

Enhancing Knowledge Sharing within Communities of Practice: An ICT Framework

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Keywords: Knowledge Management, Argumentation, Communities of Practice, Web-based systems

Abstract. This paper presents a framework that aims at fostering and enhancing knowledge sharing activities within Communities of Practice. The proposed framework comprises a methodology for explicating, exchanging, elaborating and structuring the tacit knowledge that flows in such environments, as well as a supporting web-based tool that enables the conduct of argumentative discourses and can be employed as a forum of reciprocal knowledge exchange.

Introduction

Knowledge sharing is broadly considered as a core organizational activity for sustaining organizational competitiveness and development (Liebowitz and Chen, 2001). Organizations that actively leverage the abilities of their people through knowledge sharing, mutual support, and co-creation outperform organizations that depend on the individuals' abilities alone. On the other hand, Communities of Practice (CoPs) are broadly recognized as effective environments to support knowledge sharing among professionals and organizations. This is because CoPs are formed by groups of people that have similar interests or goals, and are willing to share their knowledge, insights and experiences about specific aspects that have to be collaboratively addressed (Wenger and Snyder, 2000).

Contributing to the above issues, this paper presents an Information and Communication Technology (ICT) framework that aims at fostering and enhancing knowledge sharing activities within CoPs. In speaking of knowledge sharing activities in the context of CoPs, we refer to the exchange of a series of problem interpretations, interests, objectives, priorities and constraints, which may express alternative, fuzzily defined, or even conflicting views. Our approach exploits the conduct of argumentative discourses taking place among CoPs' members. The proposed framework comprises a methodology for explicating, exchanging, elaborating and structuring the tacit knowledge that flows within such contexts, as well as a web-based tool that builds on the above methodology for supporting the necessary communication and collaboration.

The remainder of this paper is structured as follows. In the next section, we briefly comment on related work. Then, we proceed to the presentation of the proposed conceptual framework. Next to that, we present the supporting software tool. Concluding remarks, preliminary evaluation results and a brief presentation of our future work directions are given in the last section of the paper.

Related Work

Approaches supporting argumentative collaboration usually provide the means for discussion structuring and user administration, while the more sophisticated ones allow for sharing of documents, on-line calendars, as well as embedded e-mail and chat tools. *glbis* (Conklin and

Begeman, 1987), for instance, is an argumentation structuring tool that has exhibited a major impact to a series of other tools developed to facilitate and augment the capturing of the rationale of a collaborative process. *Sibyl* (Lee, 1990) is a similar tool for managing group decision rationale, while *QuestMap* (Conklin, 1996), provides a “whiteboard” where all messages, documents and reference material for a project are graphically displayed during meetings. *Compendium* (Selvin and Sierhuis, 1999) is a graphical hypertext system, which can be used to build a semantic group memory when used in a meeting scenario, whereas *Hermes* (Karacapilidis and Papadias, 2001) is a web-based tool supporting distributed asynchronous collaboration. Other approaches, like the *Reason!Able* argumentation tool (van Gelder, 2002) as well as *Athena Standard* and *Athena Negotiator* (Rolf and Magnusson, 2002), provide well structured and user-friendly environments for reasoning.

The above approaches support argumentative collaboration at various levels and have been tested through diverse user groups and contexts. However, they do not employ knowledge management features. In a similar vein, Moor and Aakhus (2006), acknowledge that traditional argumentation software approaches are no longer sufficient to support contemporary communication and collaboration needs. In any case, the above approaches have been thoroughly considered during the development of the proposed framework and aided the conceptualization, shaping and implementation of its integrated knowledge management features and functionalities.

Enhancing Knowledge Sharing within Communities of Practice

According to the related literature, the most efficient involvement of humans in Knowledge Management Systems is through the establishment of virtual CoPs enabled by on-line interactive technologies (Philips and Bonner, 2000). Such communities are formed by groups of people having similar interests or goals, and are willing to share their knowledge, in-sights and experiences about specific work aspects, the ultimate aim being to learn from each other (Wenger and Snyder, 2000).

