www.tlainc.com/articl83.htm
Journal of Knowledge Management Practice, March 2005

A Framework For Knowledge Management System Implementation In Collaborative Environment For Higher Learning Institution

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ABSTRACT:

"Knowledge management (KM) system" is a phrase that is used to describe the creation of knowledge repositories, improvement of knowledge access and sharing as well as communication through collaboration, enhancing the knowledge environment and managing knowledge as an asset for an organization. In this paper, we analyze the KM concept, system and architecture; then we propose a framework of KM system implementation in collaborative environment for Higher Learning Institutions (HLI). We also discuss various issues involved in this field that will help organizations to increase productivity and quality as well as to achieve return on investment (ROI). Issues that are highlighted in this paper include how best to acquire and disseminate knowledge; how to determine the best way for approaching and acquiring knowledge effectively including motivating people to share and access knowledge through the system; how to determine metrics for evaluating KM efficiency; how to identify how people create, communicate and use knowledge; and how to create more inclusive and integrated KMS software packages.

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1. Introduction

Knowledge is something that comes from information processed by using data. It includes experience, values, insights, and contextual information and helps in evaluation and incorporation of new experiences and creation of new knowledge. Knowledge originates from, and is applied by knowledge workers who are involved in a particular job or task. People use their knowledge in making decisions as well as many other actions. In the last few years, many organizations realize they own a vast amount of knowledge and that this knowledge needs to be managed in order to be useful. Davenport and Prusak (1998) 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 argue that knowledge originates and is applied in the minds of people. In organizations, it becomes embedded in documents and repositories, in organizational routines, in processes, practices, and norms. There is a slightly different definition given by Alavi and Leidner (1999). They see knowledge as a "justified personal belief that increases an individual's capacity to take

action". The difference between information and knowledge for this case study could be discussed as shown as in Table 1.

Table 1: The Difference Between Information And Knowledge

Information	Knowledge
Processed data	Actionable information
Simply gives us facts	Allows making predictions, casual associations, or predictive decisions
Clear, crisp, structured and simplistic	Muddy, fuzzy, partly unstructured
Easily expressed in written form	Intuitive, hard to communicate, and difficult to express in words and illustration
Obtained by condensing, correcting, contextualizing, and calculating data	Lies in connections, conversations between people, experienced-based intuition, and people's ability to compare situations, problems and solutions
Devoid of owner dependencies	Depends on the owner

There are two type of knowledge, namely explicit and tacit knowledge (Nonaka and Takeuchi, 1995). Tacit knowledge is obtained by internal individual processes and stored in human beings. Suchknowledge is sometimes described as Experience, Reflection, Internalization or Individual Talent.

Explicit knowledge is stored in a mechanical or technological device, such as documents or databases. This knowledge would be more useful if it could be shared and used among the community that works together using collaborative technology at anytime, anyplace and

