A Framework For The Selection Of Knowledge Mapping Techniques

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ABSTRACT:

Knowledge mapping is one of the important processes in knowledge management. Before applying any knowledge mapping technique, organizations must be sure of its success and effectiveness. There are different techniques for knowledge mapping. Obviously, no technique can claim that it has an integrated approach in mapping knowledge and also it can take into account all aspects. Therefore organizations should select a mapping technique which has efficiency in them. In this paper, a framework for the selection of the most appropriate knowledge mapping technique is proposed. With use of this framework, practitioners are able to compare different techniques in order to facilitate the selection process for their organizations. The value of this framework is that, with use of it, organisations can evaluate their knowledge mapping technique with respect to the key features of it before implementing any technique as well as expending extra costs.

Keywords: *Knowledge mapping, Comparison framework, Techniques*

1. Introduction

For many years, several researchers have expressed the importance of knowledge mapping, applications, and its techniques (Wexler, 2001; Eppler, 2001; Huijsen et al., 2004b). Only few papers have discussed about how organizations and companies can select a suitable technique for mapping their knowledge (Cross et al., 2001; Huijsen et al., 2004a; Vail, 1999; Wexler, 2001). The purpose of this paper is to present a framework for knowledge mapping techniques comparison for knowledge management practitioners. This work also depicts that how organization can use such a framework. The purpose of knowledge mapping comparison can be summarized in two objects:

♦ Academic purpose: for better understanding of the nature of techniques in order to do the classifications and improve knowledge mapping process;

♦ Practical purpose: to select a technique or part of one or more techniques for specific application in an organization.

These two reasons are not separated from each other. It hops that academic studies help in practical selections and practical reasons have influence on used criterion in academic studies (Avison, 2006).

One of the definitions of knowledge map is presented here (Anon, 2003):

> "*A knowledge map is the intellectual infrastructure for knowledge management initiatives. The basis for it consists of multiple taxonomies for content repositories, dynamic categorization of people, their expertise, and the communities they belong to, and finally a set of taxonomies for the variety of tasks that are performed within and by the company's communities. The taxonomies of content, people, and tasks then have to be mapped across the three components in order to provide a foundation for such knowledge management enterprise projects as knowledge retrieval for both document based knowledge and the tacit knowledge located within the minds of the company experts.*"

Knowledge mapping is defined as the process, methods and tools for analyzing knowledge areas in order to discover features or meaning and to visualize them in a comprehensive, transparent form such that the business-relevant features are clearly highlighted (Speel & al, 1999). It can be defined as a process of surveying, assessing and linking the information, knowledge, competencies and proficiencies held by individuals and groups within an organization (Hylton, KeKma-Training, 2002).

Nevertheless, there is no research which has been done on how to help knowledge managers for taking a proper kind of knowledge mapping technique. This article describes a novel framework which can be applied in knowledge management projects. It forms one the main steps in knowledge mapping and helps knowledge managers to select their suitable technique in regard to technique's features.

The rest of the paper is set out as follows. In the next section, some knowledge mapping techniques have been explained. Following that, the results of a survey is depicted in order to identify the most important criteria. Then, comparison framework is built and techniques are compared with the presented framework.

2. Knowledge Mapping Techniques

There are different techniques to map existing organizational knowledge. Each of these techniques uses a set of tools, approaches, objectives, and specific characteristics. In this section, these techniques are introduced concisely.

2.1. Yellow Paging

The yellow pages facility is a structural collection of data and documents about people in an organization. It is an effective way to know who knows what in an organization. The purpose of yellow pages is to facilitate communication and knowledge sharing between individuals and groups of people in organizations. Many organizations have their own yellow paging applications, which enable employees to find and communication with each other and with particular expertise and skills (Mikolajuk, 2005). This method has some weaknesses, 1) problems in quality reviewing or existing knowledge of people; 2) maintenance, like up-to-dating information in system. The underling reasons are as follows (Iske, 2005):

♦ The systems are not integrated in the business processes;

♦ There is no connection between the context of entering information and the context of using information;

♦ The information providers need to be pro-active in keeping the system up-to-date.

2.2. Information Flow Analysis

Information flow analysis determines who is accessing what information resources and how often by researching in organization's functional process and informal networks. This process can be put into practice by use of complex computer programs (Lutters, 2002).

