Distributed Knowledge Management Portal For Learning Organizations With Collaborative Environment

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Abstract - A knowledge management system (KMS) is a concept that can be used for creating knowledge repositories, improving knowledge access, sharing and communicating through collaboration, enhancing the knowledge environment and managing knowledge as an asset for an organization as well as inter-organization especially in Learning Organization (LO). In this paper, we will discuss and propose a distributed KMS portal for LOs with collaborative environment, a model and its components of KMS portal in LOs that will help the organizations to increase its productivity and quality as well as to gain return on investment (ROI). The component of KMS portal consists of its functionality, architecture, taxonomy, psychological, socio-cultural and audit.

I. INTRODUCTION

Knowledge is something that humans acquire from processed information, by using data. It includes their experience, values, insights, and contextual information and helps them evaluate and incorporate new experiences and information [1]. Knowledge originates with and is applied by knowledge workers. People use their knowledge in making decisions. During the last several years, organizations have realized that they own a vast amount of knowledge. This large amount of knowledge needs to be managed so that it can be easily utilized by the organization. Davenport and Prusak [2] defined 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. They argued that knowledge originates and is applied in the minds of people who know about it as also proposed by Polanyi [3]. In organizations, it becomes embedded in documents and repositories, in organizational routines, in processes, practices, and norms. Knowledge is viewed as a justification of personal belief that increases an individual’s capacity to take certain action. They used Churchman’s [4] idea that ‘knowledge resides in the user and not in the collection of information’ [4]. In their definition, action refers to physical skills and competencies, cognitive/intellectual activity or both (e.g., surgery involves both).

Knowledge is an asset with the following four characteristics [5]. (1) **Extraordinary leverage.** Knowledge is not subject to diminishing returns, has a fixed cost to create, but not to manufacture or distribute. (2) **Fragmentation, Leakage.** Over time, knowledge assets become less valuable as they become more widely known. To be successful, knowledge must be refreshed to keep it as a source of competitive advantage. (3) **Uncertain Value.** Value is difficult to estimate and steady growth in knowledge may suddenly halt. (4) **Uncertain Value Sharing.** Knowledge would be more useful if it could be shared and used among the community. Nonaka and Takeuchi [6] proposed four KM interactions that build on the distinctions between tacit and explicit knowledge, which was described by Polanyi [3]. Tacit knowledge is something that is implied, not on what is actually documented; something an individual ‘knows’ from experience, other people, or from a combination of sources. While, explicit knowledge is externally visible, tacit knowledge is only implied. Technologies supporting each interaction of knowledge are summarized in Table 1.
### TABLE 1: TECHNOLOGIES PROVIDED IN EACH INTERACTION

<table>
<thead>
<tr>
<th>Tacit to tacit knowledge via Socialization</th>
<th>Tacit to explicit knowledge via Externalization</th>
</tr>
</thead>
<tbody>
<tr>
<td>▪ Knowledge exchange: one-to-one, one-to-many, many-to-many</td>
<td>▪ Knowledge exchange: one-to-many</td>
</tr>
<tr>
<td>▪ Traditional knowledge exh. Medium: same place/same time, face to face meetings</td>
<td>▪ Traditional knowledge exchange medium: created periodic reports, white papers</td>
</tr>
<tr>
<td>▪ Today’s technologies: teleconferencing, desktop video conferencing tools, E-meetings, village wells, synchronous collaboration</td>
<td>▪ Today’s technologies: Electronic mail (E-mail), broadcasting information via distribution lists, answering questions, annotation</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Explicit to tacit knowledge via Internalization</th>
<th>Explicit to explicit knowledge via Combination</th>
</tr>
</thead>
<tbody>
<tr>
<td>▪ This form of knowledge creation depends on an individual’s ability to make sense out of explicit information</td>
<td>▪ Today’s technologies: E-mail, GroupWare, Homepages</td>
</tr>
<tr>
<td>▪ Today’s technologies: visualization</td>
<td></td>
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</table>

Collaborative computing technology could be used to encourage knowledge sharing in the community. The collaboration technology also will be happening at difference time and place, same time and place as shown at Fig. 1 below. Knowledge management (KM) is the systematically and organizationally specified processes for acquiring, organizing, and communicating knowledge of employees so that other employees may make use of it to be more effective and productive in their work [7]. The management of knowledge was very important since in the 1990’s because it helped organizations to be more competitive and effective through sharing activity and re-using knowledge. 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 (RICE) [8]. Besides that, there are more reasons why knowledge should be managed properly. Among these reasons are information overload, technology advancement, increased professional specialization, competition, workforce mobility and turnover and capitalizing on organizational knowledge.