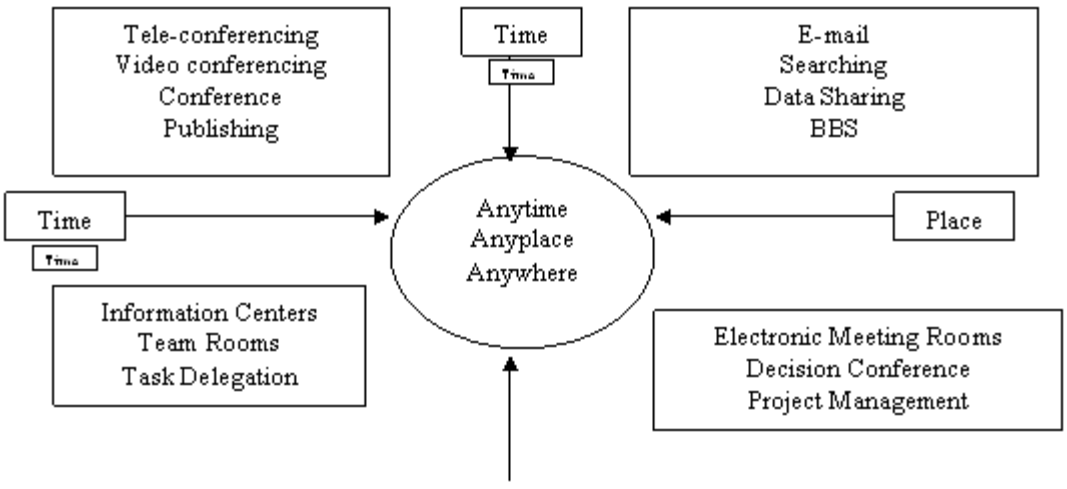

Figure 1: The Collaboration Computing Technology

The knowledge management (KM) is very important in the 2000's because it helps organizations to gain competitive advantage and effective working through sharing 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) (Lotus, 2001). There are many reasons why knowledge should be managed properly especially using the collaborative technology. Among these are information overload, technology advancement, increased professional specialization, competition, workforce mobility and turnover, and capitalization of organizational knowledge.

Based on this, Nonaka and Takeuchi (1995), proposed four KM interactions is also called SECI model. This model consists of Socialization (Tacit to tacit using teleconferencing technology, Externalization (Tacit to explicit using e-mail and broadcasting technology), Internalization (Explicit to tacit using visualization technology) and Combination (Explicit to explicit using groupware technology).

In this paper, the discussion of knowledge and its characteristics will be based on Davenport and Prusak (1998) and Nonaka & Takeuchi (1995) because we found that their knowledge of context is more relevant and applicable for organizations that involved in learning activities as a knowledge management system (KMS) where a lot of information will be take into action from knowledge repositories and the potential of generating of new knowledge among communities of practice (CoP) in collaborative environment. A KMS is an important system that should be developed in an organization. There are many ways to describe a KMS. One of them is from the technical perspective as proposed by Meso and Smith, (2000), as shown in Figure 2, which consists of three components: technology, function and knowledge. This KMS involves the processes for acquiring or collecting, organizing, disseminating or sharing knowledge among people in an institution.

