Journal of Knowledge Management Practice, March 2005

Facilitating Knowledge Sharing Through Lessons Learned System

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ABSTRACT:

Recently, many organizations realize that knowledge is a strategic tool for maintaining organizational performance. With the realization that knowledge is a core resource, organizations are now attempting to manage knowledge in a more systematic and more effective way. The theory of organizational knowledge creation suggests the sharing of tacit knowledge is a critical component of successful knowledge management efforts. Accordingly, to survive in this emerging economy of knowledge, organizations must recognize the need to introduce processes and technologies that aim to facilitate the sharing of information and knowledge then capture it for use by the organizations. This paper explores the concepts of Lessons Learned (LL) and Lessons Learned System (LLS), and then demonstrates the development of Lessons Learned System (LLS) as part of knowledge management initiative to facilitate knowledge sharing.

1. Introduction

Managing knowledge is not easy task. It is because knowledge is human-based, dynamic and involved many cultural issues that need to be addressed. However, to gained competitive advantage in the knowledge-based economy, organizations must recognize the need to introduce processes and technology as one of KM enabler that aim to convert employee's knowledge into organizational knowledge. Thus, one of the solutions to managing organizational LL is by promoting the LL system.

Lessons Learned (LL) are validated working knowledge derived from success or failure, that when reused, can significantly impact an organization's process (Secchi 1999). LL processes refer to an organization's effort to managing LL (Weber et al, 2000). Weber, Aha & Becerra-Fernandez (2001) describe there are five LL processes including collect, verify, store, disseminate, and reuse. LL system is a software system for supporting LL processes. LL systems are motivated by the need to preserve an organizational knowledge by converting individual knowledge into organizational knowledge. So that, when experts leave the organization, other employees may benefit from the captured LL to solve problems that may closely or exactly match to the similar or different contexts. Thus, through this knowledge management solutions for sharing and reusing knowledge gained through experience (i.e. LL system) many organizations can avoid the phenomenon like corporate amnesia.

2. Knowledge Management (KM) Concepts

The concepts of KM incorporate theory from numerous disciplines. There are many definitions exist, but yet, there seems to be lack of consensus about what actually constitutes KM. However, the basics term that needs to be clarified is the term "knowledge". Knowledge is defined by Davenport and Prusak (1998) as "a fluid mix of framed experience, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information". Brooking (1999) defines knowledge as information in context with understanding to applying that knowledge. Also, she defines the term data as facts and information as organized data in context. Based on given two definitions, we know that there is some form of interplay between data, information and knowledge. Also, these definitions highlight there are two general types of knowledge; tacit and explicit knowledge which many KM writers and KM experts agree with it (Dixon 2000; Inkpen 1996; Polayni 1996; Nonaka & Takeuchi 1995; Von Krogh et al, 2000).

Tacit knowledge is linked to personal perspectives, intuition, emotions, beliefs, know-how, experiences and values. It is

intangible and not easy to articulate, making it difficult to share with others. In contrast, explicit knowledge has a tangible dimension that can be more easily captured, codified and communicated. Nonaka and Takeuchi (1995) further elaborate that these two versions of knowledge can interact when the "knowledge conversion" occurs (see Figure 1) as below.

TO **FROM**	Tacit	Explicit
Tacit	**Socialization**	**Externalization**
Explicit	**Internalization**	**Combination**

Figure 1 Nonaka's SECI Model (Nonaka & Takeuchi 1995)

They believe that the knowledge creation process as a spiral and the interaction of tacit and explicit knowledge produces four modes of knowledge conversion; socialization (from tacit to tacit), externalization (from tacit to explicit), combination (from explicit to explicit) and internalization (from explicit to tacit) or it can be called as SECI model. Based on these four modes of knowledge conversion, if we take a look at one way, we can say that KM is any mechanism that can support systematically all these modes of knowledge conversion whether to identifying, managing or sharing two types of these organizational knowledge (i.e. tacit and explicit). Another way, we can use this Nonaka's model to describing a certain KM solution (i.e. LL system) as shown in Figure 2.

TO **FROM**	Tacit	Explicit
Tacit	**Socialization (Collect)**	**Externalization (Verify & Store)**
Explicit	**Internalization (Reuse)**	**Combination (Disseminate)**

Figure 2 LL Processes Described In SECI Model (Mohammad Nazir Ahmad Sharif et al. 2004)

3. KM Model For Lessons Learned System

According to (Borghoff & Pareschi, 1998), there are four approaches to collect and distribute knowledge in organizations; knowledge attic, knowledge sponge, knowledge publisher and knowledge pump. These approaches can be seen in Figure 3 as follows.

