

Knowledge Management System Architecture For Organizational Learning With Collaborative Environment

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Abstract:

Knowledge management system (KMS) is one of the most critical weapon to transform knowledge resources in organization into intellectual capital for competitive advantage. However, learning organizations (LO) still have difficulties in identifying an appropriate KMS architecture framework and KMS technologies for their organizations. There is also no clear mechanism on how to motivate and encourage a community of practice (CoP) to share and reuse knowledge, as well as to generate new knowledge in a collaborative environment. Therefore, this research aims to overcome these problems by developing a KMS model and architecture that would ensure the right knowledge could be acquired from and disseminated to the right people at the right time. A survey to a group of CoP was conducted to identify requirements as a basis for setting up a KMS model. The KMS model was used to develop a KMS architecture. The KMS architecture consists of an application layer, a technology layer, an infrastructure layer and a repository layer. This architecture was tested by developing a KMS prototype for a research and development CoP in a Public Higher Learning Institution (PHLI) LO. The system was developed by integrating Lotus Notes Script and JavaScript, which ran over an Intranet and Internet infrastructure. Agent technology was used in the system for profiling, notification, alert and monitoring. Another questionnaire survey was conducted after the KMS prototype implementation to verify the functionality of the system in facilitating knowledge sharing in a collaborative environment. The findings from both questionnaire surveys were compared to identify the effectiveness of KMS implementation in creating a collaborative environment for knowledge sharing, re-use and creation in a CoP. The study found that the use of agent technology in a KMS supports the creation of a collaborative environment in a CoP.

Keywords:

Knowledge, Knowledge Management, Knowledge Management System (KMS), Collaborative technology, Agent Technology and Learning Organization.

1.0 Introduction

Knowledge comes from information processed by using data. It includes individuals' experiences, values, insights, and contextual information and helps to evaluate and incorporate new experiences and information. Knowledge originates from and is applied by knowledge workers. People use knowledge in making decisions. During the last several years, organizations realize they own a vast amount of knowledge and that this knowledge needs to be managed (Satyadas *et al.*, 2001). Davenport and Prusak (1998) define knowledge as a fluid

mixture of experience, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information. In organizations, it becomes embedded in documents and repositories, in organizational routines, in processes, practices, and norms. There is a slight difference in the definition given by Alavi and Leidner (1999). The speed, flexibility and efficiency are important within the application and the development of knowledge. It is also important to have the best of knowledge at the right place and at the right time and at a minimal cost as well. By looking at the power and

importance of knowledge to work collaboratively, there is a need for a system known as knowledge management system (KMS) in order to allow people to work together at any given time, place and also regardless of any platform that they have. Furthermore, Tiwana (2002) has classified or categorized a KMS architecture model that consists of seven layers. The layers are interface, access, collaborative, application, transport, integration, and repositories. These layers should be revised for a collaborative environment to encourage a LO CoP to work more easily, efficiently and effectively to be more productive to the organization.

2.0 Literature Review

Knowledge exists when data and information are applied (Beckett *et al.*, 2000). According to Nonaka and Takeuchi (1995) knowledge could also be categorized into two types, explicit and tacit knowledge. Tacit knowledge is obtained by internal individual process and stored in human being like experience, reflection, internalization or individual talent. Explicit knowledge is possible to be stored in a mechanical or technological way, like in handbooks or information systems, or database, manual, internal newsletter, documentation. Knowledge management (KM) is very important in the 1990's because it will help organization to have competitive advantage and effective work through sharing and re-use of knowledge in an organization. In the market place of e-business, KM initiatives are used to systematically leverage information and expertise to improve organizational responsiveness, innovation, competency and efficiency. There are many reasons why knowledge should be managed properly in an organization. Among the reasons are as follows: information overload, technology advancement, increased professional specialization, competition, workforce mobility

and turnover, and capitalize on organizational knowledge.