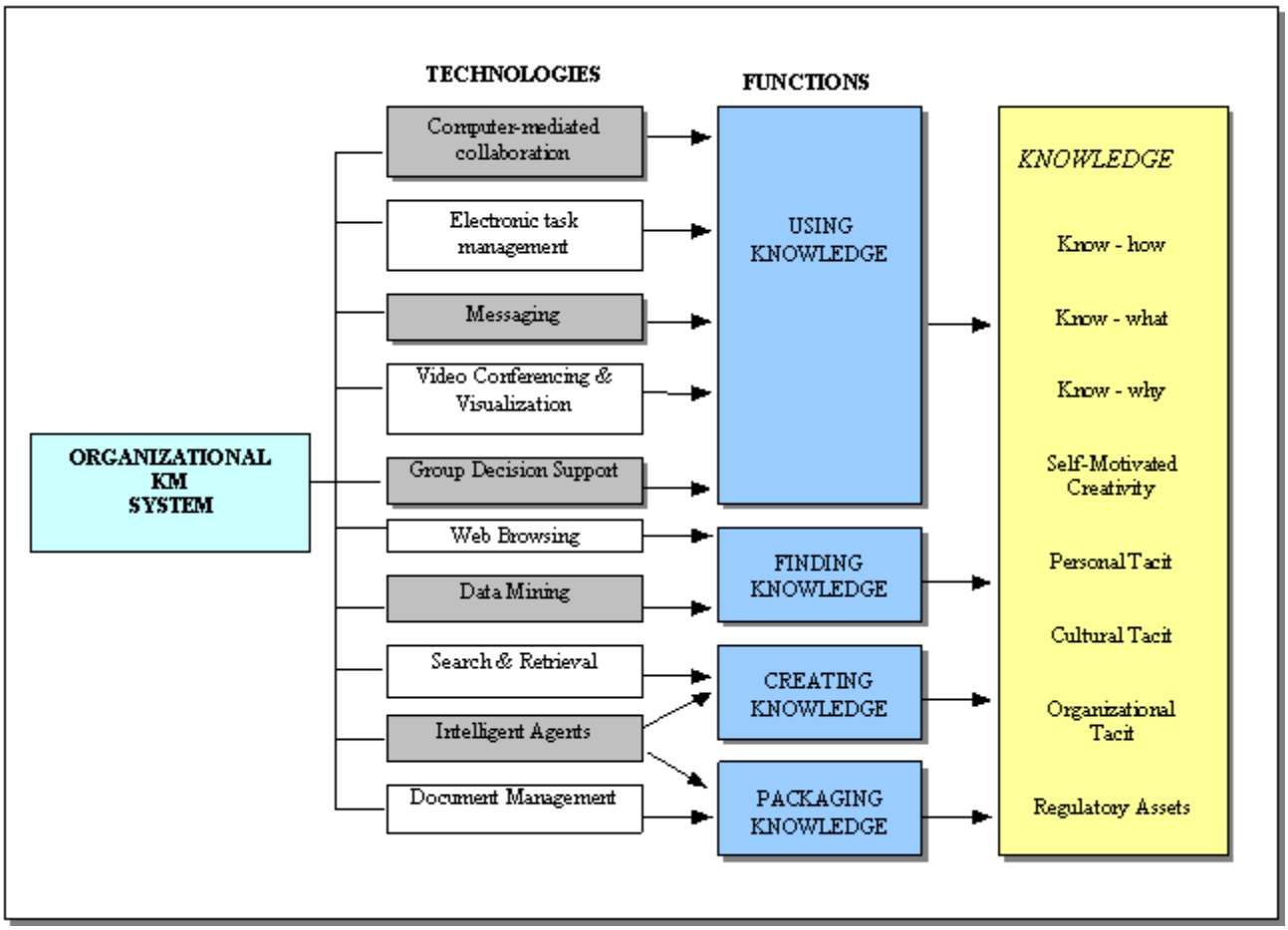

Figure 2: The Technical Perspective Of A Knowledge Management System

2. The Importance Of Knowledge Management Framework

The knowledge management (KM) framework is very important for the organizations that intend to implement the KM system in their organization. It will become as the guidelines in order to ovoid the errors and gain other benefits in terms of time and effort as well as cost involvement. Numerous researchers have proposed several KM frameworks. Many of these frameworks are prescriptive, providing direction on the type of KM procedure without providing specific details on how those procedures should be accomplished. For example, Wiig's (1997) KM framework proposes 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 (1995) model highlighted a KM framework that comprises of four core capabilities and four knowledge-building activities that are crucial to a knowledge-based organization (KBO). Arthur Andersen and APQC (1996) have advanced a model comprising seven KM processes that can operate on an organization's knowledge: create, identify, collect, adapt, organize, apply, and share. The framework advanced by Van der Spek and Spijkervet (1997) identifies a cycle of four knowledge management stages: conceptualize, reflect, act, and retrospect. Chih-Ping *et al.* (2002) proposed another framework by integrating the previous frameworks. It consists of three aspects, knowledge resources, knowledge management activities, and knowledge influences. Although Chih-Ping *et al.* (2002) has conducted a review on these frameworks, the cases used in the study were only based on highly knowledge-intensive companies. Therefore, knowledge management performed in other industries such as global support environment where there is rapid technological advancement and changes are not studied. The summary of the framework review is shown in Table 2 below.

