Leadership in Team Based Knowledge Management An Autopoietic Information System's Perspective

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Abstract. *In this paper we show how team work between participants can be facilitated through the use of principles from autopoietic theory and modern WEB2.0 technologies like social networks, forums, semantic wiki systems, podcasting as well as social tagging in order to provide a suitable environment for knowledge management.*
We argue that leadership is an important factor for autopoiesis emergence as well as project success. Results form an experiment conducted on 160 students show that teams that were able to find a leader during the first week of collaboration were successfull while teams who didn't had problems in establishing creative collaboration. In the end we argue that by providing facilities for a dynamic leadership role one indirectly can facilitate the emergence os autopoiesis in such an environment.

Keywords. autopoiesis, information system, social network, knowledge management, fishnet, WEB2.0

1 Introduction

Autopoiesis is a pseudo Greek word coined from $\alpha\upsilon\tau\acute{o}$ (auto) for self and $\pi o\acute{\iota}\eta\sigma\iota\varsigma$ (poiesis) for creation, production or forming that was first introduced by the Chilean biologists Humberto Maturana and Francisco Varela in 1973 [8] to denote the type of phenomenon they had identified as a characteristic that distinguishes living systems from other types of systems [14]. They claimed that living systems are autonomous entities that reproduce all their properties through their internal processes.

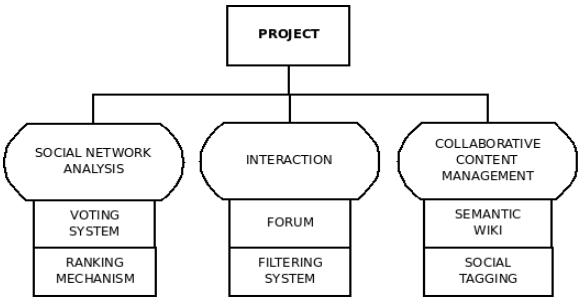

Figure 1: ΤΑΟΡΙS System's Architecture

Later on this term was introduced into social theory as well as formal organization theory by Niklas Luhman [6] who claimed that social systems are systems of communication that emerge whenever an autopoietic communication cycle comes into being that is able to filter itself out of a complex environment. Organizations are a special type of social systems in which most communications are decisions.

In [2] and [1] we argued how it is possible to apply autopoiesis in information systems theory whereby information systems are basically subsystems of organizations or social systems in a broader perspective.

As shown in [1] an "autopoeitic information system is ... defined as a set of relations between communicative events that reproduce new communicative events based on previous (stored) communication. The organization of this system (in Maturana's and Varela's sense) are the relations between communicative events described through their se-

mantics (meaning). The structure of the system (in Maturana's and Varela's sense) are the means that are used to produce communication described through syntax."

Autopoietic information systems can and should be supported rather than implemented by information and communication technology [3] [11]. As argued in [2], [12] and [1] modern so called WEB2.0 technologies can be used to facilitate the emergence of autopoiesis in information systems.

2 The ┬aOPīs System

Having such a reasoning in mind the ┬AOPīs system was implemented and is being developed continuously due to its OpenSource nature [13] in order to support the emergence of autopoiesis in social systems and organizations as a special case.

By using modern WEB2.0 technology like forums, wiki systems, social networks, podcasting, social tagging etc. a dynamic application was build which prime focus is on project and organization management in a distributed, turbulent and dynamic environment (see [16] for an in depth analysis of modern organizational concepts).

Figure 1 shows an outline of the ┬AOPīs system's architecture. The system basically allows any user to create an arbitrary number of projects which in turn other users can join or register a project of their own. Any project consists of three interconnected parts, namely a social network analysis part, an interaction part, as well as a collaborative content management part.

The part concerning social network analysis comprises of a voting system that allows project members to vote for each other as well as a ranking mechanism that analizes the voting data and maps each project member to her/his respective rank. In particular a modified PageRank algorithm is used to analize the voting data as well as to calculate member's ranks. The member with the highest rank is pronounced project leader which is a dynamic role that can change depending on voting data. Thus a dynamic hierarchy is constructed on every project resambling a dynamic fishnet structure [12].

The interactive part is represented through an multimedial discussion forum as well as an self organizing filtering system. The discussion forum supports threaded discussion, binding to mailing lists as well as inclusion of multimedia files like images, animations and video files. The filtering system basically allows any user to be a forum moderator by filtering messages and other content she/he encounters. Other users can use a moderation of another user or be the moderator for their selves. A list of most used moderators is also provided in order to yield the most popular moderators on any project.

