A PROCESS TO MANAGE CORPORATE KNOWLEDGE USING SOCIAL NETWORKS: A CASE STUDY

Ricardo Araújo Costa, Rafael de Albuquerque Ribeiro, Silvio Romero de Lemos Meira
Center for Informatics - Federal University of Pernambuco (UFPE) and Recife Center for Advanced Studies and Systems (CESAR)

Edeilson Milhomem da Silva
Center for Informatics - Federal University of Pernambuco (UFPE)

ABSTRACT
This case study describes the effects of using a Web Based Social Network (WBSN) approach to Knowledge Management in a Brazilian software development organization. During this work it was proposed a Knowledge Management process, with some metrics related to its phases. These metrics have been monitored since January 2008 and have been analyzed in order to verify the efficiency of this approach. In order to give a better understanding of the concepts related to Social Networks and Knowledge Management, it is presented a brief introduction to each one of them, including an evaluation of existing Knowledge Management approaches.

KEYWORDS
Enterprise Social Network, Knowledge Management, Process, Metrics.

1. INTRODUCTION

One of the many ways to achieve industrial competitiveness is to manage and share efficiently knowledge built inside an organization. In this context, social networks have shown signs of being an efficient tool to proliferate individual and explicit knowledge, even improving the tacit knowledge dissemination, helping to capture organizational knowledge based on the knowledge of each of its employees.

Staab (2005) has affirmed that social networks are a very good mechanism to promote more interactivity between individuals. The capturing of tacit knowledge trough interaction tools inside the Web Based Social Networks also allows extending this tacit knowledge. According to Davenport (1998), in order to create new knowledge is necessary to expose humans to new information, so they can process it and generate new knowledge inside their minds.

This work presents the a.m.i.g.o.s, a Web Based Social Network (WBSN) environment, and the experience of its use as the main tool to foster the communication, collaboration and knowledge management inside C.E.S.A.R, an Innovation Institute located in Brazil.

Besides this introduction, the reminder of this paper is organized as follows: a short explanation about knowledge management concepts, including its proposed process and metrics; definitions and benefits regard the use o Social Networks; the case study developed during this work, with a mapping between a Knowledge Management (KM) process and the a.m.i.g.o.s functionalities and effects of its use in C.E.S.A.R during the second phase of this case study; Finally it presents the concluding remarks and directions for future works.

2. KNOWLEDGE MANAGEMENT

According to Choi and Lee (2003), Knowledge Management (KM) in a software corporation is an opportunity to create a default perception among software developers so they can interact, deal and share knowledge and experiences. The reduction in loss of Intellectual Capital from employees who leave the
company; the cost reduction on the development of new products; and the increased productivity by making knowledge easily accessible to all employees are some of several benefits in using a Knowledge Management strategy.

According to Wenger (Wenger, 2004), the Knowledge Management field has come to realize the importance of communities of practice as the social knowledge fabric. He argues that the ability to truly manage knowledge assets resides on actively involving the practitioners on the knowledge management process.

Wenger (Wenger, 2004) identified three main characteristics in communities of practice. Domain provides a common focus and brings the community together; Community builds relationships that enable collective learning; and Practice anchors the learning in what people do, it represents the body of knowledge the members share and develop together. He affirms that cultivating communities of practice requires paying attention to all three elements.

2.1 Knowledge Management Metrics

If in one hand researches show that there is already a good knowledge base on performance indicators for knowledge management (Bose, 2004), on the other hand Liebowitz (2000) reviewed some of the performance indicators present in the literature and stated that “many of the cited metrics lack "creativity" in terms of determining the size and growth of the organization's knowledge base”.

Nonaka (1995) states that some managers have difficulties in fitting into the model of a knowledge driven company since they believe that the only useful knowledge is the quantifiable one and that the company is a sort of information processing machine. Ahmed (1999) also points the same difficulties for having higher level performance indicators, affirming that traditional performance measures have focused on outputs, whereas there is a need to look towards the enablers that lead to the production of results.

This only reinforces the lack of sensitiveness a financial indicator suffers, since such categories of indicators are only able to provide the whole picture of the Knowledge Management area, being unable to measure every component area. In order to have a sound management of the whole Knowledge Management process, corporations need to be able to measure every stage of the whole process.

Concerned with these limitations, apart from reviewing current indicators present on literature, Liebowitz (2000) proposed the following indicators:

- The number of new colleague to colleague relationships spawned;
- The reuse rate of “frequently accessed/reused” content;
- The capture of key expertise in an online way;
- The dissemination of knowledge sharing to appropriate individuals;
- The number of knowledge sharing proficiencies gained;
- The number of new ideas generating innovative products or services;
- The number of lessons learned and best practices applied to create value-added;
- The number of (patents + trademarks + articles + books + talks at conferences) / employees;
- The number of “apprentices” that one mentors, and the success of these apprentices as they mature in the organization;
- Interactions with academicians, consultants and advisors.