Some techniques can provide the same information. Examples of them may be using sign-out sheets to capture real world usage information and taking advantage of questionnaires and interviews which include these questions about a specific topic (Maccall, 2006):

♦ Where do you refer when you need information on it?

♦ What resources do you use on it most of the time?

♦ Who or where do you submit information on it to?

2.3. Social Network Analysis

Social Network Analysis (SNA) can be defined as a map and a measuring of relationships and flows between people, groups, organizations, computers, or other information or knowledge processing entities (Pollock, 2002). The nodes in the network are the people and groups and the links show relationships or flows between the nodes. SNA provides both a visual and a mathematical analysis of complex human systems. It is one of the methods used to understand networks and their participants are to evaluate the location of actors in the network.

SNA try to understand how tacit knowledge was broadcasted and how it can be improved. SNA also enable managers to understand and exhibit thousand relations which facilitate or prevent creation or transfer knowledge.

After doing SNA we can answer to these questions (Cross, 2002): How does information flow in an organization? To whom do people turn for advice? Have subgroups emerged that are sharing what they know as effectively as they should?

2.4. Process Knowledge Mapping

Process knowledge mapping is a method of analysis to define the knowledge needed and the knowledge available to support a business process. It also analyzes a business process to identify decision milestones (where knowledge is needed), knowledge requirements (what knowledge is needed), routes for access and retrieval of knowledge through people and technology and gaps between required skills and current skills (USAID, 2003). In this technique, we can identify individual organizational processes and their steps, the position of the person performing the step, main skills and training which the person should have it in specific position, experiences and expertise for position, needed resources and procedures or actions that should be carried out by applying it. In the other word, we use job analysis in this technique to mapping knowledge.

2.5. Functional Knowledge Mapping

Functional knowledge mapping is a step by step process which supports details. It is very similar to process knowledge mapping but functional knowledge mapping stresses on the person in the position. By using of this technique we can list individual's knowledge and social contacts which are related to the specific position. It also aids us to determine individuals having skills, experiences, academic educations and other resources which can be applicable in other areas or who may be useful or possessing knowledge about that position. Therefore functional knowledge mapping creates an organizational directory of skills, knowledge, individual's relationships and resources. When using this technique, we should prepare interviews or survey to gather the needed data.

One of the advantages of mapping knowledge using two last techniques is that one can find gaps between what she needs and what is in reality for individuals holding specific positions. These gaps can be seen in education, training, experience, and resources (Maccall, 2006).

3. Comparison Methodology

As discussed before, there are different techniques with their own special characteristics. These characteristics are greatly different in practical aspects. Using each of these techniques might result in different knowledge maps with different characteristics. Therefore we should select a technique to map organization's existing knowledge which supports our expectations and adapts for the organization's characteristics.

3.1. Suggested Criteria

Knowledge mapping techniques can be compared in many different ways. In this section, some comparison criteria are suggested. Theses criteria are:

♦ *Used tools for data gathering*: A key element of this framework can be the identification of tools used in a methodology for data gathering (Vestal, 2005).

♦ *Used tools for knowledge map evaluation*: These tools help analyzer to assess the knowledge map validation (Vestal, 2005).

♦ *Objectives*: Several objectives can be achieved when undertaking a knowledge mapping exercise. Practitioners are often faced with the dilemma of having to work with a knowledge mapping approach that is not intended nor adapted to the objectives they are pursuing. Therefore, the suitable technique with adopted objective should be taken (Lecocq, 2006).

♦ *Characteristics, capabilities*: The word "capabilities" is used to refer to the different functions and solutions that a knowledge mapping tool can offer. General and visual aspects of the represented knowledge assets which are the characteristic of any knowledge map are discussed as specific features for the representation of a network (Lecocq, 2006).

♦ *Users*: they include the members of the organization who need to access and use knowledge in their daily work. They are the ones who take advantage and benefit the most from the knowledge that is made accessible through the knowledge map (Lecocq, 2006).

♦ *Knowledge map elements*: Knowledge map does not contain the knowledge itself. We should determine in which techniques what the possible components of a knowledge map are, as well as the type of knowledge they represent and the assets they are linked to (Lecocq, 2006).

♦ *Knowledge mapping approaches*: There are three approaches to mapping knowledge (Jennings, 2005). These are process-based which is determined where we do work which predominantly repeats a predefined process, relationship-based which is determined where the work we do is primarily about managing a set of relationships, and project-based which is determined where the work we do is to complete a particular (usually substantial) project which, although process may play a role, is substantially different to others and unlikely to be repeated.

