A knowledge management system on sustainable energy technologies for Thailand

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A Knowledge Management System on Sustainable Energy Technologies for Thailand

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***Abstract*— Knowledge Management System (KMS) has proven to be an appropriate approach for the distribution and sharing of valuable information both within and outside industrial and education organizations,. KMS could also assist organizations to increase and maintain their tangible and intangible assets. Similar to its applications in other disciplines, a KM system could provide easy access to learn and share information about sustainable energy technologies. This paper presents a KM system on sustainable energy technologies that is capable to bring benefits to Thai communities. The case study is developed at the School of Renewable Energy Technology, Naresuan University, Thailand. The system works as an invaluable tool for the community to gain and share knowledge on sustainable energy technologies. It is anticipated that the system will improve the effective use of such technologies and to reduce environmental impacts due to the reliance of traditional resources such as coal, oil and gas.**

Index Terms—Knowledge Management (KM), Sustainable Energy Technologies, Thai community.

I. INTRODUCTION

The concept of knowledge management (KM) has been known for many years. KM involves the capturing, defining, storing, categorizing and linking of knowledge; searching for and subscribing relevant content from appropriate sources; and presenting the content with sufficient flexibility [1]. Such knowledge is thereby made available in ways that can help or assist the user onto discovering meaningful knowledge for an organization or a community. In addition, KM system supports tacit knowledge and meta-information creation [2]. Normally, a KM system does not rely on a single KM technology but instead, it is based on a collection of indexing, classifying, and information-retrieval technologies. In addition, the system is coupled with methodologies designed to assist the users for the purpose of extracting meaningful knowledge [3]. KM system connects users with the stored knowledge; people with people, and with relevant stakehokders.

Success of KM system has been demonstrated in many organizations. From the surveyed literature, it has been reported that KM system have provided increases in the value of the organization which include assets, property, organization's data (organization's memory) and customer satisfaction among many business organizations [4][5][6][7]. For example, KM system assisted a company in Taiwan in the tape-carrier-package integrated circuit smart-card assembler and testing business to gain a sizeable profit within two years [4]. The company launched the KM system in 1998, and by the end of 2000, it has reported a gain of 700 percent profit. Another example is a dice-and-mould company [5]. The experience and lessons learned from previous projects have been used to enhance the quality of the product and improve the efficiency of production. This has led to improved levels of satisfaction from the customers. Experience is important in this dice-and-mould company as well as many other companies. On the other hand, the lack of experience is a major cause of mistakes and design failures for the products [5]. This is another area KM system can assist with. Lessons learned from previous projects are captured in various forms of documentation. The company can reuse them with other employees in each process step. An example of the use KM system is Infosys [6]. The company has demonstrated that knowledge from previous cases or projects is useful for all employees in every branch across multiple continents. For example, in the case of one employee in the US who is scheduled to give a presentation to a customer, the KM system of Infosys allows the employee to retrieve previous projects from different branches in other countries in order to find out relevant information from previous projects [6]. By the same token, deploying KM system in other sectors such as education, science, energy in a similar approach, KM system has the potential to assist the organisations to attain success.

In the case of the remote communities in Thailand, the lack of knowledge is the main obstacle that prevents the communities from using the local energy resources efficiently. This leads to community problems including poverty, environmental degradation and poor health [8] [9]. Government energy organizations and related agency groups have been employed and worked on pilot studies on sustainable energy services projects for many years. However, the inherent problems of these projects are the high turnover of experts and specialists, and, the lack of in depth knowledge on the systems among the local users [10]. The high cost of the systems, tools and equipment, and the limited budget for planning, research and development are other main obstacles [11] [12] [13]. Therefore, a KM system is an approach that can be used to provide a platform to extract and exchange meaningful knowledge for the stakeholders relating to the design and use of sustainable energy services. KM platform has the potential to be an invaluable tool to assist communities to handle the challenges relating to their energy needs. This paper presents a case study of a KM platform on sustainable energy technologies for the Thai communities. This report includes a background on the sustainable energy technologies and Information Technology (IT) tools, details of the KM system, qualitative results showing the success of this case study and the conclusion of this paper.

II. A CASE STUDY OF KM SYSTEM ON SUSTAINABLE ENERGY TECHNOLOGIES FOR THAI COMMUNITIES

Knowledge management system plays an important role for improving the monitoring, investment, and sustains the use of natural resources [14] [13] [15]. Web technologies comprising the Internet, web applications, and web GIS, support and facilitate the provision of information on sustainable energy services to the users. They also help to implement an effective KM system for promoting the utilization of sustainable energy services [16].

