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Infrastructure for Collaborative Enterprises**

WETICE 2005



Proceedings



WET ICE 2005

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Evaluating Collaborative Applications from a Knowledge Management Approach

Aurora Vizcaíno, Mario Piattini, Manuel Martínez, Gabriela Aranda,
University of Castilla-La Mancha, Escuela Superior de Informática, España
{Aurora.Vizcaíno |Mario.Piattini}@uclm.es, mmartinez@uv.mx, garanda@uncoma.edu.ar

Abstract

Different focuses exist to evaluate collaborative systems. Since knowledge is becoming the most important asset of enterprises, we propose evaluating collaborative tools by using a knowledge management approach. To do so, we analyse six aspects of the knowledge management process, which are: knowledge creation, knowledge accumulation, knowledge sharing, knowledge utilization, knowledge internalization and knowledge integration and then propose a model to evaluate each one.

Keywords: Collaborative tools Evaluation, knowledge management.

1. Introduction

Collaborative tools have frequently been evaluated in terms of their usability. The usability of a system can be defined as the capability of a product to be used easily [3]. It is also one of the six main software quality characteristics presented in ISO standard 9126 [1]. However, other characteristics exist that for an enterprise are more important than or at least as important as the usability of a system. One of these characteristics is *Knowledge* which is becoming the primary asset in the post-industrial era [26]. Nowadays, knowledge is a key factor for an organization's competitive advantage, and because of this the production environment and infrastructure are playing a diminishing role and intellectual capital and knowledge management a growing one [11].

In this paper we propose a method for evaluating collaborative systems from the point of view of knowledge, taking into account whether the tool helps users to detect knowledge flows, to disseminate them, to store previous experience and to reuse it. The content of this paper is organized as follows: In section 2, the importance of managing flows of knowledge is described. In section 3 works related to evaluation and knowledge measurement are outlined.

Section 4, then presents the method that we propose to evaluate groupware tools from a knowledge management point of view. Finally, conclusions and future work are presented in section 5.

2. Knowledge and Flows of Knowledge

Everyday enterprises generate and use knowledge but this knowledge is seldom managed and stored by companies, even though studies have demonstrated that those companies which use mechanism to control and manage their knowledge are more competitive, under the same market conditions, than those companies that do not use a knowledge-based focus [12], [6]. However, managing knowledge is not an easy task since it can be explicit or tacit. Explicit knowledge can be expressed in words or numbers and shared in the form of data, scientific formulate, audio, video, etc. Thus, explicit knowledge is easy to share and formalise [27]. On the other hand, tacit knowledge is that which is in people's brains and is more personal and difficult to formalize, being harder to communicate and share with others [22]. Moreover, employees are frequently unaware of the tacit knowledge that they possess since they have obtained it from their daily experience without realising it. Therefore, it is often a problem to try to obtain this knowledge from them. Another problem related to knowledge is its transfer. Knowledge should flow to create new knowledge or to be improved. Thus, Nonaka and Konno [21] define a flow of knowledge composed of four steps, shown in Figure 1:

- *Socialization*, when tacit knowledge is created from tacit knowledge. For instance, by communication between employees. One important point to note here is that an individual can acquire tacit knowledge without language. Apprentices work with their mentors and learn craftsmanship not through language but by observation, imitation and practice [21].
- *Externalization*, which requires the expression of tacit knowledge and its translation into comprehensible forms that

can be understood by others, for instance, by formalising it in reports, documents, etc.

- *Combination*, when explicit knowledge creates more complex explicit knowledge by combining information that resides in formal sources like documents.
- *Internalisation*, when explicit knowledge generates tacit knowledge, for instance when a person consults formal sources like a book and increases his/her tacit knowledge. Frequently, enterprises lack of methods to foster this flow of knowledge and this fact leads to a repetition of mistakes and the "reinvention of the wheel" [8].