![Collaborative Computing Technology Diagram](image-url)

Fig. 1: The collaboration computing technology (Adopted from Bostrom et al. [9])
II. REVIEWS ON KNOWLEDGE MANAGEMENT AND SYSTEM MODEL

Knowledge management system (KMS) is a system that needs to be developed in an organization. There are many perspectives for describing the KMS. Among them is from the technical perspective, proposed by Meso and Smith [10] as shown in Fig. 2. It consists of three components: technology, function and knowledge. KMS involves the processes for acquiring or collecting, organizing, disseminating or sharing knowledge among people in LOs. Numerous researchers have proposed several KM models. The majority of the model is a prescriptive model where it provides direction on the type of KM procedures without providing specifics details on how those procedures should be accomplished. For example, Wiig’s [11] KM model proposes the three KM pillars which represent the major functions needed to manage knowledge. The pillars are based on a broad understanding of knowledge creation, manifestation, use, and transfer. The Leonard-Barton [12] model highlighted a KM model that comprised four core capabilities and four knowledge-building activities that are crucial to a knowledge-based organization (KBO). Arthur Andersen and APQC [13] have advanced a model comprised of seven KM processes that can operate on an organization’s knowledge: create, identify, collect, adept, organize, apply, and share.

The model advanced by Van der Spek and Spijkervet [14] identifies a cycle of four KM stages: conceptualize, reflect, act, and retrospect. Chih-Ping et al. [15] proposed another model by integrating the previous models. It consists of three aspects; knowledge resources, KM activities, and knowledge influences. Although Chih-Ping et al.[15] have conducted a review on these frameworks; the cases used in the study were only based on highly knowledge-intensive companies. Therefore, KMS implementation in other industries such as global support environment where there is rapid technological advancement and changes have not been studied.

Fig. 2: The technical perspective of a knowledge management system
III. DISTRIBUTED KNOWLEDGE MANAGEMENT FOR LEARNING ORGANIZATIONS WITH COLLABORATIVE ENVIRONMENT

There is an English proverb that states: “Two heads are better than one”. This proverb stresses the importance of having a second person involved in whatever task one is performing. By having two persons working together on one task, the job will be performed faster. If one person is an expert in a field that the other is not, then, the combining of expertise will definitely make the job easier and smoother to run, thus ensuring the best results. This situation is more relevant in the context of LOs, which promote knowledge sharing among the students, lecturers, administrators and other stakeholders. The question here is how do we bring these heads together? Fig. 3 illustrates how these individuals emerge together to form a team in collaborative KMS (CKMS) of the LO. Working together, whether with two or more people means that there is teamwork involved. Teamwork refers to the cooperation and collaboration between the team members. Collaboration can provide a framework for bringing the 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 of us would be able to contribute on his or her own strength, skills and knowledge, to ensure the best results for the project. This is why collaboration is very important compared to handling the project alone. Cooperation, collaboration and teamwork are essential to the survival of any organization. We realize that the importance of teamwork and collaboration may lead to the successful conduct of business. In this case, there is a model for collaboration that was proposed by Anumba et al., [16] as shown in Fig. 4.

![Fig. 3: Call for a distributed collaboration in LO](image)