The KM platform has been implemented using web GIS server-side application and installed at the School of Renewable Energy Technology, Naresuan University, Phitsanulok Thailand. In order to implement the KMS on sustainable energy technologies, data and information on sustainable energy technologies have been collected. They are classified into two categories: knowledge on sustainable energy technologies and regional data of sustainable resources at Phitsanulok, Thailand. The first category of knowledge was created and captured from the stakeholders and experts among the energy sectors and the electrical power industry. The second category, local data about the Phitsanulok region, was collected from related public organizations such as the District Agriculture Extension Office from each district (also known as "Ampher" in Thai) in Phitsanulok. This data is in the form of text, figure, table and spatial data. Both categories of data are then converted to the appropriate formats and stored on the server.

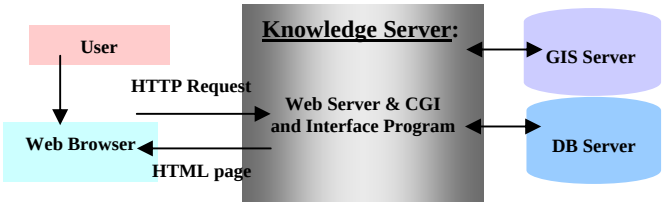

Figure 1: Structure of the KM platform

Figure 1 illustrates the structure of the proposed platform. The system consists of the DB server, the GIS server and the knowledge server. A MySQL database runs on the database server which is a Window 2003 server and IIS (Internet information Server). The web server interprets all the clients' requests for services. Minnesota Map Server is installed on the GIS server which runs on a Linux and Apache environment. Minnesota Map Server is used to provide the basic GIS framework [17] [18] [19] [20]. The "user" in the Figure is a "*browser*" or a stakeholder who retrieves the information from the system over the Internet. The knowledge server consists of the web server and interface programs. The web server will receive request from users via the browsers over the Internet. The server translates the request into internal codes and invokes the appropriate functions by passing the request to the interface program. The interface program will then process the request and formats the information from the GIS and/or the database server for use by the client browser application.

The platform will represent knowledge as perceived from a GIS prospective. That can be in the forms of database view, map view and model or process view. Figure 2 shows an example of a screen display of the system. Each link will connect to another page that will show particular features. For example, the link on operation shows a number of sustainable technologies that is used to generate the services for community.

Figure 2: An example of screen shots on the KM platform on sustainable energy technologies - the main page of the platform

Design and planning features are in the "*Member*" section as shown in Figure 3. The map of Phitsanulok is displayed as a province in Thailand where the implementation of the KMS will be based.

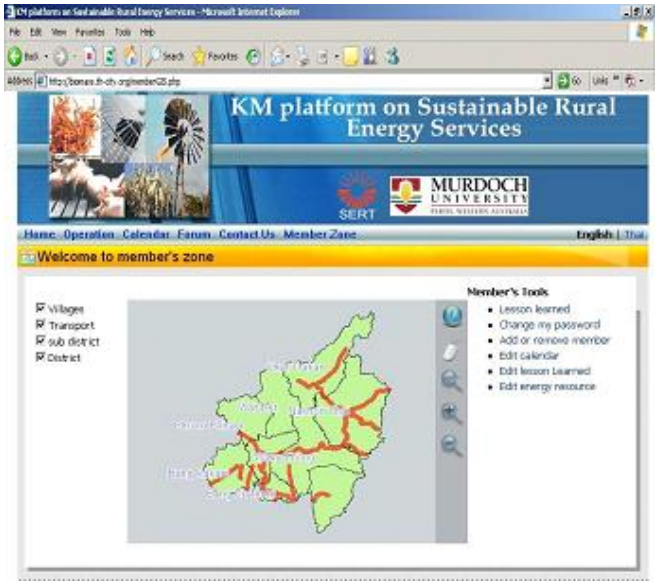

Figure 3: An example of screen shots on the KM platform on sustainable energy technologies – member page.

The KM platform will help local users to access knowledge on sustainable energy technologies in their local area. Figure 4 describes the groups of participants and permission to access to the features on the platform. There are three groups of users: *browsers*, *researchers* and *local government administrators*. The *browser* will browse and learn information on sustainable energy and how to operate the sustainable energy system with better

efficiency. *Researchers* divided into two categories: *user* and *admin. User*, this group of researchers has access priority similar to the *browsers*. In the case of researcher with *admin* status, the researchers are considered as the same as the previous group, however, additional privileges can be gained from accessing more knowledge that is related to their research work or to give advices in the forum.

In the context of Thailand, each district is divided into sub-districts which are known as "Tambons". The Tambon council members are the local government administrators (LGAs) who will provide and access local information from the system [21] [22]. LGAs are related to the development or are responsible for improving the quality of life among the local communities [23]. By using KM platform, local administrator can be empowered with knowledge and know-how to assist them to develop appropriate system for their respective locations.

