically dispersed intellectual community interested in the research and educational materials generated by PHLI.

- Faculty and Staff

The PHLI faculty and staff have a somewhat different set of objectives. The PHLI is developing its research presence through graduate education, grants and funding, technology transfer, and scholarly publications. In a very real sense, this mirrors some of the requirements that face organizations such as consulting companies and industrial research laboratories. How can the PHLI researchers find collaborators, facilities, and grant proposals that might support new projects. The Internet is allowing professional societies and other academic organizations to build online intellectual communities.

- Administration

From an administrative perspective, the PHLI would like to promote community involvement and research activity. While these activities are not completely aligned, a knowledge management system (KMS) could enable key administrators to gain insights with regard to ongoing activities. Administrative capabilities should support the development of policies that encourage new projects and activities in line with the strategic directions set for the university. For example, community contacts and project outcomes could be collected and used to foster new community outreach initiatives.

The need to develop and maintain a KMS is common to many knowledge-intensive organizations. While the term "KM" has become overloaded with different meanings, there is a need to develop specific strategies to capture and organize knowledge assets or expertise. PHLI is a knowledge-intensive organization that could benefit from KM efforts.

There are seven steps of critical success factors (CSF) to KM process in the PHLIs. The steps are:

- The **identify stage** determines which core competencies are important to academic success. Every department needs robust knowledge about its pedagogical needs and expectations from its members, services and administration. An understanding needs to be developed to settle its place in the pedagogical world and in other organizational and environmental aspects such as research endeavors and consulting services offered by the department.
- The **collect stage** deals with acquiring the internal and external knowledge, educational skills, fundamental theories and human experience needed to create the selected core responsibilities and knowledge domains.
- The **select stage** takes the continuous stream of collected, formalized knowledge and assesses its value. Initially, one framework should be selected as the basis for organizing and classifying knowledge to be stored in the Knowledge Bank or Repositories.
- Departmental memory resides in three different forms: in human minds, on paper and electronically. The **store stage** takes the nuggets of knowledge and classifies them and adds them to the departmental memory. Much of this knowledge can be represented in electronic form as expert systems. This is where even tacit, intangible knowledge assets are transformed to tangible one.
- The **share stage** retrieves knowledge from the departmental memory and makes it accessible to the users. Individuals, teams and departments often share ideas, opinions, gossip, knowledge & expertise in meetings held in person or through groupware.
- The **apply stage** reclaims and uses the needed knowledge in performing tasks, solving problems, making decisions, researching ideas and learning. To reclaim just the knowledge, requires that the system understand the user's purpose and context. To receive the knowledge at the right time requires a proactive system that monitors the user's actions and behavior and determines his/her purpose.

- The **create** stage uncovers new knowledge through many avenues, such as observing students, student feedback and analysis, research, experimentation, creative thinking and automated knowledge discovery and data mining.

The features and a model of system configuration of KMS are also shown as in Figure 5. Among its functionalities at the PHLI is:

- Electronic on-line document sharing including sharing of files, workflow diagrams, tools, procedures, manuals, best practices, and lessons learned etc. It is how students, lecturers, administrators, researchers and sponsors in the communities can share the ideas or communicate the new knowledge, learn and then can use it effectively.
- Correspondence Handling and Tracking System (CHATS) for the management of all correspondence, complaints, enquires etc. Here, students can communicate with their lecturers or sponsors regarding their studies or financial problem and other matters without having to arrange for the meeting and have to wait for quite a long time to see face to face. Students also can discuss with each other synchronously, and they can grab the result of their discussion as fast as can.
- Extensive collaboration tools such as group and individual calendars, task and resource management, "to-do" lists, email, discussion boards, and on-line surveys. It is really important for the people in the PHLI to plan, manage and collaborate with each other. As for example, with the discussion board, the administrators can discuss with the academicians about the structuring of the courses, examination date, the date of students registration, SSB, SSM and others.
- Various security features to ensure that information are only available to the people who need it. The password and login is only for the authenticated person in the PHLI. Only people who have that password can access the databases or the information, such as only the students who registered or in the class of certain lecturer who are available and authenticated to access those lecturers databases and website.
- Information retrieval through Search and Advanced Search to allow you to find any information simply and easily. Here, we can see that most of the PHLI own their website and inside the website, it is provided with the searching tools. By typing words

to be search in the searching box, it will bring us the information that is needed. It is useful for the students and researchers especially in completing their task.