	Passive Collection	Active Collection
Passive Distribution (Pull)	**Knowledge Attic**	**Knowledge Sponge**
Active Distribution (Push)	**Knowledge Publisher**	**Knowledge Pump**

Figure 3 Approaches To Knowledge Collection And Distribution

In this paper, we focus on the development of LL systems as described in knowledge attic. This is the simplest form of corporate memory management as discussed in (Borghoff & Pareschi 1998). It emphasizes the bottom-up nature of organizational learning. However, to ensure this function well it requires a high discipline of the knowledge workers in the organizations. SELLS (1999) through NASA Space Engineering Lessons Learned Programme has developed this example of knowledge attic corporate memory. The NASA's LL system is developed to ensure that the flight system undergoing design, development, integration, test and evaluation will meet the requirements. To enable this, the NASA's group has created a lessons learned database, which can be accessed through electronic forms.

In order to describe our LL system, we need to refer Figure 2 To facilitate the collection of LL, we provide an electronic form, which includes fields for the *name, date, titles, category, applicable to, keywords, LL statements, abstract,* and *recommend.* All new LL can be submitted through this form. To support the socialization mode, we provide an online discussion in our LL system where the users can interact each other through online chatting, or meeting besides face-to-face discussions. In addition, we also provide uploading feature that allow user to upload other materials such as video or audio files to support tacit to tacit knowledge. It is because some LL is difficult to represent them in a writing form. For verifying and storing LL, the system enables expert to review unverified LL and allows the experts to edit or modify them. Once the LL is verified, it will be stored as verified LL and can be disseminated throughout organization. For disseminating LL, we develop email notification function in our LL system. It works when once expert verifies a certain LL, automatically the system will notify the respective user about the new LL. Besides that, our system allow user to download any LL or related materials on specific LL. Thus, this feature can also facilitate the combination mode as described in SECI model. Finally, to allow user reuse LL in his applicable context, we build a searching mechanism by applying Boolean searching method. Instead of user browsing a list of LL, they can also search for them and apply stored LL to his new context or working environment.

Figure 4 shows the main features of our proposed LL systems. At this point, we refine the Figure 3 in different way of thinking and then summarizing the most important features of our LL system by using the same model but in different way of explanation. As shown in Figure 4, it can be clearly seen that by providing an electronic form to collecting and distributing of LL is a kind of knowledge attic. It really depends on discipline of the knowledge workers and requires the bottom-up nature of organizational learning. To support this feature, we need organizational approach to encourage employees to share their LL. For this purpose, the organization can establish knowledge sharing programme, policies, incentives or some kind of appreciation to those who contribute the LL. Next, Borghoff and Pareschi (1998) discuss the knowledge publisher, in which this type of corporate memory (knowledge publisher) asserting LL is left to the individual workers (passive collection). The role of the system is to forward them to the workers for which the LL might be relevant (active distribution). Thus, in our email notification capability, we support this concept by alerting the right employee (based on employee's field profile) with new LL through email notification. This will occur when an expert has verified the new LL. Another way to increase this feature is by using others techniques like agent-based delivery, case-based delivery or ontology-based delivery. However, it all depends on the other factors such as organization culture and also the types of LL. For other main features, our LL system also provides a Boolean searching method for accessing LL from database. This feature is also can be discussed as knowledge pump as explained by Borghoff and Pareschi (1998). In order to retrieving or distributing the LL, the knowledge pump describes that employee may looking for information by using of electronic search form on the LL system. Most importantly, in the case of LL retrieval, the need for getting the right information to what type of LL that user has input is very critical task (active distribution). To enhance our searching method, the LL system should be able to accept more keywords index or capturing semantic keywords that can be used for advanced searching of LL (active collection). However, for the time being, we do not provide this feature. We only support for keyword searching technique and advance searching through Boolean searching method. To enhance this feature, we need to consider other searching method. Finally, we provide an online discussion through facility like e-forum. This feature can be used to encourage active discussion (active collection) through online chatting or meeting. However, the way that LL can be captured is left to the individual workers (passive distribution).