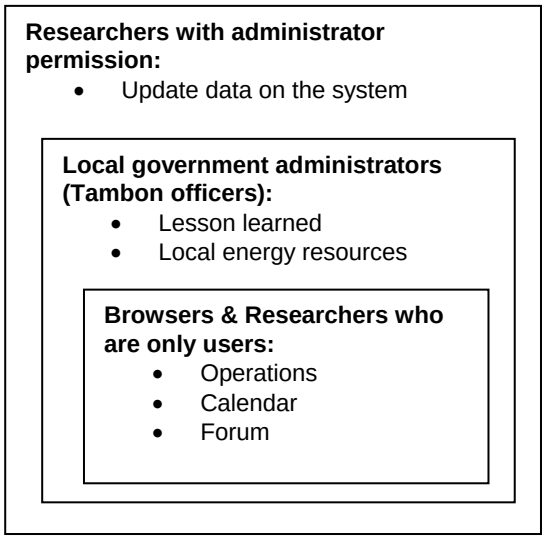

Figure 4: Permission to access to features of participants

In addition, previous reports have shown that the infrastructure of Thailand is ready for the implementation and access to the KM platform. Reviews on the statu of ICT in Thailand also shows that infrastructures for Internet connection via both land line or satellite are readily available in these communities [22] [24] [25]. Phitsanulok has the potential and infrastructure to build up the KM platform based on web technologies due to the Thai government's policy [25] and experience from many pervious projects. For example, low cost ADSL connection by the Telephone Organization of Thailand (TOT), Post Office Internet kiosks have already covered almost over all the countries - 31% of the rural areas [24], SchoolNet and Internet Tambon projects [25] launched by the government. The 2001 report showed that 90 % of rural citizens have accessed the Internet via the services provided by Communication Authority of Thailand (CAT) [26] and TOT [22]. Therefore, using KM platform on sustainable energy technologies or services in Phitsanulok is appropriate. The finding from this study can be considered as a leading example for Thai communities and other developing countries.

III. THE RESULTS

The KM platform has been launched to the public since February, 2007. Pre-questionnaire has been set up in order to survey the participants' background, participants' knowledge on sustainable energy and the Internet infrastructure of the community. Two hundred of pre-questionnaires were distributed to local communities at the same time that the platform was launched. A month later, post-questionnaire were distributed to the same cohort. There are dual purposes for the post-questionnaire: surveying the satisfaction of the participants to the platform and assessing the participants' knowledge on sustainable energy.

Up to date, we received 100% return of the pre-questionnaire and 75% of the post-questionnaires. The findings reveal that 46% of researchers are experienced on KM, 19.55% of users and 14.29% of LGAs. The popular place that they access to KM is government sites. 60% of the the places they visited were: work place, education institute and other places. Hence, the Internet infrastructure of community is appropriate.

Likert scale of 1 to 5 was used to measure the satisfaction of participants to the platform by setting up the following questions:

Q1. The graphical user interface of KM platform is user friendly.
Q2. The information on the KM platform is up to date.
Q3. The KM platform provides communication between you and others or experts i.e. e-mail, forum and etc.
Q4. The KM platform provides meaningful information.
Q5. The KM platform provides adequate information on Sustainable Energy Services for designing and building sustainable energy services.

All feedback received have an average score of more than three out of five scales. This shows that the participants are in general satisfy with the platform. In particular, Q4 has gained the highest score.

Paired-Sample T Test was used to measure the knowledge of people in community. Part of the survey named "test", was set up in both pre and post questionnaires. This "test" portion consists of multiple-choice questions concerning knowledge on sustainable energy. The questions have been validated by the researchers of school of renewable energy technology, Naresuan University.

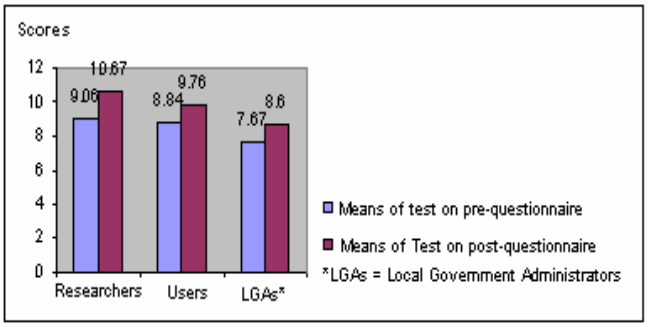

Figure 5: Paired-Sample T-Test of pre and post score

Figure 5 shows the comparison of means value of the test. Paired-Sample T Test is used to analyse the score from the tests. The mean values illustrate that the score of post test is higher than the pre-test in every group.

IV. CONCLUSION

This paper reports a case study of KM platform on sustainable energy technologies. The literature shows that the lack of knowledge of local people is an obstacle to develop or use energy resources with efficiency. In order to enhance or improve knowledge of local people, KM platform is implemented by using Web GIS server-side application. The findings support that the KM platform is a valuable tool to distribute of meaningful of knowledge to community.