♦ *Top-down or bottom-up approach*: To mapping knowledge, we can apply two different approaches which are acquired two type map. Top-down map championing processes usually have those at the top of the hierarchy championing a map. In the other hand, Bottom-up knowledge map processes are seen by the dominant coalition of the organization as the most political (Wexler, 2001).

♦ *Create static or dynamic knowledge map*: Jeong-Han Woo (2004) applied dynamic knowledge map concepts to experts' knowledge reusing. Knowledge map has two dynamic and static sides (Gómez, 2000). The dynamic side focuses on the process of the knowledge and the static side focuses on the elementary attributes which are unchangeable such as contextual information (Liang, 2007).

♦ *Strategic or tactical view*: We can build a knowledge map with a well-known dimension used to analyze organizations: strategic orientation which includes tactical and strategic views (Hornett, 2006).

♦ *Support individual, group or organizational knowledge*: There are many researches which are applied individuals (persons relevant to the organization), group (any groups of persons!) and organizational knowledge in them (Driessen, 2007; Hornett, 2006; Belsis, 2005; Walton, 2006; Putz, 2004).

♦ *Support tacit or explicit knowledge*: Nonaka and Takeuchi identify tacit and explicit knowledge. Tacit knowledge is defined as action-based, entrained in practice, and therefore cannot be easily explained or described, but is considered to be the fundamental type of knowledge on which organizational knowledge is built (Nonaka & Takeuchi, 1995; Choo, 1998) and Explicit knowledge is defined as knowledge that can be codified, easily communicated and shared (Martensson, 2000).

3.2.   Criteria Selection

In order to build and verify a comparison framework, experts' opinions are used. For this purpose, a designed questionnaire which is presented in Figure 1 was distributed between more that 50 experts. These experts are selected by browsing the related literature about knowledge mapping and associated fields of study. Obviously, they are from different countries and cultures which are depicted in Figure 2. Furthermore, the experts' educations' distribution is also depicted in Figure 3.

These are some existing criteria for comparing knowledge mapping techniques. Please, determine the importance of each one in your judgment.

1- Used tools for data gathering

Not importance☐   low importance☐   average☐   important☐   very important☐

2- Used tools for knowledge map evaluation

Not importance☐   low importance☐   average☐   important☐   very important☐

3- Knowledge mapping Objectives

Not importance☐   low importance☐   average☐   important☐   very important☐

4- Characteristics, capabilities

Not importance☐   low importance☐   average☐   important☐   very important☐

5- Users

Not importance☐   low importance☐   average☐   important☐   very important☐

6- Knowledge map elements

Not importance☐   low importance☐   average☐   important☐   very important☐

7- Knowledge mapping approaches (process-based, relationship-based and project-based)

Not importance☐   low importance☐   average☐   important☐   very important☐

8- Top-down or bottom-up approach

Not importance☐   low importance☐   average☐   important☐   very important☐

9- Create static or dynamic knowledge map

Not importance☐   low importance☐   average☐   important☐   very important☐

10- Strategic or tactical view

Not importance☐   low importance☐   average☐   important☐   very important☐

11- Support individual, group or organizational knowledge

Not importance☐   low importance☐   average☐   important☐   very important☐

12- Support tacit or explicit knowledge

Not importance☐   low importance☐   average☐   important☐   very important☐
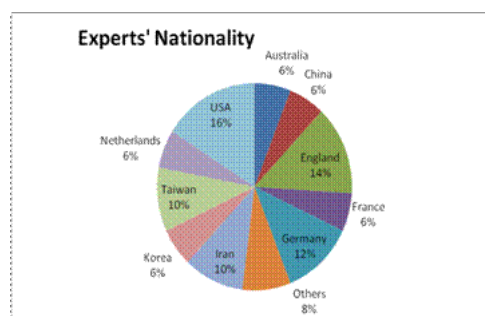
Figure 1: Questionnaire

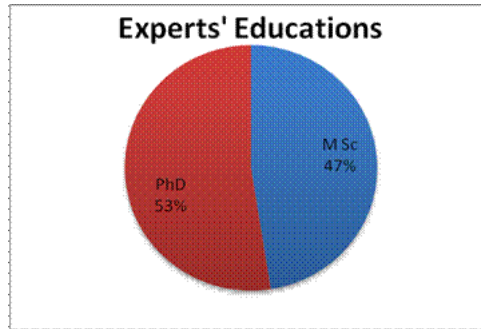**Figure 2: The Distribution Of Experts' Nationality**

Figure 3: The Distribution Of Experts' Education

By use of a ranking technique, we graded questionnaire's choices. In these questionnaires "1" is represented as "Not Important" and 5 as "Very Important". In Table 1, a part of results are shown. Amounts of a_{ij} present the value of the i feature which is dedicated by j^{th} expert.