Table 2: A Review Of Knowledge Management Frameworks

Frameworks	***Descriptions***
Leonard-Barton,1995	*1. Shared and creative problem solving* *2. Importing and absorbing technological knowledge from the outside of firm* *3. Experimenting and prototyping* *4. Implementing and integrating new methodologies and tools.*
Arthur Anderson and APQC, 1996	*1. Share 2. Create 3. Identify 4. Collect 5. Adapt 6. Organize 7. Apply*
Wiig, 1993	*1. Creation 2. Manifestation 3. Use 4. Transfer*
Choo, 1996	*1. Sense making (includes "information interpretation")* *2. Knowledge creation (includes "information transformation")* *3. Decision making (includes "information processing")*
Van der spek and Spijkervet, 1997	*In the Act process* *1. Develop 2. Distribute 3. Combine 4. Hold*
Nonaka, 1996	*1. Socialization (conversion from tacit knowledge to tacit knowledge)* *2. Internalization (conversion from explicit knowledge to tacit knowledge)* *3. Combination (conversion from explicit knowledge to explicit knowledge)* *4. Externalization (conversion from tacit knowledge to explicit knowledge)*
Alavi, 1997	*1. Acquisition (knowledge creation and content development)* *2. Indexing 3. Filtering 4. Linking 5. Distributing 6. Application.*
Szulanski, 1996	*1. Initiation (recognize knowledge need and satisfy that need)* *2. Implementation (knowledge transfer take place)* *3. Ramp-up (use the transferred knowledge)* *4. Integration (internalize the knowledge)*

3. Knowledge Management And Collaborative Environment

KM tools have played its major roles to support the KMS that consists of knowledge use, knowledge finding, knowledge creation and knowledge packaging (Meso and Smith, 2000). Normally, the tools are also called the KM technologies such as mailing and search and retrieval system that are used to accomplish certain missions and objectives in the organizations. In this case, KM technology could involve more than one feature, but the more features it has, the better its functionality (O'Leary, 1998; Abdullah *et al*., 2002: 2003a: 2003b: 2004). There is an English saying: "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 make the job easier and smoother to run, thus ensuring the best results for the job. This situation is more relevant in the context of HLI where it is vital to promote knowledge sharing among others like students, lecturers, administrators and the wider community. The question here is how do we bring the 'heads' together? Figure 3 illustrates how these individuals emerge together to form a team in the HLI.

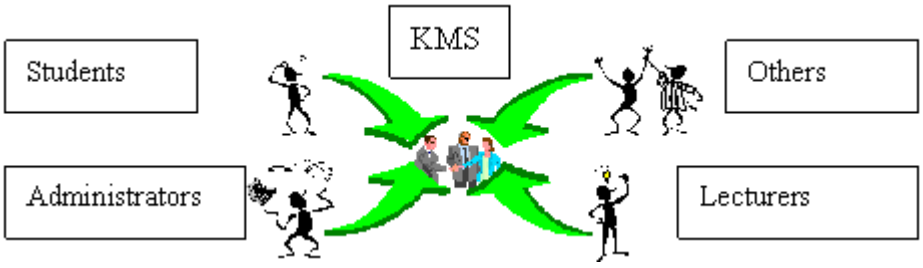

Figure 3: Call For Collaboration In HLI

Working together, whether among two or more people means teamwork is involved. Teamwork refers to the cooperation and collaboration among the team members. Collaboration can provide a framework for bringing the different 'heads' together, organizing their efforts, managing the process and producing the outstanding results. When each member collaborates in 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. 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 and the successful conduct of business. A model of collaboration was proposed by Anumba *et al.*, (2001) is shown Figure 4 below.

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

Figure 4: Collaboration Of Working Model

Based on the concept of KM and collaboration environment in multiple views and perspectives, we found that it is a good start and a opportunity for those who are in the organization to link and build the framework for the benefit of their CoP that would work any where and any time (Bostrom *et al*, 1992; Abdullah *et al*., 2002: 2003a: 2003b; Mohayidin *et al*, 2003; Abdullah *et al*., 2004). Therefore, we want to study and propose a KM framework specifically for higher learning institution (HLI) in the context of collaborative environment.