IV. RESEARCH APPROACH

In order to get inputs for formulating a model for collaborative KM portal in LO or for any related domain areas, we employed the following approach: documentation study of previous research, followed by a questionnaire survey and interviews in the community of practice in the LO, focusing on those who are involved in KM portal deployments such as system analysts, chief knowledge officers (CKO’s), programmers, and other active users. The designing of the questionnaire involves on what are the most relevant elements questions that is supposed to be included in the KM portal implementation. These elements questions are importance to ensure the system or KM portal worked according to its specifications of the LO requirements in order to serve CoP to work collaboratively. These questions are also emphasis on how the elements played their roles in order to support the CoP, which involved KM process environment. In this case, the survey was conducted by disseminating the questionnaires to the particular respondents involved in the KMS development as mention above, and who intend to use a KMS for their purposes in a CoP. From the list of measurement elements factors that were identified, respondents were also asked to rank their opinion about these elements by using a Likert scale that consists of a 10 points scale for each of the issues. The mean values for the usages were calculated on the following from highest to lowest scale that is from 10 = Very High and 9 = High, up to 2 = Low and 1 = Very Low. Respondents were also asked open-ended questions that allowed them to give views and comments regarding KMS implementation. The main elements of consideration in this study in order to develop the model of distributed KMS portal with collaborative environment are: KMS strategies, KMS architecture, functionalities of a KMS with collaborative environment to support communities in the organization, and KMS performance measurement. We also identified other elements suggested by the respondents during the survey. This is followed by formulation of the model, discussed in the next section.
V. RESULTS AND DISCUSSION

The most respondents are agreed that a proposed model should be developed in order to guide the implementation of a KMS portal in a collaborative environment. These concepts and its modeling are discussed below. The selection of distributed KMS portal with collaborative model was made for LOs because it might be a good start for KMS to enable many parties in LOs such as students, lecturers, administrators and others to work together to solve problems encountered in the organization. Beside that, LOs have many potential projects as initiatives to promote knowledge sharing of KMS model and its implementation.

A. A Proposed Distributed KMS Model With Collaborative Environment

The proposed Distributed KMS portal model with collaborative environment for the LOs implementation consists of six components. This includes KMS functionality and system architecture as the backbone in order to support the whole KM portal system. This is discussed in detail in Section A. Section B describes the KMS infrastructure and technology. Section C describes a KMS process model to categorize and process the forms of knowledge before the knowledge is being deposit in KM repositories for future use as well as for archive by the communities. Section D describes the psychological and socio-cultural components necessary to create a collaborative environment for the people who are using KMS in the LO. Finally, section E describes the KMS audit component.

B. KMS Functionality and Architecture

The KMS functionality and architecture may comprise of the following features. KMS architecture consists of these four layers: infrastructure layer, technology layer, protocol layer, and repository layer. Each layer is a client that connects to the system in the server and accesses the knowledge repositories via Local Area Network (LAN) or Wide Area Network (WAN) whether in synchronous or asynchronous mode of collaboration among the communities of practice. KMS may be based on the Internet and Extranet platform, as well as intranet infrastructure. The model of KMS network infrastructure is shown in Fig. 5.

![Fig. 5: The sample architecture of KMS](image-url)
The common areas of KMS functionality are:

- **Knowledge Portal:** It is a place where users will interact with the system as a first point of entry. From here, users will do everything that they want in order to accomplish their task or mission.

- **Electronic Document Management System:** It serves as containers for important corporate information and explicit knowledge. Many organizations maintain a vast amount of data in these systems, and it is therefore critical to have an effective system for managing this data so that the knowledge can be transferred to potential users.

- **Information Retrieval Engine:** It serves as an interface to a diverse set of knowledge silos, and plays a central role in setting up a Knowledge Management System. A search engine features relevancy ranking, natural language querying and summarization, which increase the speed and the precision of finding information.

- **Data Warehouses and Data Mining Tools:** Existing legacy databases in organizations contain vast amount of crucial data such as customer information, product data and sales statistic. KMS must provide meaningful access to these data warehouses. This is often done by SQL (structured Query Language) in conjunction with protocols such as ODBC (Open Database Connectivity).

C. Knowledge Management Infrastructure and Technology

Since knowledge is stored throughout an organization and is usually distributed on several different applications and platforms, various technologies are needed in order to retrieve the information and present it to the user. Below are descriptions of the roles of specific technologies in a KMS environment.

- **Intranets (Workgroup):** The web browser and the web server are the central technologies in KMS. Internet technology provides an easy and customizable interface to the organizations in different knowledge repositories through API’s and middle-ware.

- **Groupware:** This provides a medium for participants to communicate in a non real-time manner. Examples are various discussion groups that exist on the Internet. This is an important technology for enhancing the exchange of information, and is a popular way of knowledge sharing.