Admitting that knowledge that cannot be easily codified and distributed is of premium value, issues related to knowledge sharing between community members lately receive a growing interest. In order to successfully address these issues, we have thoroughly explored the related social and technological environment to identify and address critical *behavioral* and *user-computer interaction* issues. The framework presented in (Evangelou and Karacapilidis, 2005) resulted out of a thorough investigation of the related literature, including case studies that consider diverse issues of employees’ behavior in knowledge sharing activities. In this paper, we exploit it towards the development of a software tool that facilitates collaborative work and helps CoPs’ members efficiently share their knowledge.

The proposed tool

An important challenge towards augmenting the effectiveness of CoPs is to provide their members with software tools that facilitate and augment the quality of their daily practices. Web technologies are of premium value for the support of distant collaboration among a community’s members as well as for the management of CoPs. Aiming to provide cross-functional teams and workgroups with the necessary means to collaborate and share their knowledge in a distant and asynchronous mode, we have developed CoPe_it! (<http://copeit.cti.gr/>), a web-based software tool that can be employed as a forum of reciprocal knowledge exchange. More specifically, CoPe_it! can assist and augment argumentative collaboration among members of CoPs by facilitating the creation, sharing, leveraging and utilization of the relevant knowledge, as well as by supporting the underlying decision making processes. CoPe_it! can be used by any group of people working together as a team, who want to exchange their points of view towards elaborating and solving an issue.

In addition, it can serve the structuring and handling of an argumentative discussion without any restrictions concerning the problem domain of the issue under consideration.

The joint consideration of the individuals' standpoints through the conduct of argumentative discussions is considered as one of the most dominant collaborative practices for the achievement of a group's goals and objectives. CoPe_it! supports the conduct of electronic discourses by providing a shared environment for the exchange of the involved stakeholders' points of view in the form of linguistic statements. In this way, users may formulate and put forward their own alternative solutions that fulfill some goals at a specific acceptance level. Moreover, they may express arguments in favor or against alternative solutions, as well as preferences imposed on them. Through these discourse elements, stakeholders articulate their diverse problem interpretations, interests, objectives, priorities and constraints. Furthermore, such elements reflect the stakeholders' differences in terms of intelligence, knowledge, training, experience, personality and cognitive styles.