4. Methodology

For the purpose of developing and formulating the framework of KM system for any domain areas such as in HLI, we have studied the documentation of previous research and designed a questionnaire that to be used to interview members of the HLI's CoP, especially those involved in the KMS development. These include system analysts, chief knowledge officers (CKOs), programmers, and active users. The main elements or issues of consideration are: (1) Strategies consideration in terms of action plan, scope and project domain, and budgeting. (2) Social and psychological aspects that focus on the motivation and reward system in order to encourage people to share knowledge and work together as a team. (3) Architectural aspects where it involve the infrastructure requirement and connectivity with other knowledge repository in KM system. (4) Functionalities and capabilities of KMS in terms of collaboration environment, and organizational and performance aspects as well any other aspects, that may be suggested by the respondents. From the list of measurement factors that were identified, respondents were asked to rank their opinion about these issues 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 to 2 = Low and 1 = Very Low. The profile of the respondents is shown in Table 3 below.

Table 3: The Profile Of The Participants

Type of Community	Position	No. of Respondents
KM Dev. Team	CKO, SA, PR	5
Research Group1	Manager, RA	3
Research Group2	Manager, RA	3
Research Group3	Manager, RA	3

After performing the interviews, all data collection was analyzed and we formulated the frameworks as discussed in the next section.

5. Results And Discussion

The result has shown that many respondents (on average is about 78.75 percent) who were interviewed agreed that KM system should be focusing on issues in terms of KM architecture and its functionality (80 percent), KM infrastructure and technology in order to deliver better service to serve the community (85 percent), KM process as a model of acquisition and dissemination (75 percent), and other relevant aspects such as cultural and psychological that reflect enhancing the performance of community in organization (75 percent) (See Figure 5). The detailed discussions based on the findings from literature review and survey analysis are described at the following section.

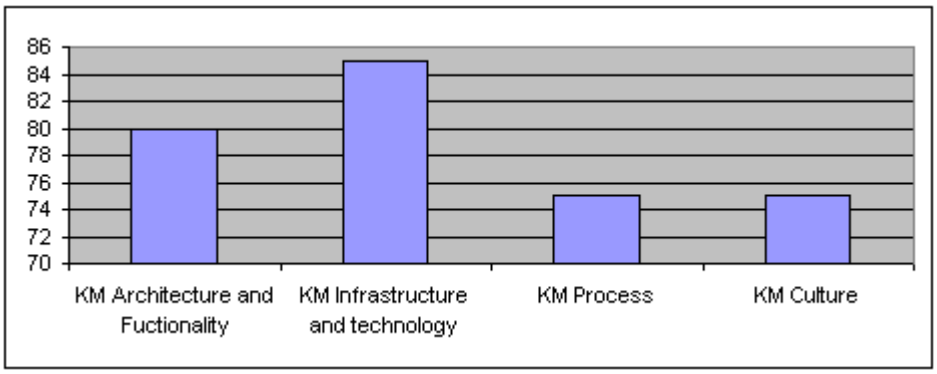

Figure 5: The Findings Of The KMS Issues.

5.1. The KMS Architecture And Its Functionality

The functionality of KMS and its architecture comprises of the features as discussed below. The KMS architecture could be developed by using four layers, which includes application layer, technology layer, infrastructure layer and repository layer. In this case, KMS functionality also worked based on the Internet and Extranet as well as Intranet infrastructure in client and server computing. The model of the KMS network infrastructure is shown in Figure 6 below.

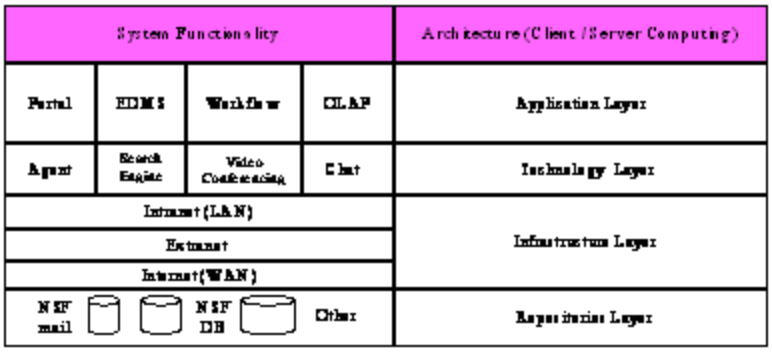

Figure 6: The Functionality And Architecture Of KMS Model

The most commonly used areas of functionality are:

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

- Electronic Document Management System (EDMS): Containers of 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 when setting up a KMS. A search engine features relevancy ranking, natural language querying and summarization, that increases 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 or knowledge repositories. This is often done by SQL (structured Query Language) in conjunction with protocols such as ODBC (Open Database Connectivity).