3. SOCIAL NETWORKS

The Social Networks theory approaches the social relationships as nodes and links. Each node represents an actor within the social network, and each link represents a social connection between actors. There are many different ways to link these actors, each one related to the nature of the represented social network (Iacobucci, 1994).

One of the reasons justifying the interest of organizations in social networks is how these networks are quite efficient to share the knowledge of each individual (Staab et al., 2005). Once that knowledge, that is relevant to the members of the Social Network, is documented, it can be reused, avoiding wasting of effort from employees.
According to Domingos (2001), the way that users publish information in social networks is impressive and without any precedent. Because using social networks is an efficient way to share and distribute individual knowledge, its use to support a knowledge management initiative has become a frequent approach. Moreover, using social networks can bring other benefits, like providing an interactive and informal environment where users can express themselves, easily enriching the organization memory.

4. A SOCIAL NETWORK AS A KNOWLEDGE MANAGEMENT TOOL

In order to achieve a better result in its knowledge management strategy, C.E.S.A.R. has developed and incorporated the use of a WBSN tool named a.m.i.g.o.s, which was first deployed in October 2006. This new initiative is trying to add some human-oriented aspects to a system-oriented approach (Costa et al., 2008) Portuguese acronym for Multimedia Environment for Integration of Groups and Social Organizations, the main goal of a.m.i.g.o.s is to provide a software infra-structure to support the creation of WBSN. The a.m.i.g.o.s also intends to stimulate the knowledge creation and sharing by its members, providing many features in order to be used as a knowledge sharing tool (Costa et al., 2008).

4.1 Mapping a cyclic KM Process on A.M.I.G.O.S

As one of the main goals of A.M.I.G.O.S. environment is to provide a tool to foster the knowledge acquisition, combination and sharing through the organization, it was made a comparison between the KM process proposed by Bose (2004) and the existing functionalities, generating the a.m.i.g.o.s KM process (Fig. 1), presented as follows.

This proposed process is composed by 4 phases, each focusing in a set of functionalities and its usage. On the following sections the phases of Creation and Capture, Refinement and Storage, Management, and Dissemination are presented in more details.

4.1.1 A.M.I.G.O.S. Knowledge Creation and Capture

Bose proposed that the knowledge comes from experiences and skills of the employees and must be stored in raw form to be useful to others members of the organization.

In the a.m.i.g.o.s environment there are basically two ways to users create and capture knowledge. The first source of knowledge is the reported user’s experiences. Every user is encouraged to describe his experiences, lessons learned and any other information as stories, with its related stories, images, videos,
audios or any other electronic document. These stories can, additionally, be related to specific communities, increasing the contextual information of the described experience.

4.1.2 A.M.I.G.O.S. Knowledge Refinement and Storage

The refinement and storage of knowledge are made through a diversity of activities that take place inside the a.m.i.g.o.s. environment.

Users are encouraged to develop new knowledge through dialogues about any subject related to a community. The entire dialogue is immediately stored and made accessible by any other member of the community, and, depending on permissions policy, to all a.m.i.g.o.s. users.

The refinement can also occur inside stories created by users, where others can add more information, or even refute what is written. This also is immediately stored in the repository.

4.1.3 A.M.I.G.O.S. Knowledge Management

Because it is basically a social network, there is not a tool in the a.m.i.g.o.s. environment that can be used to allow knowledge management made by a group of specific users, usually the KM team. Instead, several mechanisms were developed to allow the users to manage knowledge implicitly.

The first mechanism is the rating tool. Every time a user reads a piece of knowledge (stories, topics, documents, objects, etc.), he can rate it so the users can be directed to the most relevant pieces of knowledge. The second mechanism is the stories sorting mechanism. Through these filters it is easy for users to identify which are the newest stories, the most recent commented, the most active (a mixture of most commented and most recent), and so on.

Another efficient mechanism used to manage the knowledge is the folksonomy, which allows any user to classify any existing piece of knowledge with some special keywords, called tags. These keywords are used by users to filter and find knowledge related to a specific subject.

4.1.4 A.M.I.G.O.S. Knowledge Distribution

According to Bose, an effective knowledge management needs that every piece of knowledge is accessible to every member in an organization, at anytime and in an organized way.

In a.m.i.g.o.s., the distribution process is focused in searches for knowledge (stories, forum, topics, messages, communities and experts) according to the permissions set for each one of them. But what makes a.m.i.g.o.s. a different social network environment is the recommendation engine that runs in background according to actions taken by users.