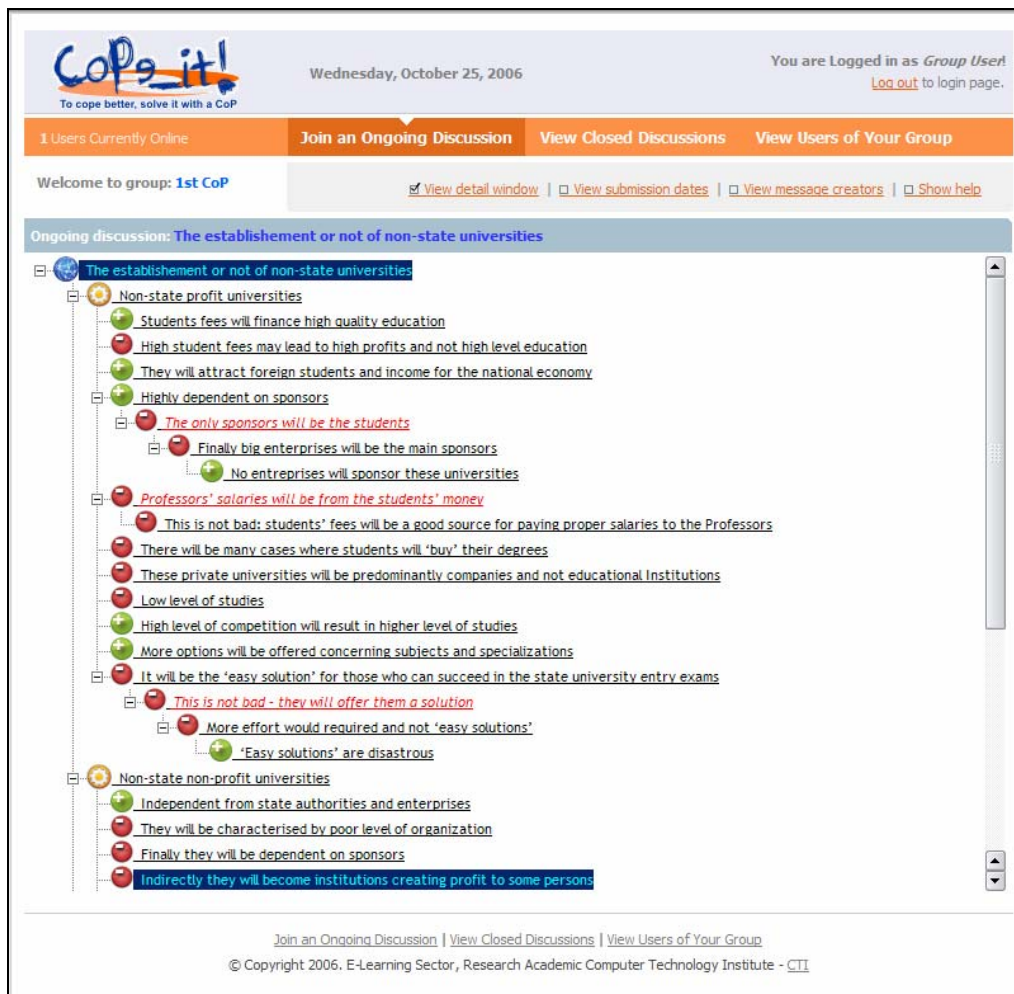


Figure 1: An instance of the discourse-based knowledge graph

As regards knowledge sharing in particular, CoPe_it! provides a structured visualization of the knowledge expressed during argumentative discourses. Furthermore, it helps the organization of a CoP's knowledge by taking into account the input provided by the individual members of a CoP, and constructing an illustrative discourse-based knowledge graph (Figure 1) that is composed of the ideas expressed so far, accompanied by supporting documents. In this way, it augments group reflection and leveraging of knowledge creation through argumentation. It also provides the necessary means for efficient building of

organizational memory, which can be reused in future collaboration instances. Moreover, it enables the integration of argumentation-based reasoning mechanisms for the evaluation of the proposed courses of action.

In order to establish a high level of sharing and reusing knowledge across domains and tasks, CoPe_it! has been based on a well-defined ontology model. This also facilitates community members in achieving a common understanding, while also enhancing collaboration and exploitation of organizational knowledge resources. Much attention is also paid to reasoning and user awareness issues. Towards this aim, the proposed tool exploits a set of user profiles and activity reports that conceptualize the diverse roles and activities undertaken by stakeholders involved in a CoP. More specifically, through the integrated reasoning mechanisms, discussants are informed about the status of each discourse item asserted so far and may reflect further on them according to their beliefs and interests on the outcome of the discussion. In addition, our approach aids group sense-making and mutual understanding through the collaborative identification and evaluation of diverse opinions. Furthermore, CoPe_it! provides a shared web-based workspace for storing and retrieving the messages and documents of the participants. The knowledge base of the system maintains all the above items (messages and documents), which may be considered, appropriately processed and transformed, or even reused in future discussions. Moreover, the tool supports multi-level user management and it can be accessed through major web browsers.



Figure 2: An instance of the reports provided by the tool

Towards aiding CoP members in having a clear and global monitoring of the actions taking place during a collaborative process, CoPe_it! also provides a set of illustrative reports (diverse formats are supported). These reports derive out of the detailed recording of the actions performed by users. Depending on the privileges of a particular user, such reports may contain information about the overall use of the tool (total numbers of registered users,

users' logins, discussions handled by the tool, memberships of each group, etc.), or its use in a particular CoP or discussion (members of the group, number of posts, history of members' actions, etc.). Figure 2 illustrates an instance of these reports.