5.2 KM Infrastructure and Technology

Since knowledge stored throughout an organization 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 what roles specific technologies play in the organization's KMS environment.

Intranets: The Web browser and the Web server play a central role in KMS. The Internet technology simply provides an easy and customizable interface to the organizations 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 the many 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 software that monitors knowledge resources and alerts the user when new information is added or information is changed. User would control the agent that can specify the type of knowledge that should be monitored. Agent software provides an interface for the user so that minimal knowledge about the search algorithms required for the particular knowledge asset is necessary.

5.3 The KM Process Model

There are four activities involved in the KM process model in order to utilize the knowledge in the organization. These are the activities that begin with acquiring and storing the knowledge into the KM system, followed by disseminating and using of knowledge among the communities.

1. Acquiring Knowledge: Acquisition of knowledge in a collaboration environment uses elements adopted from Arthur Andersen and APQC (1996), which involve sequential steps that should be taken in order to make sure that the knowledge could be acquired from the right people, time and place. It is suggested as follows:

    a. Identify Knowledge (Determine sources and type of knowledge)

    b. Collect Knowledge (Gather and transform knowledge according to the specifications)

    c. Adapt Knowledge (Categorize the knowledge)

    d. Organize Knowledge (Prepare and map knowledge into the specific requirements.)

    e. Store Knowledge (Keep and index the knowledge dynamically)

2. Store: This is a process where the knowledge will be kept in repositories. These can be documents that are organized and categorized to enable browsing or fast access of knowledge.

3. Disseminating Knowledge: The KMS can disseminate knowledge in a collaboration environment essentially into four ways, depending on whether the

communication method is synchronous or asynchronous or combination of both. These techniques, either in real time or not, are shown at Table 4 below.

Table 4: The Techniques Used For Disseminating Of Knowledge

Techniques	Applications	Mode of Involvement
Synchronous Technique (ST)	• Meeting room • Discussion • Forum	Same Time, Same Place
Asynchronous Technique (AT)	• Bulletin Board System • Notice Board • Agent Based	Different Time, Same Place
Distributed Synchronous Collaboration (DSC)	• Video conferencing • Tele-conferencing • Chatting	Same Time, Different Place
Distributed Asynchronous Collaboration (DAC)	• E-mail • Short Messaging System • Voice mail • Fax machine • Agent Based	Different Time Different Place

4. Use: In the process of use, knowledge of how to use the KMS in a collaboration environment will be increased by the CoP for their specific purposes such as for problem solving, decision making and learning.

5.4. KM Related

Issues

There are underlying psychological and cultural issues that are important when thinking about applying a KMS. These include the roles, values and norms of the knowledge workers, as these will have an impact on the development and implementation of any solution that is arrived by the organization (Fennessy, 2002).

Roles: To carry out a range of activities supporting evidence based on the organization to improve decisions making and the quality of the services.

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

Values: intrinsically formed within the group.

KM technology: KM may be new to the participants; so that they may be unable to articulate what is needed as far as a KMS is concerned. All have extensive but varied experience in using a range of IT applications and are comfortable with new applications.

5.5.