The base to this recommendation process is the profile inference module. Every content written or added (as electronic documents) to the a.m.i.g.o.s social network is analyzed and the relevant keywords, with its weight, are added to the user profile. Additionally, every story which was positively rated is also added to the user profile. So every user in the environment has two groups of relevant keywords, the keywords related to subjects which the user likes to write about, and another set of keywords related to subjects which the user is currently interested in reading.

The mechanism of automation of the recommendations passed by the following developments: (1) recommendations for similar content based on the information that users usually post / write in communities, stories and objects (documents or sites), (2) recommendations for taking similar stories as a basis the stories read by the user, and (3) recommendations of relevant users (experts). These mechanisms aim to attend the Bose objectives, which are: foster the organization knowledge through the creation of new tacit knowledge (through exposing the employees to new explicit knowledge) and increase the employee qualification.

4.2 Results

In July 2008 the second phase of the a.m.i.g.o.s case study was initiated. Because the previous phase had already indicated that the WBSN approach to KM was the better approach to C.E.S.A.R (Costa et al., 2008), the second phase main goal was to have a better understanding about the behavior of a.m.i.g.o.s’ users on the Knowledge Management perspective. To achieve this better understanding it was necessary to define some new metrics based on the work made by Liebowitz, in 2000. So, during this phase the following metrics were defined and monitored:
- Number of new Knowledge Published: Which on the wiki approach is basically the number of file uploads and page creations, and on the a.m.i.g.o.s approach is the number of stories related and uploaded objects. Because it is needed a deeper evaluation to verify which stories or objects are new knowledge, this metric worked with every possible new knowledge.
- Number of Discussions: Which for the first initiative is the number of messages sent to the general mailing lists plus the number of messages sent to the engineering mailing lists, and for the a.m.i.g.o.s approach is the number of topics and messages initiated and posted on public communities.
- Number of Recommended Knowledge: Which is basically the number of recommendations on a.m.i.g.o.s but do not have an equivalent on the wiki and mailing list approach.
- Number of added contacts: This indicator is based on “the number of new colleague to colleague relationships spawned”;
- Number of times a topic or history is read: This indicator is based on “the reuse rate of ‘frequently accessed/reused’ content”. For this to be calculated it was defined that a story or topic is read if it stays open on the browser for at least five seconds;
- Number of stories and topics positively qualified: This indicator is based on “the capture of key expertise in an online way”. For this to be calculated, it is considered any story or topic with an average rate greater than or equal to three stars (which can vary from zero to five stars);
- Number of knowledge classifications: This indicator tries to measure how frequently the created knowledge is classified using tags. For this to be calculated, it was counted the number of tags applied to any item (stories, topics, objects and comments) inside the environment;
- Number of qualifications: This indicator tries to measure how often a knowledge item (stories and topics) is rated by users, independent of the rate;
- Number of access to elements through tags: This indicator tries to measure how often users look for items related to a specific subject, represented by a tag;
- Tagcloud visualizations: This indicator tries to measure how often users look for knowledge through the list of subjects available, which is represented by the environment tagcloud;
- Number of unique users: This indicator tries to measure what is the real impact of the system on the organization. For this it calculates how many different users log in and uses the system in a month.

When analyzing the knowledge creation metrics (Figure 2) it is possible to verify that there is a pattern on knowledge creation. For every month, except December, there were at least 500 messages inside communities, and 200 stories added to the environment. Because the Brazilian summer vacations are usually in the last two weeks of November and all weeks of December, it is expected a decrease on all collected metrics related to these months. But it is necessary to monitor these indicators for at least six more months in order to find a more accurate pattern.
Looking to the number of added contacts, which is presented on the Figure 3, it was possible to verify that, in a span of six months, the number of new relationships varied from 385 in July 2008 to 65 new relationships in December 2008. Except for the last two months, there were more than two hundred new relationships created by the social network users.

As it was verified, the numbers of new relationships for the last two months of the experiment were far lesser than the overall for the four months before. This behavior probably is also related to the Brazilian summer vacations, and also to some kind of stability on this number. This kind of stability is expected as the social network mature and the number of new members starts to decrease.

Observing the variation of the number of read items (Figure 4), it is possible to verify a really active community. The number of read topics and stories varied from 3000 to 4000 monthly, which is more than 15 times the number of created stories and topics during the same span of time. It was also noted a decreasing on the number of read items for the last two months of the year, as expected.

It is important to notice that the number of downloaded objects do not suffered on the last two months. A more deep analysis would be necessary to understand why this happened. These data also suggests that the objects do not take part on the day-to-day activities as does the topics and stories. But even with a high reading number, the number of rated items – that is, the number of topics and stories evaluated by users with a rate from one to five stars (Figure 5) – was not so encouraging. It was noted that an average of only 10% of users who read an item usually rate it. After some interviewing, it was identified that only 20% of interviewed users did know about the existence of the rating functionality or how they could benefit from it, which indicates that there is a problem related to the functionality usability.