The KMS architecture is a fundamental issue in the area of KM that must be well resolved in order to deliver competitive services to the users as well as the organization. Meso and Smith (2000) proposed a KMS architecture that processes a combination of all the aspects stated below as well as other components which able to perform according to the requirement of the organization. These components consist of technology, function and the knowledge by itself. In terms of technology, KM should have the following features such as computer-mediated collaboration (CMC), e-mail, video conferencing, web browsing (portal), search engine, intelligent agent, and document management. Furthermore, in terms of its functionality, KM involved the processes for acquiring or collecting, organizing, disseminating or sharing knowledge and using knowledge among the stakeholder. And lastly, KMS implementation should be looked on its content of knowledge in terms of how to answer certain questions such as know-how, know-what, know-why, know-who and so on.

Collaboration environment provides a framework for bringing heads together, organizing their efforts, managing the process and producing outstanding results. When each member of a team collaborates on a mission or project, each would be able to contribute his or her own strength, skills and knowledge, to ensure the best results for the project (Attaran and Attaran, 2002). Cooperation, collaboration and teamwork are essential to the survival of any organization. Many realize that the importance of teamwork and collaboration may lead to the successful conduct of business. Collaboration also could be done using agent technology as support tools for team members who will to work at any given time and place. A collaboration model that was proposed by Khoshafian and Buckiewicz (1995) is shown in Figure 1 below.

	Same Time	Different Time
Same Place	Face-to-face collaboration (Synchronous)	Asynchronous Collaboration
Different Place	Distributed Synchronous Collaboration	Distributed Asynchronous Collaboration

Figure 1: Collaboration Model

3.0 Methodology

This research is organized into several phases starting from Phase One that describes the performance of fieldwork such as literature study and pre- KMS implementation, which develop and distribute the questionnaire as well as to produce the model and architecture for KMS related with collaborative environment. And then, followed by the Phase Two that implements the KMS Prototype using collaborative technology and Lotus Notes groupware and scripting language such JavaScript. After that, in Phase Three, another round of questionnaire was distributed to the respondents (Post-KMS implementation). A comparison is made between the Pre and Post KMS implementation. In Phase Four, the KMS model and architecture was revised. Phase Five concludes the study.

4.0 A Case Study

Based on the KMS survey results and the literature review that has been done, its show the architecture of pre-KMS implementation should be considered in terms of protocol interface application, technology, infrastructure, and repository in order to support knowledge sharing in the organization. Then, KMS is capable to perform as a knowledge portal using the collaborative technologies by supporting the networking infrastructure in order to process knowledge in the CoP. Besides that, psychological and cultural issues, as well as a knowledge audit should be considered in the process of pre-KMS implementation to ensure KMS is working successfully. In this case study, the development of KMS prototype as a knowledge portal for LO so called Collaborative Research Management Portal Environment for Learning Organization or CoRMPeLO has been developed and implemented by supported with agent-based system in term of agent services such as profiling, notification, alert and scheduler system. This system is developed based on the research management unit in a public higher learning institution (PHLI) as a case study because this research unit involves a CoP that includes administrators, researchers, RAs and others. The system configuration and workflow operation of the KMS prototype with agent technology is shown in the Figure 2 and Figure 3 below.

