Project Knowledge Management Based on Social Networks

Panos Fitsilis¹⁺, Vassilis Gerogiannis¹, and Leonidas Anthopoulos¹

¹ Business Administration Dep., Technological Educational Institute of Thessaly, Larissa, 41110, Greece

Abstract. One of the most valuable resources for organizations today is knowledge developed and held within their teams during the execution of their projects. Although the need for maximal reuse of lessons learned and knowledge accumulated for keeping companies at the leading edge is evident, this knowledge is often lost because it can be difficult or impossible to articulate. In this paper, we present ONSOCIAL system, a system that attempts to capitalize knowledge accumulated over social networks. For achieving this objective, ONSOCIAL system is using the concept of confluence nests, where tacit knowledge stored in social networks is collected and classified, with the use of domain software project management ontology. The end result is a customised semantic enterprise social network that can be used for improving the performance of project management processes.

Keywords: Knowledge Management, Project Management, Ontologies, Social Networks.

1. Introduction

Social capital is widely referred to as the resources accumulated by individuals or groups through relationships in a network [1]. These relationships contain knowledge that after certain analysis can be utilised for various purposes. Therefore, social capital has been associated with a variety of positive socio-economic outcomes, such as improved public health, decreased crime rates, and more efficient financial markets [2]. Based on their social capital, individuals can draw on assets (e.g., helpful information, personal relationships, capability to form groups, etc.) from other members of the networks to which he or she belongs.

As a result social networks and specifically enterprise social networks can be used in the context of project management in order to answer questions, such as:

- How to select the best performing project team?
- What is the know-how available to project through the competences of its stakeholders?
- Who is the most trusted supplier for a specific project need?

As somebody could imagine, the number of different questions that can be asked is almost infinitive and as such they do not constitute a systematic or practical way to utilize the social capital available. What are needed are: a) a holistic approach and b) a number of validated for their usefulness measures in order to convert the social capital to a practical software project management tool.

For addressing the above research questions, we present an approach which is based on three different disciplines and attempts to combine them in a single model. Namely these disciplines are: project management, enterprise social networks and ontologies-knowledge management. In the proposed approach, three are the basic steps involved: a) building the enterprise social network, b) modelling knowledge required for successfully implementing a software project using custom developed software project management ontology, and c) querying the system for answering to specific project needs as described in the list of questions above.

The work presented is currently implemented in ONSOCIAL research project (http://onsocial.teilar.gr/). The remainder of the paper is structured as follows. Section 2 provides the background of the project: project management methodologies and of ontological engineering and defines the context of this paper. Section 3 presents an overview of the system and section 4 presents the conclusions and future work.

¹⁺ Corresponding author. Tel.: +302410684204; fax: +302410613147
E-mail address: fitsilis@teilar.gr
2. Background

ONSOCIAL system is based on three different disciplines and it attempts to combine them in a single model. Namely these disciplines are: software project management, enterprise social networks and ontologies and knowledge management.

The discipline of project management has evolved over half a century and permeates all industries, institutions and governments throughout the world. In response to the perceived need to organise thinking about project management a number of frameworks have been produced (Projects In Controlled Environments 2 (PRINCE 2) [3], PMI Guide to the Project Management Body of Knowledge [4], International Project Management Association Capability Baseline (ICB) [5], etc.).

Social Network Analysis (SNA) offers a powerful tool that provides the means for analysing informal networks [6]. Social network analysis aims to understand the relationships between people, groups, organizations, and other types of social entities [7], and has been used extensively in fields such as sociology [8] and management [9]. A social network is modeled as a graph with nodes representing the individual actors in the network and ties representing the relationships between the actors. The key benefit of SNA is the ability to visualize networks and manipulate these visualizations in real-time. As such, in the context of project management, SNA can acts as a diagnostic gap-analysis tool for social networks in organizations. Broadly speaking, the benefits of interventions based on SNA include: a) promoting the collaboration within groups or teams of an organization; b) facilitating communication c) enabling smooth information flow within the teams.

Prior work has also shown that project artefact properties are directly influenced by social network properties of teams, such as their email interactions, and their contribution history of developers. In earlier work, Bird et al. [10] constructed email social networks from open source project mailing lists and found that social network analysis measures were highly correlated with development activity. In addition, they found that global connectivity measures such as betweenness were better indicators of development activity than local measures such as degree centrality. Pinzger et al. [11] used contribution history to construct the networks of binaries and the developers that contributed to them. They found that measures such as degree centrality, closeness centrality, and Bonacich power in contribution networks also had very good predictive power in determining failure-prone binaries. Meneeley et al. [12] created networks that consisted solely of developers where edges between developers were based on collaboration on common files. They used social network analysis to assign values of metrics such as betweenness, degree, and closeness to developers. A holistic approach for combining knowledge, tasks’ needs in knowledge, project geographical different location was presented from Fitsilis et al. [13] where seven different project dimensions were used together in order to give answers to more complex queries.