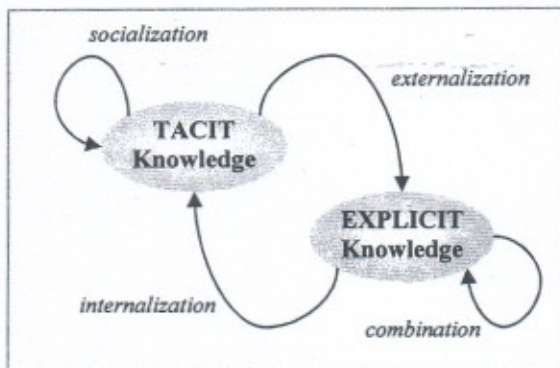


Figure 1: Steps of Knowledge Flow

In [11] the authors detected different situations that may be present in an enterprise when the knowledge does not flow correctly. These are:

- *Hubs*, which is a specific individual or organizational unit with a large number of connecting knowledge flows. A hub might be useful in the organisation if it can cope with the knowledge flowing to and from it, and can effectively use this information. However, too many flows ending up in one place might create congestion and develop into a bottle neck.
- *Black holes*, according to the authors black holes are places where no flows originate. For instance, a tool where information and knowledge is introduced but which is never consulted.
- *Springs* are areas where lots of flows originate, but none enter. This fact could mean that lots of ideas are created and exported to the rest of the organisations but no feedback from others' experience is received.
- *Missing links*, this term describes situations where a link would be beneficial, but for some

reason is not there or is not functioning satisfactory.

Detecting all or some of these situations would help to improve the performance of an enterprise. The evaluation of knowledge management has become increasingly important since it promotes strategic organizational learning [31] and generates the capabilities required to meet customer expectations [6]. As collaborative tools are nowadays used to transfer and share knowledge we think that evaluating the collaborative tools that an enterprise use would help to evaluate, in an indirect way, the knowledge management that an enterprise has.

3. Related work

Pinelle and Gutwin in [25] studied forty-five papers from the ACM CSCW conference (1990-1998) and found that almost one-third of the groupware systems were not evaluated in any formal way and that only about one-quarter of the papers included evaluations in a real-world setting. One of the main conclusions found from this study was that more attention must be paid to evaluating groupware systems and that there is room for additional evaluation techniques that are simple and low in cost.

Currently, there are many techniques and approaches to evaluate Collaborative Systems. For instance Cugini et al, in [7] propose a frame divided into four levels: requirements, capability, service and technology. Baeza-Yates and Pino [4] focus on evaluating the quality of the output, the number of people and time spent on the overall task and the total work done. Sonnenwald et al [30] propose an evaluation of collaborative systems based on an innovation diffusion theory. And so we could continue describing different approaches that are summarised in [25] as:

- Organizational impact/impact on work practices [19] [24]
- End product produced through using the software [16]
- Efficiency of task performance using software [14]
- User satisfaction with the software [10]
- Task support provided by the software [18]
- Specific features of the groupware interface [33]
- Patterns of system use [32]
- User interaction while using the software [29]

Some of these proposals contain some factors related to knowledge management but none of them is specifically focused on evaluating it. For this reason, we think it is convenient to propose an evaluation

according to this issue, which is increasingly more relevant for companies.

From the point of view of how to measure the degree of knowledge management that an enterprise has, in [6] the authors define a knowledge management performance index (KMPI) to assess the performance of an enterprise in its knowledge management. KMPI has five components that can be used to determine the knowledge circulation process. According to [6] this circulation process is formed of: knowledge creation, knowledge accumulation, knowledge sharing, knowledge utilization, and knowledge internalization. We shall base our proposal on this knowledge circulation process to evaluate how collaborative tools help in each stage of this process.

4. Evaluation of the Knowledge Management Features of Collaborative Tools

Knowledge creation: This is the first phase of the process. It occurs when new information is obtained and understood. The list of the questions that our model proposes to evaluate at this stage is:

- Does the tool help to find information? Does the system help to understand it? For instance does the system show examples or clarify concepts?
- Does the system propose solutions to problems?
- Has the tool any mechanism to explain the solutions that it shows?

Knowledge accumulation: This is a critical issue in knowledge management. New collaborative systems try to learn from daily client use and automatically store information that could be needed in the future. In order to evaluate this aspect we propose to answer these questions:

- Does the tool have a database where the information can be stored? Does the database have quality enough?
- Does the tool have intelligent mechanisms to capture information? For instance, some knowledge management tools such as those described in [28] have intelligent agents in charge of detecting useful information and storing this in the system.
- Does the tool help to document daily activities? This means, whether the system shows documents that should be filled in by the employees explaining how they performed their work or describing what they did that day.