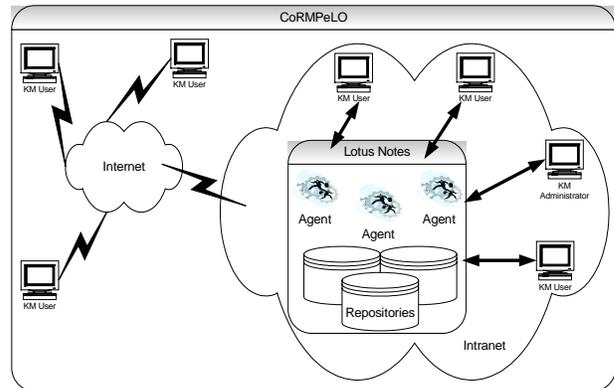


Figure 2: KMS Configuration System

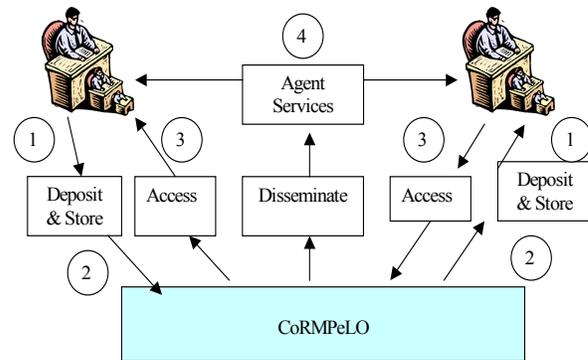


Figure 3: The Workflow of KMS Operation

5.0 Results and Discussions

As a result of this research, KMS model and architecture with application, technology, infrastructure and repository layers is workable in collaborative technology environment. These include pull, discovery and capturing technology that is used in knowledge acquisition in term of asynchronous and synchronous as well as push, publish and notification technology that is used with intelligent agent in acquisition and dissemination of knowledge. In this context, it also shows improvement of post KMS compared with the pre KMS implementation as a result of the survey as indicated in Table 1 below. Therefore, it indicates that the outcome of this research is significant and delivered a good impact to the organization.

Table 1: The Efficiency Ratio Agreement of Collaborative Application Technology

Factors of Evaluation	Agreed
Search engine is more helpful	12:14
Need Additional Feature (Agent: Spider)	11:14
Well Organization and Digital Formation	12:14
Quality and Productivity Increment	10:14
Helpfulness of GUI and Icon-based	10:14
Time, Cost, Security and Easy Access	10:14
Utilization of Resources and Documentation	12:14
HCI	10:14

The revised KMS model and its architecture has been made because there are other components that should also be considered such as the taxonomy component with related to the knowledge repository, the detailed specification on technique, and technology involvement in a collaborative environment. So, we have proposed the new KMS model and architecture for LO that consists of six main components in order to serve community of KMS with collaborative environment to work together for a certain mission in the organization. These components include: Architecture, Functionality and Application, Taxonomy and Process, Culture, Psychological and Audit, so called AFTPCAS Model are identified as a KMS architectural framework for a collaborative environment in the LO. The connectivity of the multiple issues and aspects plays a major role in KMS model and architecture after modification as the outcome of research is shown in Figure 4 and Table 2.



Figure 4: The Modification of KMS Model

6.0 Conclusion

As the findings of this research, we found that KMS architecture could be developed

Table 2: KMS Mechanism for knowledge Acquisition and Dissemination

Mechanism or Mode of Collaborative Technology	Community Involvement
<i>Synchronous Mode (SM)</i> • Meeting room • Discussion • Forum	Same time
<i>Asynchronous Mode (AM)</i> • Bulletin Board System • Notice Board	Different time
<i>Distributed Synchronous Collaboration (DSC)</i> • Video conferencing • Tele-conferencing, • Chatting	Different place/same time
<i>Distributed Asynchronous Collaboration (DAC)</i> • E-mail • Short Messaging System (SMS) • Voice mail, • Fax machine	Different place/different time

by using four layers, which includes protocol layer as a top level one in order to allow to become as a user interface application with the community, and followed by technology layer that facilitate the community to work together to share, re-use and generate knowledge among them. We also found that the KMS model could be shown in seven components in the AFTPCAS KMS model that includes the functionality and system architecture as the backbone to support the KMS process, taxonomy deployment, and cultural aspects as well as the knowledge strategies and measurement or system auditing.

The functionality of system may consist of a Portal, EDMS, Workflow management, Data Warehouse and Artificial Intelligence such agent technology. In a complex KMS, which covers the whole knowledge cycle, the minimum technologies requirement would be:

- Intranets, Electronic Document Management System (EDMS),
- Information Retrieval (IR) technique, Relational and Object Database system,
- Electronic Publishing System,
- Groupware and Workflow System,
- Agent Technology and, Data Mining Tools.

The KMS is good work area where people can share their knowledge between the CoP from the KMS model and architectural framework as proposed to be used in the organization. In this case, agent technology is an effectiveness tool that was identified and applied in order to act on behalf of the people in the community in order to perform something repetitively and time based system.

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