However, in order to achieve project knowledge management and knowledge reuse, several enabling activities and alternatives approached should be considered. One approach that offers substantial benefits and can be combined with SNA is that of ontological engineering. Over the last few years, ontologies have become part of popular research topics from a variety of different fields.

An ontology is a formal specification of a shared conceptualization, as defined by Gruber [14]. Ontologies allow the specification of concepts with attributes of a specific type. Concepts can be organized in a hierarchy (using the specialization relationship between two concepts). Considering the large number of ontologies developed, ranging from generic and core ontologies to domain and application specific ontologies, and the lack of standardization, an evolution of methodologies and supportive tools for “ontology engineering” is expected. However, among the most prominent and standardized ontology languages is OWL 2 [15] and among the development tools, Protégé ontology development tool [16].

3. Overview of ONSOCIAL system

The ONSOCIAL system aims to provide project managers with an innovative and seamless project management toolkit, which will be adaptable to their needs and their specific type of projects. The ONSOCIAL framework will be adaptable to organisations’ specific needs like the type of projects that they manage and the variant knowledge that they have. The main aim of the ONSOCIAL system is to enable the
composition, sharing and distribution of knowledge that will result to business solutions evolvement. The ONSOCIAL system will support organisations to identify their best practices and metrics targeting to effectiveness and performance improvement that result to the advancement of adaptability and responsiveness to rapidly changing market demands and customer requirements. Further, ONSOCAL enables the dynamic formation of virtual teams by facilitating knowledge exchange, while at the same time protecting private knowledge assets, as the multi-layer ontology will also encode policies for data usage.

ONSOCIAL system combines SNA and semantic modelling techniques in order to provide to project managers a methodology, techniques and tools to transform the social capital available today in large enterprise social networks to economic benefit for its users.

For achieving the above a theoretical model is needed able to combine Social Networks and Semantic Modelling. The theoretical foundation that ONSOCIAL project is formalised using the concept of confluence nests [17].

Confluence Nest (CN) is a tripartite graph with hyperedges. A tripartite graph is a graph whose vertices can be divided into three disjoint sets and edges are connecting vertices from these three disjoint sets. Formally, the confluence nest is defined as

\[ CN = (O, S, I, E) \]

where

- **O** is a graph representing a Software Project Management Ontology
- **S** is a graph representing an Enterprise Social Network
- **I** is a set of Information Objects containing knowledge or reusable components
- **E** is a set of hyperedges connecting vertices of O, S and I.

The idea that a confluence nest is attempting to represent is “which artefact is developed by whom and contains knowledge of what type”. The idea of confluence nests is presented graphically in Fig. 1.

![Fig. 1: Concept of “confluence nests”](image)

According to this view, the knowledge of each employee is the sum of personal knowledge together with the knowledge that results from the social network. It is very customary to go back for a quick solution of a problem to partners or friends who have encountered the same problem before. At the enterprise level, members of the organization possess documents of different types (publications, deliverables, presentations), e-mails, contacts, etc. The analysis of the above information will enable us to build a social network with the properties we desire. At this point we should mention the "Social Software" [18], i.e., software designed to
support social networking, communication and cooperation groups and individuals, taking into account the social environment.

The social software and the corresponding scientific field "Social Computing" [19] which examines the development and use ICT to enhance or facilitate social action of the user evolves rapidly in recent years. Members of organizations are using social software applications such as e-mail, instant messaging, internet forums, blogs, wikis, tools for collaborative authoring texts, tools, social networking, social bookmarking tools, etc. both within the organization and outside it. The extraction and analysis of information generated and stored by these tools can help build the social network with the properties we desire.

The steps for knowledge extraction in the proposed system are presented graphically in Fig. 2. The information (documents, e-mails, contacts, etc.) staff evaluated using the procedures and structure of the ontology (step 1). The identified information is evaluated and the produced metadata are stored using the proposed ontology (step 2, 3 and 4). At the same time the stored information is augmented with information that is stored in enterprise social network, such as friendships, recommendations, notifications, group memberships, etc. (step 5).

![ONSOCIAL SYSTEM – Team selection use case.](image)

Obviously, the above described architecture is able additionally to answer to similar use cases, such as “project supplier selection”, “project artefact reuse”, “project resource allocation”, etc.

4. Conclusions

ONSOCIAL system explores the process of project management by assisting large distributed project organizations in their efforts to capitalize on the knowledge accumulated to social networks. For achieving this objective ONSOCIAL system is using the concept of *confluence nests*, where tacit knowledge stored in social networks is collected and classified with the use of domain software project management ontology. The end result is a customised semantic enterprise social network that can be used for improving the performance of project management processes.

Currently ONSOCIAL system is implementing the “Project Team Selection” use case, while development is under way for implementing more project management use cases, such as “supplier selection”.

5. Acknowledgements

The research presented in this paper has been co-financed by the European Union (European Social Fund) and Greek national funds through the Operational Program “Education and Lifelong Learning” of the National Strategic Reference Framework. In particular, the research work has been co-financed by the R&D
programs "ONSOCIAL" which take place in the context of the "ARCHIMEDES III" National Research Programme.

6. References