In order to select the features of comparison framework, these steps are followed:

Average of each of matrix rows (m_i). the values of m_i are:

(m_1=4.375, m_2=4.375, m_3=4.5, m_4=3.25, m_5=3.5, m_6=3.875, m_7=4.125, m_8=3.5, m_9=4, m_{10}=3.5, m_{11}=3.75, m_{12}=4)

Average of m_i to calculate the mean of all values ($M = \dfrac{\sum_{i-1}^{12} m_i}{12} \Rightarrow M = 3.896$).

Determine features that are greater than or equal to M. as shown, m_1, m_2, m_3, m_7, m_9 and m_{12} follow of this proviso ($m_i \geq M$). Therefore, the following features are selected:

♦ used tools for data gathering

♦ used tools for knowledge map evaluation

♦ objectives

♦ knowledge mapping approach

♦ create static or dynamic knowledge map

♦ support tacit or explicit

After indicating the most important criteria, a new comparison framework with determined features are constituted. These features are upheld in average by experts.

Table1: Questionnaires' Results

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Used tools for data gathering	5	3	4	3	5	5	5	5	4	3	5	5	4	3	4	5	4	3	5	3	4	5	4	4	5	3	4
Used tools for knowledge map evaluation	4	4	5	5	4	4	4	5	3	5	4	3	5	4	4	5	5	5	4	3	5	4	5	4	5	4	5
Objectives	4	5	4	5	4	4	5	5	4	5	3	4	5	5	3	4	3	4	3	4	5	5	5	5	3	5	4
Characteristics, capabilities	3	4	4	4	3	3	3	2	4	3	3	5	3	4	3	3	2	4	4	4	3	4	5	5	3	2	3
Users	5	3	3	3	3	5	5	1	2	4	4	1	4	4	1	5	3	5	1	5	5	1	2	5	1	3	5
Knowledge map elements	4	5	4	4	4	3	3	4	2	2	5	2	4	2	5	5	2	2	3	2	5	3	5	3	4	5	4
Knowledge mapping approaches	4	5	5	4	4	5	5	1	3	2	3	2	4	3	1	1	2	2	3	2	1	5	5	3	5	5	5
Top-down or bottom-up approach	5	4	4	2	2	4	3	4	4	2	2	4	4	3	4	5	2	5	2	4	2	2	5	2	2	5	4
Create static or dynamic map	5	4	5	5	4	4	2	3	2	3	5	5	2	3	2	2	5	3	4	2	5	4	5	4	5	5	3
Strategic or tactical view	5	2	3	5	2	5	4	2	2	3	2	5	5	2	2	2	3	2	5	4	4	3	3	2	2	5	4
Support individual, group or organizational knowledge	4	4	3	5	2	4	5	3	5	5	2	5	5	4	2	5	3	2	5	3	5	5	3	4	3	3	4
Support tacit or explicit knowledge	4	5	4	5	4	5	2	3	2	3	3	4	4	2	4	2	3	4	5	2	2	3	3	4	5	4	5

4. A Framework For Comparison

The comparison of knowledge mapping techniques is a very difficult process and various viewpoints about that. It is not necessary that analyzers' viewpoints adopt with users' viewpoints. Hence, it is so important to codify another set of viewpoints which satisfies all people

and experts.

As discussed in section 3, there would be six main elements in this framework. This framework is not expected to be completely comprehensive. In future, it may encounter with a number of added features. However, our belief is that we present a set of features which proof that it is an evidence guideline as a basis to techniques comparison during examining a techniques or using of some combination of them. These features are not exclusive and may be there is some intercommunication between them.