The collaborative content management part consists of a semantic wiki system based on frame logic [4] (particularly using the $\mathcal{F}$LORA-*2* reasoning engine [15]) as well as of a social tagging system. Users by organizing their own content through attribute-value tags provide the reasoning engine with metadata which in turn allows other users to query the dynamically created knowledge base.

In this paper we decided to show a particular use case of this system in an project-based knowledge management environment to provide new insights into this domain.

As argued in [5], [9] and [10] semantic wiki systems provide a suitable tool for personal and collaborative knowledge management. Here we argue that semantic wikis also provide a platform for project-based knowledge management as well as that a leader plays an important role in such an environment. To establish a dynamic leadership role social network analysis was used as argued previously.

3 Experiment

The ┬AOPīs system was used as an knowledge management platform where team work of distiributed people was neccesary in order to simulate a virtual organization's environment.

The experiment was conducted on 160 students that were randomly separated into teams of 4 - 7 members over a period of four weeks. Each team was assigned to a special topic in order to conduct research from different knowledge sources available and to build a semanitc wiki system by creating explicit knowledge about the given topic as well as to aquire tacit knowledge at the same time. The teams were also instructed to use the system's ranking mechanism to yield a project leader who will communicate with "upper management" (the teachers) and present their work.

After four weeks of cooperation results were impressive. Since students were forced to cooperate with people they sometimes didn't even know the first week was quiet within a search for project leaders. As soon as such a role was established work was devided into parts and teams started to conduct research on their topics.

Three weeks later impressive knowledge bases on the particular topics emerged consisting of lots of text encountered in different books, articles, and web sites. The semantic wiki systems were crowded with text, images, animations, short movie tutorials, metainformation and queries that summarized information and put it into new perspectives (dictionaries, summaries, tables of content etc.). Still there were teams that weren't able to find a leader and such teams failed in the task to create a satisfactory solution.

In order to proove our hypotheisis that project leadership was one of the crutial variables for project success, a survey was conducted to identify which criteria students used in establishing a leader role as well as how succesful they would rate their projects. It is interesting that teams that used leadership skills as a criteria were able to identify a leader and were thus successful.

On the other hand teams that didn't, weren't able to identify a leader and were less successful. Still on an average scale 82 % of the students rated their project successful and 84 % of students thought that their project leaders have leadership skills. If we take that students were devided into teams randomly which yields possible uncompatibilities between students personalities into consideration these are impressive results.

4 Discussion

From an autopoietic theory viewpoint in information systems we can say that autopoiesis depends on an recursive communication process which either emerges or not. If this process stops the information system "dies" as well as its autopoiesis.

Thus the lesson we learned is that to facilitate autopoiesis one needs to facilitate interaction. In the mentioned survey we also asked students for suggestions and improvements of the system and most of them answered that they want additional interaction systems (chat rooms, instant messeging, improoved forum system, status of on-line members, collaboration). Other improvements that were suggested are improoved user interface (better graphical user interface design, more user-friendly interface), additional functionality (better content formatting, additional query possibilities) and less system flaws.

The other, and probably more important lesson we learned is thar autopoiesis is something that emerges not something that can be implemented. Still, by using modern network technologies as argued before, as well as social network analysis and a leadership establishment, autopoiesis can be facilitated. In the conducted experiment students that became leaders of their teams facilitated communication, assigned roles and jobs to other members and thus autopoiesis was facilitaed as well through such a recursive communication cycle.

From a knowledge management perspective the final results were impressive web based knowledge bases embodied in semantic wiki systems created by the teams. The aquired tacit knowledge is much harder to measure and grade, but succesfull team members mostly passed their knowledge management exam from their first attempt, whilst unsuccesful ones needed a second try or at least had worse results.

5 Conclusion

In this paper we showed a particular use case of the ᴛAOPĪS system which aims to become an implementation of an autopoietic information system. The ᴛAOPĪS system was used in a distributed team based knowledge management environment to provide the most important processes of knowledge management: knowledge discovery, knowledge capture, knowledge sharing as well as knowledge application.

In a conducted experiment we showed that leadership is an important factor for project success in such an environment. Using social network analysis one can establish a dynamic project leader role and facilite the emergence of a fishnet organization. Such an organization, due to leadership, seems to be a good environment for knowledge management.

From an autopoietic theory perspective by facilitating leadership one facilitates interaction and thus facilitates a continous communication process

that leads to the emergence of autopoiesis. As long as such a recursive communication cycle exists so does the organization of the system.

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