- **Agent Technology:** This is the software that monitors knowledge resources and alerts the user when new information is added or changed. Users can control the agent by specifying the type of knowledge that should be monitored. Agent software provides an interface for the user so that little knowledge about search algorithms are required to search for a particular knowledge asset

The Knowledge Management Taxonomy and Process Model

a) Acquire Knowledge

The following element adopted from a model by Arthur Andersen and APQC (1996) to acquire knowledge in a collaborative environment:

- **Processes:** In order to make sure that the knowledge could be acquired from the right people, time and place, these steps are suggested:
  - **Identify Knowledge:** Determine sources and type of knowledge
- Collect Knowledge: Gather and transform knowledge according to the specifications
- Adapt Knowledge: Categorize the knowledge
- Organize Knowledge: Prepare and map knowledge into the specific requirements
- Store Knowledge: Keep and index the knowledge dynamically

b) Store Knowledge

This is a process where the knowledge is kept in repositories. These can be in the form of documents that are organized and categorized to enable future browsing or speedy access of knowledge.

c) Disseminate Knowledge

The KMS can disseminate knowledge in a collaborative environment in four ways, depending on whether the communication method is synchronous, asynchronous, or combination of both. These techniques, either in real time or batch, are shown in Table 2.

d) Use Knowledge

In the process of usage, knowledge could be generated by KMS in a collaborative environment will be used by the stakeholders for problem solving, decision making and learning.

D. Knowledge Management System (KMS) Soft Issues

There are underlying psychological and cultural issues that are critical in creating an effective collaborative environment. They influence the development and implementation of a KMS or any technology-based solutions for a LO [17]. These issues include roles, values, norms and experiences of the knowledge workers.

E. Knowledge Management Audit

This component is very important in order to maintain and ensure performance of a KMS system is according to its specification. The security and compatibility of the KMS is also critical to ensure the LO benefits from the KMS. KMS audit can also be used to benchmark the KMS to maintain its quality and productivity, as well as to increase its return of investment (ROI).

<table>
<thead>
<tr>
<th>Technique</th>
<th>Applications</th>
<th>Mode of Involvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Synchronous Technique(ST)</td>
<td>• Meeting room • Discussion • Forum</td>
<td>Same Time, Same Place</td>
</tr>
<tr>
<td>Asynchronous Technique (AT)</td>
<td>• Bulletin Board System • Notice Board • Agent Based Technology</td>
<td>Different Time Same Place</td>
</tr>
<tr>
<td>Distributed Synchronous Collaboration (DSC)</td>
<td>• Video conferencing • Tele-conferencing • Chatting System</td>
<td>Same Time Different Place</td>
</tr>
<tr>
<td>Distributed Asynchronous Collaboration (DAC)</td>
<td>• E-mail • Short Messaging System (SMS) • Voice mail • Fax machine • Agent Based Technology</td>
<td>Different Time Different Place</td>
</tr>
</tbody>
</table>
Roles: To carry out a range of activities supporting evidence based on the organization to improve a decision-making and produce the quality of the services.

Norms: These differ according to the post and positions occupied by the groups represented in the team. Such norms when applied to evidence based on organization services also differ depending on background and training in the area.

Values: These are intrinsically formed within the group as they interact continuously with the KMS as well as amongst them.

Experiences: KMS may be a new concept to the participants; so they may be unable to articulate what they require from a KMS. The members may have extensive but varied experience in using a range of IT applications and may not be a comfortable with newer solutions such as a KMS.

V. CONCLUSIONS

Technological opportunities to improve interaction and increase collaboration in organization as well as inter-organization are expanding rapidly. There are many benefits of well designs the KMS as a portal. These include saving time and effort to acquire knowledge, so that all interested parties can use the organization’s combined knowledge. Knowledge should be able to be used wherever and whenever it is needed. KMS portal with a collaborative environment is eliminates time wasting randomly via the dissemination of knowledge just for the sake of possibility it may be for the interest to certain people. In order to become more beneficial to the LOs (or any other organization), knowledge as an organizational asset should be managed and maintained carefully.

As a conclusion, there are four core features of a distributed KMS portal with collaborative environment that should be considered:

- Infrastructure, Content and Portal
- Collaboration and Learning
- Social Capital, Expertise and Communities
- Business Intelligence and Integration.

However, LOs or organizations that pursue KM policies are more likely to succeed if they complement technological aspects of KMS developments with strategies for a collaborative environment allow people to work together at any time and any place. The encouragement of employee-run networks or communities of practice seems to be a successful strategy that provides both employees and the company with rewards from KMS within their workspace.

REFERENCES