Knowledge sharing: this activity could be defined as a collective process where the people involved collaborate with others in order to learn from them [13]. This sharing effort often creates communities called "communities of practice" where each member cooperates by sharing knowledge about a common domain [17]. The principal means that these communities of practice use for communicating and sharing knowledge are collaborative tools [9]. The following questions check different characteristics that a collaborative tool may have to improve knowledge sharing:

- Does the tool have mechanisms to communicate with other people? What mechanisms does it have: synchronous (chat, videoconferencing, shared whiteboards) asynchronous (e-mails, mailing lists, newsgroups, asynchronous forums)?
- Does the tool mechanisms locate experts? Some applications help the user to contact other people by showing the email address, the telephone number, or even a map indicating in which office the person can be found.
- Does the system have mechanisms to detect who is working on similar tasks, and propose communities of practice?
- Does the tool have a mechanism to track the communities of practice's work?
- Does the system have a mechanism forward new information to those employees that might need it?
- Does the tool have a control of workflows? CSCW applications may know the path that workflow should follow and these systems can automatically send what has already been processed to the next point. Or they can also detect mistakes in the organization process. For instance, when a flow is not received or flows that are not used are received, therefore detecting some of the situations described in section 2.
- Does the tool have a mechanism to detect which person may know about a topic that another person needs information about? This means detecting each person's expertise.

Knowledge utilization: According to [6], knowledge utilization depends on two constructs: degree of knowledge utilization in an organization, and knowledge utilization culture. Having a system that automatically searches for information helps to reuse it. Let us now see how collaborative tools can promote knowledge utilization:

- Does the system have techniques to search for the information?

- Does the system have techniques to avoid noise in the information?, in [5] some criteria to reduce noise are described such as indexing, vocabulary control and filtering. A groupware tool should be very selective to avoid the collection and retrieval of too much information.
- Does the system have alert mechanisms to advise the user to consult information or to contact somebody else? This means, that when a person is working on a topic the system can automatically detect that it has information related to this topic that may be useful to him/her. Therefore, the system proposes that the person reviews this information or contacts another person who has previously worked on the same topic.
- Does the system recommend the best way to perform a task? That is, when a person searches, s/he is provided with information which has previously been useful to other people (these kind of systems have been called Recommender systems)

Knowledge internalisation. According to [6] knowledge internalisation is related to three constructs: capability to internalise task-related knowledge, education opportunity and level of organization learning. To evaluate how a collaborative tool can help in each construct several questions are proposed:

- Does the system help to learn how to perform a task? To do so, the system needs to know the profile of each employee in order to know what information they have and how new information should be shown in order to make the internalisation of new knowledge easier.
- Does the system have a mechanism to improve the employees' abilities? For instance, in the case of the tool enabling employees to do e-learning courses, or collaborative courses.
- Does the system have techniques to teach organizational philosophy, standards, and the clients' profile? Some tools have introductory tutorials or courses to teach new employees the enterprise's philosophy, their standards used or other information which may be useful for training them.

Besides the stages proposed by Chan et al, we propose a new issue to take into account knowledge integration. This means that the tool facilitates the integration and uniform representation of the semantic of common workspaces [2]. Therefore, the question to answer is

- Does the system facilitate the integration of the information and knowledge?

5. Conclusions and future work

This paper describes part of a work in progress in which we are developing a model to evaluate collaborative tools from a knowledge management approach, since, as was previously explained, knowledge is becoming the most important asset of enterprises. Therefore, it is important that collaborative tools help to manage knowledge and it is also important to evaluate in what degree the tools that a company uses help in this process.

As future work, we are planning, by using this model, to evaluate several known tools focused on knowledge management with the goal of detecting whether our model covers all the important aspects that a collaborative tool for this issue can have. After, we aim to formalise this evaluation and propose a quality model with not only a checklist but also formal metrics since, as was indicated in the ECE00 workshop [15] and in the WETICE03 [20], developing useful metrics is the key to successful evaluation. To do this, we shall use the GQM (Goal Question Metrics) model, determining the goal of the metric, the questions that should be answered to reach the goal and the metrics that evaluate each question, such as has been done in [23].

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