- Flexible views so that each user can tailor the portal to meet their own requirements
- Easily implemented within a company or community due to its Internet architecture. PHLI institution nowadays has their Intranet and can link to other information and institutions via the Intranet. KMS that will be implemented must make sure that it can be link to others. For example, Lotus Notes is one of the KM software that can be easily implemented in the PHLI.

4. RESULTS AND DISCUSSION

Public higher learning institutions (PHLI) as fully sponsored by the government have a significant level of KM activities, and it is important to recognize these, and use them as foundations for further development, rather than to invent a whole new paradigm. PHLIs and their staff must recognize and respond to their changing role in a knowledge-based society. In order to assess the challenges that higher education institutions face in embedding KM, we use Davenport's four types of KM objectives as a lens through which to view higher education institutions: the creation and maintenance of knowledge repositories; improving knowledge access; enhancing knowledge environment; and, valuing knowledge.

The KMS of the PHLI, need it's own suitable framework. The current frameworks are not suitable to the PHLI because it is not emphasis on the role of human, technologies and the content development itself. PHLI consisted of human who managing it, administrating, doing research, and doing teaching and studying; consisted of the technologies which is needed by the human to convey and distribute their content which is ideas, knowledge. It is consisted of the content development, which is the KM process.

The proposed model of KM framework for the PHLI is shown in Figure 4 below. In this case, a prototype system by using Lotus Notes software has been developed as shown at Appendixes 1. This appendix will show the role of technologies in order to acquire and disseminate all kind of knowledge in the PHLI. In this case, the system set up was based on PHLI in a selected university in Malaysia.

As a general concept or overview of KMS functionality as well its components in PHLI environment, it could be view as shown as the Figure 4 and Figure 5 below. This KMS development was take the consideration and based on the technical perspectives as stated at discussion in the literature review before. Especially that was related

to technologies, its functionality and the knowledge (tacit and explicit) or content development and as well as its implementation.