	Passive Collection	Active Collection
Passive Distribution	**An Electronic Form**	**Online Discussion**

(Pull)		
Active Distribution (Push)	**E-mail Notification Feature**	**Boolean Searching Method**

Figure 4 The Main Features Of Our LL System

4. Implementation

LL system has been developed by many organizations such as all US military branches, several Department of Energy organizations, and Construction Industry Institute (Weber et al, 2000). However, it can be also implemented in other organizations like business, education, research institute or commercial companies. In this paper, we demonstrate our LL system by developing it for the case study of bakery and cake shop. The shop produces and sells cake, bread and cookies and appeared since last 50 years. The experience for produce the cake, bread and cookies is not organized in a proper way. It causes the organization suffer from the loss of time and money when experienced employee leaves the company. The project is done to assist the company manages its experienced with more systematic and effective way. The project's name is called "Tong Ah Bakery House Lesson Learned System (TBHLL)".

The development tools used at this project consist of Apache web server, PHP web programming language and MySQL database. Apache is a free, open source web server that can run under several operating systems. PHP (Hypertext Preprocessor) is an open source, server-side, and HTML embedded scripting language used to create dynamic web pages (Welling & Thompson 2001). In a HTML document, PHP script (similar syntax to that of Perl or C) is enclosed within special PHP tags. Because of the PHP is executed on the server, the client cannot view the PHP code. PHP can perform any task that any CGI program can do. It also can talk across networks using IMAP, SNMP, NNTP, POP3, or HTTP. However, its strength lays in its compatibility with many types of databases. MySQL is an open source database management system for relational databases. Relational database stores information in tables and the information are accessed through SQL (Structured Query Language). Example: CREATE TABLE, INSERT, UPDATE, and DELETE.

To illustrate a static picture of the functionality of our system, we draw a use case diagram as shown in Figure 5. The main features of LL system as shown in Figure 4 and explained earlier in Section 3 are shown with relationships to the respective actors like employee, expert and administrator.

Figure 5 Use Case Diagram For LL System

All actors must login to get access as authorized users. Administrator plays the significant roles in maintaining the user's account such as add or delete accounts. Furthermore, admin is also responsible in generating the reports whereas expert is assigned to the task in maintaining the category of LL such as add or edit LL categories. In our opinion, this task should be giving to the experts because they know much more about the business process. Meanwhile, expert can also verify the lessons learned submitted by employees. Automatically, once the LL is verified, the notification for a new added LL occurs to the relevant employee profile as shown by the Notify LL use case. This use case is included in Verify LL use case as stated by a include relationship in figure 5.0. Moreover, expert and employee can make a discussion through e-forum or access the LL through search function. There are two types of searching functions, which are Boolean search and advanced search. Only the verified LL is able to be retrieved using search functions. Besides e-forum and searching feature, a Submit LL use case enables employee to submit a new LL through an electronic form (see figure 6.0). If necessary, he can also upload picture, video, audio and document file or plain text file as an attachment to supporting his LL (see Figure 7).

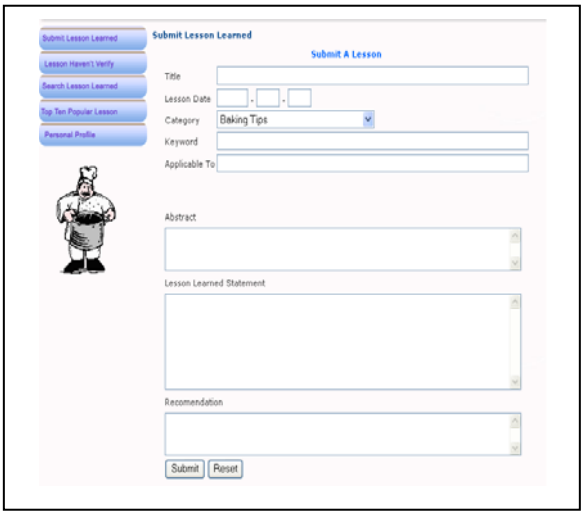

Figure 6 Interface For submitting LL

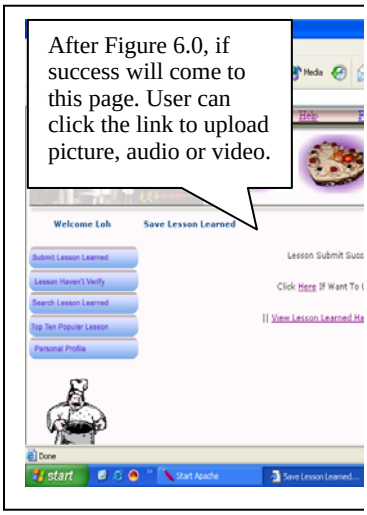

Figure 7 Interface For Upl

A Search for LL use case allows the employee and expert search the LL they want. The Boolean searching enables employee and expert search the LL by entering keyword with the combination of Boolean operator (see Figure 8).