KM Strategies And Measurement

This component is very important in order to maintain the system, so that it works smoothly and serves the people who are linked to it. Maintenance and measurement also ensure that the system works according to the specification. Measurement can also be used to benchmark the system in order to maintain quality and productivity as well as to increase return of investment (ROI). For the purpose of KMS implementation in HLI, the respondents agreed on the best framework in order to implement a KMS in a collaborative environment. These frameworks and concepts are discussed below. They also agreed on many major issues that are highlighted. The selection of this KMS framework was made, as KM should serve many parties in HLI such as students, lecturers, administrators and others to work together in order to solve several problems encountered in the organization.

6. The KMS Framework Proposal

As a summary of the research work at HLI, the proposed KMS framework for system implementation was identified and formulated. We have found that the framework of the KMS would include five components. These include functionality and system architecture as the backbone to support the KM system, psychological and cultural aspects as well as the knowledge strategies and measurement or system auditing. The functionality of system may consist of Portals, EDMS, Workflow management, Data Warehouse and Artificial Intelligence. The facilities that support the functions of the KMS consist of Infrastructure and Technology as enabler tools, and Processes as a set of activities to manage knowledge, and also Repositories such as corporate memory. Beside that, Psychological and Cultural aspects as well as a knowledge audit that supported the idea that KMS could act as a catalyst to the workers in the HLI. This relationship of these five components is shown in the Figure 7 below.

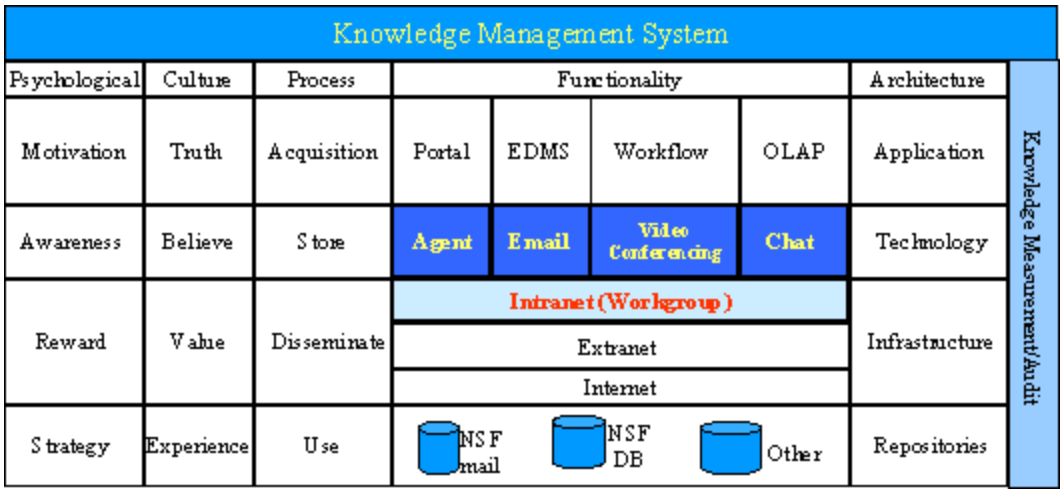

Figure 7: A Proposed Framework Of Knowledge Management System For The HLI

7. Conclusions

The technological opportunities to improve interaction and increase collaboration in organizations are expanding rapidly. There are many benefits of a well-designed KMS in the organization. These include saving time and effort to get knowledge, so that all interested parties can use the organization's combined knowledge: knowledge is able to be used wherever and whenever it is needed, eliminating time wasting random distribution just-in-case people are interested. In order to be more beneficial to the HLI (or any other organization), the knowledge, as an organizational asset should be managed carefully. In this case, there are four core features or categories for KMS framework as proposed that should be considered and concerned as listed below:

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

However, HLI, or any organization that pursues knowledge management policies, is more likely to succeed if they complement technological aspects of KMS developments with the collaborative strategies which to allow people to work together at any time and any place. The encouragement of employee-run networks or CoP seems to be a successful strategy that provides both employees and the company with rewards from knowledge management within the their workspace. For future research, we will develop a prototype system based on this KM framework and test the applicability of the prototype for the

CoP. After that, a survey will be conducted in the CoP to evaluate the effectiveness of the KM framework in the prototype implementation.

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