This behavior of not rating items also can be verified on the number of items with a positive average rate (Figure 6). Only a few topics and stories created did receive rates greater than or equal to three stars. This number is usually around 10% of all items created monthly.

But far more encouraging than the number of qualifications or the number of positively rated items is the number of classified items (Figure 7). The created stories have an average of approximately 2.1 tags for each story. This number is even higher when applied to objects, which presents an average of 2.9 tags for each object. Even topics have an average of 1.3 tags for each created topic. These numbers also indicates a certain level of awareness of the importance of knowledge classification, so a piece of knowledge could be more easily found by another user who would need this knowledge.

Besides a really high number of knowledge classifications, users do not take full advantage of this classification. Even with almost 500 different tags, the number of accesses to a tag, listing items tagged with a keyword (Figure 8) is really low.
When looking to the numbers of items classified and confronting them to the number of access to the classification lists (tags and tagcloud), is possible to verify that users do care about classification, but apparently do not know how to access this classified item through the classifications mechanisms, which indicates that there is a problem on the classifications mechanisms, more precisely related to the interface for accessing the classified content.

Another interesting indicator is the number of unique visitors to a.m.i.g.o.s. Because users are not obligated to use it, the number of unique visitors is not near the number of employees. C.E.S.A.R has approximately 600 employees, but a little more than 50% of them are regular users of the WBSN, even that more than 90% of them has logged in at least once.

These numbers suggests that it still is necessary to bring and keep more users inside the WBSN environment. When interviewed, some users affirmed that sometimes they have trouble accessing the a.m.i.g.o.s because this tool is not present yet on their day-to-day activities. That kind of behavior is really an eye-opener, suggesting that probable the most appealing characteristic of an environment like that is to be part of the members’ day-to-day activities inside their companies.

After this second phase it was possible to identify that the WBSN approach to KM is still working well, but metrics indicates the need for enhancements in certain aspects of the WBSN, like the classifications mechanism, the rating mechanism and new functionalities which would bring users’ day-to-day activities inside the environment.

5. CONCLUSION AND FUTURE WORKS

A large number of companies are choosing a WBSN approach on their knowledge management strategies. This work presented the use of a WBSN called a.m.i.g.o.s as the main tool for communication and knowledge management in a Brazilian software development company: C.E.S.A.R. The main goal of this work is to present and evaluate an alternative to align individual interests in an organizational knowledge management initiative, turning it a natural process.

The a.m.i.g.o.s WBSN has been used by C.E.S.A.R since October 2006 and the results indicated that this approach has been well-succeed to give cooperation, collaboration and knowledge sharing support in C.E.S.A.R projects (Costa et al., 2008). Using a WBSN the organization adds some human-oriented perspectives on a traditionally system-oriented approach, which makes the use of WBSN as a KM tool quite promising, decreasing the gap to a dynamic approach to KM.

Also according to the data collected during the second phase of this case study, four main improvements shall be made to the system in order to better attend users’ needs. The first one is the development of a new feature related to day-to-day activities. Because C.E.S.A.R is a project-oriented company, one of the best ways to support these day-to-day activities is related to project support inside the WBSN. With that kind of support, every project would have a special environment which would support its activities, and where every project member should access in order to keep up to date with the project status, discussions, documents, stories, etc.

The second improvement is related to better exploit the classification mechanisms provide by the folksonomy module. According to the collected metrics, users usually classify knowledge with tags, but they
do not use them when looking for information. Based on this behavior it is clear that the folksonomy module shall be modified in order to facilitate the access to the classified content.

A third improvement is related to document management capabilities. The knowledge creation metrics shows little improvement and little activity regarding the uploaded files and bookmarked sites, which together constitutes the user objects. The development of a version control module allowing the uploaded files to have its versions managed would probably lead to a larger knowledge base, bringing files that without this feature would be placed outside the WBSN. Some improvements to the objects user interface probably would also lead to increasing document accesses.

The fourth major improvement shall be made regarding recommendations. The data presented in this work indicates a modest number of both, manual and automatic recommendations. However, with a larger knowledge base, the automatic recommendation probably would have more relevant data to work on.

In general this work can be used as a reference to other initiatives focusing on the use of WBSN as the main tool in a KM approach. The metrics defined are real and have been monitored for six months, setting some parameters regarding the KM efficiency of a WBSN approach in an environment like that on C.E.S.A.R.

ACKNOWLEDGEMENT

This work was supported by the National Institute of Science and Technology for Software Engineering (INES¹), funded by CNPq and FACEPE, grants 573964/2008-4 and APQ-1037-1.03/08.

REFERENCES


¹ http://www.ines.org.br