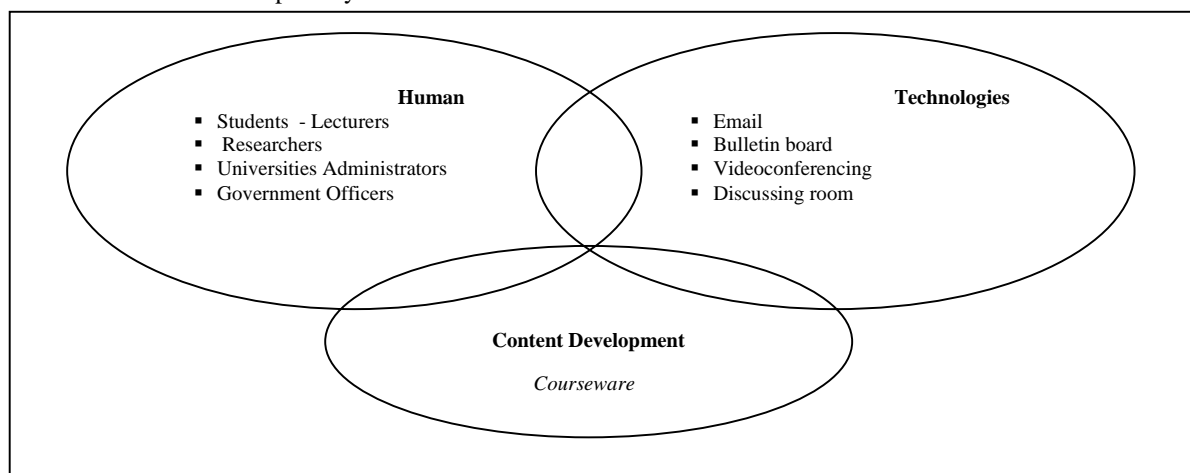


Figure 4: The System Components of KM Framework for the PHLI

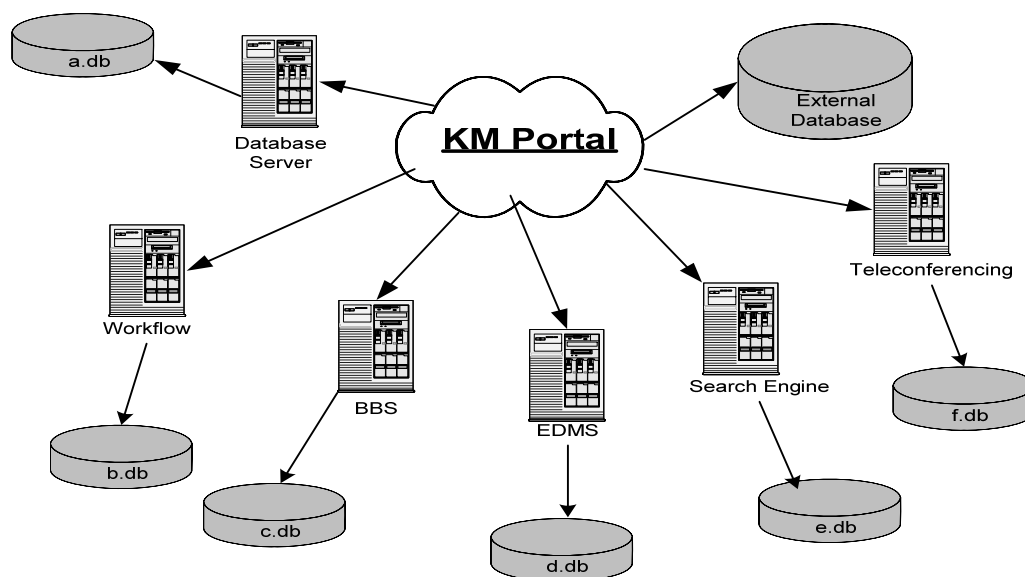


Figure 5: The System Configuration of KMS and Its Functionalities for PHLI

5. CONCLUSION

As a conclusion, it seems that KMS could be implemented in the PHLI with the base of KM framework that has been proposed. In order to develop a successful of KMS, the PHLI must ensure the proper requirement steps of implementation of KMS is ready

and try to adapt as much as possible of the technologies that are suitable for. It is will be need to ensure that the PHLI can gain the benefit from the implementation so that they will not waste the time and money.

They also must focused on the important of the collaboration environment, whereby the students,

academicians, researchers and the administrators could be working together, sharing the knowledge and others. Therefore, they also need to find the problem of implementing the KMS in order to make sure that they will always aware of the problem arises and they can try to find the solution to overcome that problem. Here, it is suggested that the proper plan must be adapted along with implementation in order to maintain the effectiveness of the institution.