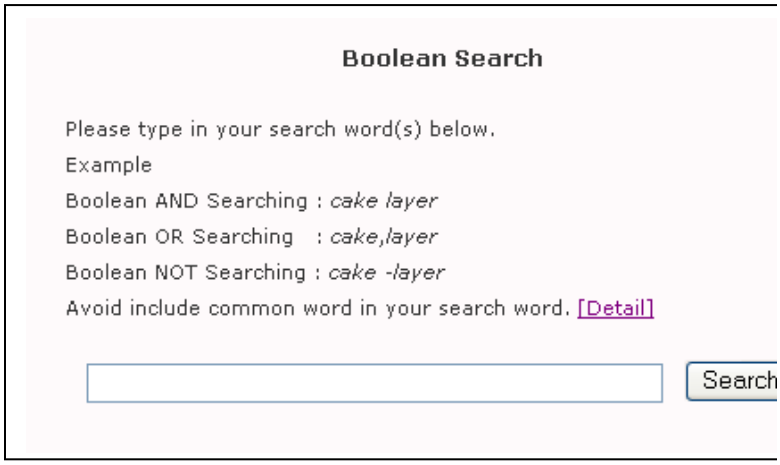

Figure 8.0: Interface For Boolean Search

In Advanced Search (see Figure 9), space between the searching word is equal to operator OR. Additional information related to the search term can also be selected. The search will accept field of category using "and" or "or" logic based on the users' selection from the pull-down menu. Users can choose which field of the documents that the search will be done. Examples are title, whole document, keyword and so on. Truncation allows users to retrieve documents containing variations on a search term. Single character or common words in search terms will be ignored.

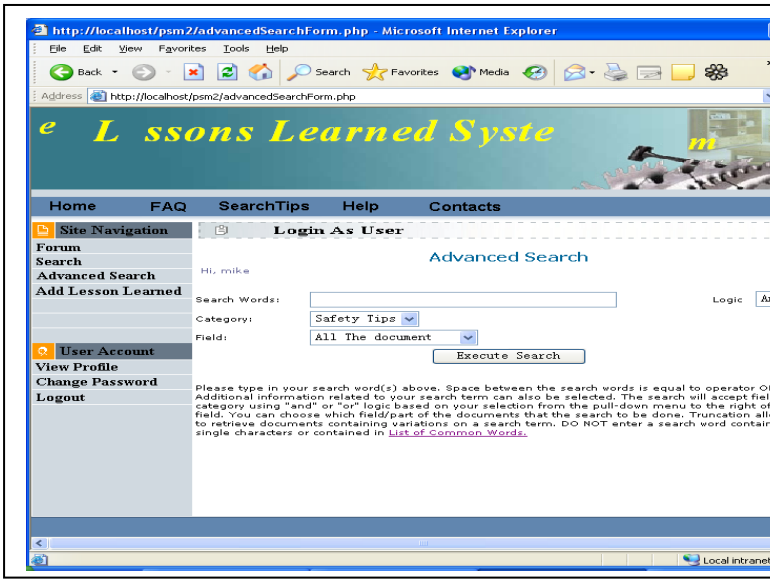

Figure 9.0: Interface For Advanced Search

5. Conclusions

Although KM practitioners frequently comment that KM is not a technology problem, it is also the case that most KM solutions include an element of technology (Weber & Kaplan 2003). Recently, the LL system is recognized as one of the KM solutions in many KM literature or research. This is increasingly motivated by KM as becoming a strategic tool in many organizations to enhance organizational performance and for gaining a competitive advantage. LL system can be used to preserve individual knowledge and transform it to an organizational knowledge. Thus, the organizations can prevent their business from corporate amnesia phenomenon and then maintain its sustainable development in knowledge-based economy growth. This paper demonstrates a prototype of LL system as defined in knowledge attic of corporate memories by Borghoff and Pareschi (1998). We develop our LL system based on our proposed KM model for a LL system explained in (Mohammad Nazir Ahmad Sharif et al. 2004). We then discuss our proposed system in a different way of thinking of several types of corporate memories model as introduced by Borghoff and Pareschi (1998).

Our future works is to enhance the features of the proposed LL system and also do more research on other issues in LL such as LL representation, textual-based LL, methodologies for developing LL system, and knowledge modeling for LL.

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