System Architecture

As far as its architecture is concerned, CoPe_it! comprises two discrete modules, namely "Role and Profile Modeling" and "Collaboration and Knowledge Sharing Space", that enable user management and argumentative collaboration support, respectively. This component-oriented approach has a series of advantages, such as the easier future conversion to 'web services' and achievement of interoperability with other components (modules, tools, etc.) or external services. Moreover, it facilitates the encapsulation of ontology models in each of its modules.

Role and Profile Modeling. This module, besides providing typical user management services (e.g. authorization and access rights), is dedicated to the modeling and assignment of roles to the users. Furthermore, it provides the grounds for the incorporation of awareness services, as well as the management of user profiling, filtering and routing requirements. More specifically, the "Role and Profile Modeling" module formalizes CoP members, as well as CoPs *per se* in an efficient and CoP oriented way, considering both static and dynamic aspects of CoP mediation activities (e.g. membership history, roles' changes over time). Towards this aim, user privileges that correspond to (sets of) system rights are related to the roles undertaken by CoP members within a particular discussion. The module also formalizes a set of special user types, e.g. CoP members that do not actively participate in argumentative discussions and are considered as 'silent' users. Multi-membership is also foreseen for users participating in more than one CoPs.

Collaboration and Knowledge Sharing Space. This module provides the knowledge sharing, collaboration and argumentation (virtual) space needed by CoPs. It is integrated with the "Role and Profile Modeling" module, in order to offer effective and efficient mediation services, supporting both asynchronous and synchronous collaboration. Furthermore, it facilitates the formation and linking of discussion items, as well as their association to specific discussions and other sources of information/knowledge. Giving emphasis to the visualization of collaboration, this module also provides various argumentation representations, which are easy for humans to interpret. In addition to the above, the "Collaboration and Knowledge Sharing Space" module supports the creation/management of "Collaboration Paradigms". This refers to the adaptation of the visualization features according to the different roles, profiles, or even collaboration contexts. Moreover, to the incorporation of the appropriate reasoning mechanisms for each particular case. Towards this aim, a set of such mechanisms has been defined, while a framework for the selection of the most suitable one by a CoP has been also developed.

Implementation issues

CoPe_it! has been developed on state-of-the-art technologies, such as XML and MS Visual Studio .NET Framework V2. It is based on a multi-tier architecture that ensures openness and extensibility. More specifically, its *storage tier* provides persistent storage for data and information. It consists of a set of discussion files in XML format, together with a database schema in the Relational Database Management System (RDBMS) Microsoft SQL Server 2000. The *middleware tier* provides the application logic that includes all domain specific ontologies and constraints. This tier has been implemented as dynamic linked libraries (dll) using the C# and VB.NET programming languages. Finally, the *presentation tier* handles the visualization of discussions.

Conclusions

In this paper, we presented an ICT framework that aims at enhancing knowledge sharing activities within CoPs. Our approach aims at providing an efficient space for collaborative knowledge-intensive work and adopts the practices of a community. The proposed framework has been derived from our past work regarding socio-technical aspects of knowledge sharing within organizational contexts. The supporting software tool fully complies with the Web Engineering discipline. Thus, special attention was given to technical aspects such as the extensibility, reusability and neutrality of our approach. The tool is currently under evaluation (adopting the framework and metrics proposed in (Karacapilidis et al., 2005)), while the preliminary results are highly encouraging in terms of usefulness and ease of use. Our future work directions concern the thorough evaluation of the proposed tool in diverse community settings and knowledge domains.

Acknowledgements

Research carried out in the context of this paper has been partially funded by the EU PALETTE (Pedagogically Sustained Adaptive Learning through the Exploitation of Tacit and Explicit Knowledge) Integrated Project (IST FP6-2004, Contract Number 028038).

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