REFERENCES

- [1] Alavi, M. (1997). *"KPMG Peat Marwick U.S.: One Giant Brain"*, Boston, MA: Harvard Business School.
- [2] Andersen, A., and The American Productivity and Quality Center. (1996). *The KM Assessment Tool: External Benchmarking Version*, Winter.
- [3] Choo, C.W. (1998a). *"The knowing organization: How organizations use information to construct meaning, create knowledge, and make decision"*, New York: Oxford University Press, Inc.
- [4] Choo, C.W. (1998b). *"Information management for the intelligent organization: The art of scanning the environment"*, Medford, NJ: Information Today, Inc.
- [5] Davenport, T. H. (1997), "Some Principles of KM". Available at: <http://knowman.bus.utexas.edu/kmprin.htm>.
- [6] Davenport, T. H., and Prusak, L. (1997). *"Working Knowledge: How Organizations Manage What They Know"*, Cambridge, MA: Harvard Business School Press.
- [7] Davenport, T.H., De Long, D.W and Beers, M.C (1998), "Successful KM projects", *Sloan Management Review*, Winter, pp 43-57.
- [8] Davenport, T., and Prusak, L., (1998), "So what's a KM project?", *The Antidote*, no. 11, pp. 34-37.
- [9] Drucker, P. F. (1993). *"Post-Capitalist Society"*, New York: HarperCollins Publishers, Inc.
- [10] Holsapple, C.W. and Joshi, K.D., (1999), "Description And Analysis of Existing KM Framework", *Proceedings of 32nd Hawaii International Conference on System Science*.
- [11] Kotnour, T. G., Orr, C., Spaulding, J., and Guidi, J. (1997). "Determining the Benefit of KM Activities", (Invited Session) *IEEE International Conference on Systems, Man and Cybernetics*, Orlando, Florida.
- [12] Leonard-Barton, D. (1998). *"The Wellsprings of Knowledge: Building and Sustaining the Sources of Innovation"*, Mass.: Harvard Business School Press.
- [13] Meso, P., & Smith R., (2000), "View of Organizational KM Systems", *Journal of Knowledge Management*, Vol. 4, No. 3 pg 224-234
- [14] Myers, S. P. (1996). "KM and Organizational Design: An Introduction", *Knowledge Management and Organizational Design*. Boston: Butterworth-Heinemann.
- [15] Nonaka, I., and Takeuchi, H. (1995). *"The knowledge-creating company: How Japanese companies create the dynamics of innovation"*, New York, Oxford University Press.
- [16] Petrash, G. (1996). "Dow's Journey to a Knowledge Value Management Culture", *European Management Journal*. Vol. 14, No. 4, pp. 365-373.
- [17] Rosemann, M. and Chan, R. (2002). "A Framework to Structure Knowledge for Enterprise Systems". Available at: <http://aisel.isworld.org/pdf.asp?Vpath=AMCIS/2000&PDFpath=260.pdf>
- [18] Rowley, J. (2000), "Is higher education ready for KM?," *The International Journal of Educational Management*, vol. 14, no. 7, pp. 325-333.
- [19] Rus, I. and Lindvall, M. (2002). "Guest Editors' Introduction: KM in Software Engineering", *IEEE Software* 19(3), 26-38.
- [20] Satyadas, A., Harigopal, U., and Cassaigne, N. P., (2001), "KM Tutorial: An Editorial Overview," *IEEE Transactions on Systems, Man, and Cybernetics-Part C: Applications And Review*, vol. 31, no. 4, pp. 429-437.
- [21] Szulanski, G. (1996), "Exploring Internal Stickiness: Impediments to the Transfer of Best Practice Within the Firm," *Strategic Management Journal* (17:Winter Special Issue), pp. 27-43.
- [22] Van der Spek, R. and Spijkervet A. (1997). "KM: Dealing Intelligently with Knowledge", *KM And Its Intergrative Elements*, eds (Liebowitz, J. & Wilcox, L.). New York: CRC Press.

[23] Wickramasinghe, N. (2002). "Practising What We Preach: Are KM Systems in Practice Really KM Systems?", *Proceedings of the 35th Hawaii International Conference on System Sciences*.

[24] Wiig, K.M., de Hoog, R., and R. van der Spek. (1997). "Supporting KM: A Selection of Methods and Techniques.", *Expert Systems with Applications*, 13(1).

Appendix 1: The Example Interface Design of a prototype KMS at PHLI

Example 1; Main menu of KMSfor PHLI as a central of desktop control



Example 2: An Interface of KMS for a portlet linkage for knowledge dissemination



Example 3 An Interface of KMS for a portlet linkage for community's communications



Example 4: Another Interface of KMS for a portlet linkage project planning



Example 5: An Interface of KMS for a portlet linkage for project control



Example 6: An Interface of KMS for a portlet linkage for system integration