In Table 2, you can see the techniques' comparison. The table's elements are extracted from numerous researches (Lutters, 2002; Shields, 2004; Jennings, 2005; Liang, 2007; Barroso; NAVSEA, 2001; Walton, 2007; Iske, 2005; Liebowitz, 2005; MAQ, 2004; USAID, 2003; Mccall, 2006; Wiig, 1996; Hellström, 2003; Lin, 2001) and upheld its validation by experts.

Table 2: knowledge mapping techniques comparison

	Yellow Page	Information Flow Analysis	Social Network Analysis	Process Knowledge Mapping	Func Knowledg
used tools for data gathering	Question and answer systems, Skills dictionary and reports	interviews, skill inventories, and extensive surveys information flow diagram (IFD)	Questionnaire Sociogram graph theory	brainstorming, or conduct interviews with the process owners	Survey an
used tools for knowledge map evaluation	Skills dictionary	Questionnaire, interviews and sign-out sheets	InFlow, Krackplot, and NetMiner	-	observ interview rep
Objectives	create transparency as to the location of knowledge in the organization by registering individual competencies in a database or similar	Determining who is accessing what information resources and how often	discover interaction patterns between members	define the knowledge needed, Decision milestones, the knowledge available to support a business process, Routes for access and retrieval of knowledge and Gaps between required skills and current skills	locate kr sensitiv Identif characteri process rel knowlec
knowledge mapping approach	Project-based	Relationship-based	Relationship-based	Process-based	Proces
create static or dynamic map	Static	Static	Dynamic	Dynamic	Dyn
support tacit or explicit	Explicit	Tacit	Tacit	Explicit, Tacit	Explic

5. Discussion

A structured approach to select a proper knowledge mapping technique has been proposed in this paper. This framework encourages the adoption of these techniques if they have a strong positive relationship with organization objectives and have no major adverse effects.

The framework identifies the key technique which improves knowledge mapping process. This is based on experts' ideas that were determined the most suitable features for comparison framework. Thus, the framework indicates which knowledge mapping techniques will have the greatest effect on the desired knowledge map in order to use in knowledge management projects.

Evidence, from experts, indicated that a failure to mapping knowledge in the appropriate sequence can lead to disappointment and the effective knowledge map is dependent on the quality of the selection of knowledge mapping technique. The implication of this finding is that the necessary technique must be employed for making effective knowledge map. Failure to do so will lead to disappointing results. The increasing search for knowledge mapping techniques reinforces the need to emphasis that the reported success from the use of knowledge mapping technique cannot be emulated unless the condition which make a technique successful are also emulated. There is a need to assess the infrastructure of techniques which is required in order to recreate a similar scenario.

In order to review the success of a selected technique in achieving effective knowledge map, measurement should take place to show a clear link between the approach that has been taken and the results that have been gained. Unless efficiency is measured after a technique which is selected by using this framework has been employed, it cannot be determined whether this framework has had a positive or negative effect on knowledge map efficiency. Without measurement, any improvements are anecdotal. By demonstrating that the new way of selecting are having a positive effect, it will be easier to increase the pace of efficiency improvement are clearly being demonstrated. The greatest strength of the framework is in the provision of information to encourage knowledge managers to focus on the objectives to be achieved, link knowledge mapping techniques to objectives, organization capability for employing some tools which are not used before and the type of organization that knowledge management project is implemented in (hierarchy, project based or process based).

6. Conclusion

A key part of knowledge management is performing knowledge map to determine knowledge flows within an organization and to provide insights for improving business and organizational processes.

In this paper, through field studying and by using experts' opinions, six main features were extracted which can help to select an appropriate knowledge mapping technique.

A framework were created by those six factors which are used tools for data gathering, used tools for knowledge map evaluation, Objectives, knowledge mapping approach, create static or dynamic map   and support tacit or explicit knowledge.

Above comparison is represented with attention to key features of each mapping knowledge techniques. These features play an important role in successful knowledge mapping. The represented framework can help knowledge managers to select their suitable techniques with attention to technique's features and apply it in organization and be sure of mapping knowledge successfully. They can also adopt knowledge mapping techniques to support and conceptualize knowledge sharing in their organizations and to help individuals find experts who are looking for.

Limitations of the study include: The findings are based on few researches in this article and further research with similar partnerships needs to be undertaken to establish points of comparison. There is no case study which explain how to select a knowledge mapping technique or even how mapping knowledge.

More case studies and a fundamental study of the types of knowledge and organizations that could benefit from this approach would help people to make better decisions when **considering the implementation of this selection framework.**

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