V. REFERENCES

[1] Zack H. M. (1999), "Managing Codified Knowledge", *Sloan Management Review*, Vol. 40 No. 4, Summer 1999.

[2] Tiwana A. & Ramesh B. (2001), "Integrating knowledge on the web", *IEEE Internet Computing*, May-June 2001. pp. 32-39.

[3] Lawton G. (2001), "Knowledge Management: Ready for Prime Time?", *Industry Trends*, February 2001 pp.12-14.

[4] Wei, C., Hu, P. J. & Chen, H. (2002), "Design and Evaluation of a Knowledge Management System", *IEEE Software*, May/June 2002.

[5] Bayer, F., Enparantza, R. et al (2005), "Chapter XII: Know-CoM: Decentralized Knowledge Management Systems for Cooperating Die- and Mold-Making SMEs", *Case studies in Knowledge management*, IDEA GROUP Publishing 2005, pp. 186-210.

[6] Mehta, N. & Mehta, A. (2005), "Chapter XVII: Infosys Technologies, Limited", *Case studies in Knowledge management*, IDEA GROUP Publishing 2005, pp. 289-314

[7] Murray, E. J. (2002), "Internet Support for Knowledge Management Organizational Memory Systems", *Information Resources Management Association International Conference*, Seattle, Washington, USA. May 19-22, 2002 IDEA GROUP PUBLISHING, pp.288-291.

[8] Schlapfer A. (2002), "Renewable Energy Technology Innovation in non-western communities", *Ph.D. Thesis*, Murdoch University. Australia.

[9] Organization for Economic Co-operation and Development (OECD) (1997), "Key issues in developing renewables", *International Energy Agency*, ISBN 92-64-16009-4 FF 100 / 1997.

[10] Ketjoy, N., Sirisumpunwong, C. et al (2004), "First year investigation of PV Mini-Grid System in Chaiangrai Province of Thailand", *19th European Photovoltaic Solar Energy Conference*; Paris France.

[11] The School of Renewable Energy Technology (SERT) – Naresuan University in Phitsanulok (2004), [Online], Available at www.sert.nu.ac.th [2004, March 16].

[12] Albolino, S. & Mesenzani, M. (2002), "Multimedia Interaction for Learning and Knowing: inspirational knowledge management to create value for individuals in organizations", *Proceeding of the 13th International Workshop on Database and Expert System Application* (DEXA'02).

[13] Rumakumar, R. (1996), "Energizing Rural Areas of Developing Countries using IRES", *Energy Conversion Engineering Conference*, Washington D.C. USA 11-16 August, 1996.

[14] Ketjoy, N., Schmid, J. & Rojanaporn (2003), "RES 2.0 a Software Simulation of PV –Diesel Hybrid System for Rural Electrification", *2nd Europe PV Hybrid and Mini-Grid Conference*, Kassel, Germany, 25-26 September 2003

[15] Zahedi, A. (1998), "Computer-based Multimedia System on Education of Renewable Energy Technology", *International Conference on System, Man and Cybernetics*, San Diego, CA, USA, 11-14 October, 1998.

[16] Handzic, M. & Sarajevo, A. L. 2005, "Knowledge Sharing Via Technology", 6th ECKM , Limerick Ireland. pp. 49 -58.

[17] Map Server. (2005), [Online], http://mapserver.gis.umn.edu

[18] ESRI (2005), "The Guide to Geographic Information System", [Online], Available at: www.gis.com.

[19] Tang, S.M. & Selwood, J.R. (2003), "GIS Web Services: A route to societal GIS" *Map Asia Conference*.

[20] Nengcomma, C. (2007), "Basic Internet GIS by PK", [Online], Available at: www.gis2me.com [2007, April 19]

[21] Department of Local Administration of Thailand (2007), "An act of legislation to govern of the local administrator"[Online], Available at: www.thailocaladmin.go.th:15030/prb/main.jsp [2007, September 15]

[22] Cusripituck, S. 2005, "Challenges in Making IT Work for Thai People", *Post and Telegraph Department, Ministry of Information and Communication Technology*, [Online], Available at: www.ptd.go.th [2005, April 7].

[23] Department of Local Administration, Phitsanulok (2007), "Mission & structure of the organization", [Online], Available at: www.pitloklocal.org/pitloklocal_01.htm [2007, September 15].

[24] Rattakul, R. (2002), "Bridging the Digital Divide: A Case Study of CATNET Nationwide Internet Kiosks", *Business Analyst, Communications Authority of Thailand 2002*, pp. 325-329.

[25] Bhongsatiern, J. (2004), "Thailand's regulatory and policy development", *APEC Telecommunication and Information Working Group 29th meeting*, Hong Kong China.

[26] Internet Booth CATNET, [Online], Available at: www.cat.net.th/webbooth/internetbooth.html [2007, May 1].