PROCESS-CENTRIC ENTERPRISE WORKSPACE BASED ON SEMANTIC WIKI

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Abstract: We describe the design of a process-centric solution for a specific enterprise process, proposal development, in a large consulting company. The solution is based on a semantic wiki and aimed at capturing informal knowledge processes. It improves collaboration while allowing proposal managers to allocate, track, and manage the work of development teams. We motivate our system by data gathered from more than 60 potential users and validate the approach through usability tests. We discuss technical and acceptance issues as well as future steps necessary to maximize deployment of the system.

1 INTRODUCTION

The emergence of Web 2.0 tools with their ease of collaboration, and increasing trends of geographically distributed teams in large companies have prompted the need for improved collaboration tools in enterprises (McAfee, 2006). Many of Web 2.0 tools when transferred to enterprise environments have not been very successful. Therefore, there is a need for a class of enterprise customized solutions that can provide enterprise employees with improved ways to collaborate and share.

In this paper, we describe some recent efforts at deploying and testing Web 2.0 ideas in a large consulting organization (Accenture). We analyze the results of these early deployments and propose our approach to build process-centric collaboration workspaces that allow enterprise users to work more effectively. Our approach is based on semantic wikis and focuses on improving the proposal development process at Accenture. We report on the requirements gathering process, describe the details of the workspace design, present initial results and discuss the impact of these results.

2 MOTIVATION

Companies today are constantly looking to develop tools and methodologies for more efficient knowledge work. The goals of these efforts include exploiting the existing repositories better, supporting knowledge work of individuals, and enabling collaborative knowledge articulation, capture, transfer, and sharing.

With these goals in mind, we investigate the existing Web 2.0 type of tools already in use in Accenture and try to identify potential bottlenecks:

- A Wikipedia style wiki has been deployed for more than 2 years but the response from potential users has been underwhelming. Currently this wiki has around 1000 pages with Category:Acronyms type pages being the most accessed with 35% of all views, followed by 27% of all views being the Main Page.
- There is a wiki-based workspace deployed for a software development group for their internal needs but has not been gained enterprise-wide acceptance since it lacked official IT support.
- There is an enterprise-wide workspace that is based on Microsoft Office SharePoint Sever (Microsoft, 2006) that allows collaborative editing and contribution for registered groups. The advantage of this solution is the support by the internal IT department and hence the capability to integrate with other internal applications e.g. employees pages.
- Employees pages are a social network platform allowing micro-blogging, status updates,

connections with the central repository, reputation building through activity summaries etc.

The mentioned usage of wikis and employees pages is aligned with the idea of socially resilient enterprise (Farrell et. al, 2008) fostering blogs, wikis, social tagging and corresponding to the idea of participatory web within the enterprise. To assure success of adapting Web2.0 ideas to an enterprise environment, the support of internal IT is necessary. Since standard enterprise content management systems are rapidly moving in this direction, offering blogging and wiki capabilities (e.g. Microsoft Office SharePoint), it seems that the basic capabilities now exist to build Web 2.0 style collaboration and knowledge management tools for the enterprise.

Although the capabilities to build these tools are now available, the users in an enterprise are very different from those on the Web. In an enterprise, users log in with their ids and therefore do not benefit from anonymity which often fosters collaboration on the Web. In standard enterprise content managements systems as Microsoft SharePoint users have limited editing power. They are allowed to manipulate proprietary controls (e.g. web parts) and to interact with pieces of content as lists and document libraries.

In the following section we analyze major business processes in Accenture and perform interviews and surveys with a number of knowledge workers to investigate the needs for more flexible and advanced tools.

3 CASE STUDY

As in a majority of knowledge work oriented companies, knowledge management systems in Accenture deal with the result of the knowledge work rather than the process itself. Knowledge is created by employees during their daily tasks, but only the final products get uploaded to the central repository. This not only leads to loss of detailed information on how the knowledge coded in the documents is produced, but also only some documents are uploaded to the central repository and shared. Therefore only a portion of the knowledge is captured and even though employees go to a central spot – an intranet portal to search for information in the central repository - often their needs cannot be addressed and they rely on their personal networks for information. Since Accenture is a large consulting company with over 170,000 employees,

dealing with a number of domains, personal networks do not reach out to all areas. This need gives rise to Web 2.0 tools for capturing the knowledge process and finding subject matter experts or employees working on a similar problem e.g. the employees pages solution.

3.1 Problem Setting

Consulting companies base their business on project-based work, i.e., clients issue requests for proposals addressing the need to solve some of their problems, and companies respond with the proposal document. If successful the proposal will lead to a company being hired for that project. Hence proposal writing is an integral part of business. Important factors for creating a compelling proposal are:
- Explicit knowledge of the organisation gained through many years of operation, stored in the repository including templates, recommendations and guidelines etc.
- Tacit knowledge each individual possesses as a result of his experience
- Collaborative efforts of teams working on proposal preparations.

Although the focus here is on the proposal 'document', it is important to understand that the proposal development process is much broader and begins earlier in the business development lifecycle. The information is in people's minds and is reflected through their actions and decisions (e.g. an adopted strategy depends on the client, on the market, on the experience in the market, on past successful projects etc.). Thus the proposal writing process is an informal process and while formal guidelines exist decisions about paths to take in order to produce the final result are based on experienced individuals acting in a collaborative manner. While skilled employees use their tacit knowledge to produce a winning proposal, less experienced employees have to resort to the central document repository.

This gives rise to an application that can assure collaborative development of proposal documents, while capturing stages in informal processes of individuals and assuring easier access and reuse of knowledge. In a matter of speaking a process-centric and context-aware collaborative workspace assuring knowledge articulation, creation, transfer and sharing for employees distributed over workgroups and geographies.

For this setting we considered wikis as proposal team workspaces as in (Farrell et. al, 2008). Some additional reasons for using wikis are reported by

Majchrzak, Wagner and Yates (Majchrzak et.al, 2006) e.g. enhanced reputation benefit for active enterprise wiki users making work easier and helping organisations improve their processes. Or as reported by Denis and Signer (Denis and Signer, 2008) increased transparency over geographically distributed research teams even though the authors report that the impact is always greater in cases when there are no legacy solutions.

3.2 Requirements Gathering

In order to produce requirements for our prototype we conducted online-surveys, semi-structured interviews and work shadowing of interest groups. Table 1 lists the targeted organisations and their foreseen roles regarding system usage and deployment.

Table 1: Interviewed and surveyed user groups based on their foreseen roles.

Responsible entities for introducing and maintaining the system	Users of the system
Internal IT organisation	Consultants
Collaboration Technology & Business Leads	Dedicated Proposal Support Teams

Overall we interviewed and surveyed 50 people, and work shadowed 10 people - mainly members of the dedicated proposal support team that supports proposal teams in writing proposals for large projects, Figure 1. The interviewed employees had various relevant position levels as senior managers, managers, and consultants.

We initiated the requirements gathering process by a high-level survey on the usefulness of the current knowledge repository and enterprise search tools for targeted processes. 27 participants from the dedicated teams and consultants answered this survey. The main themes from their responses were around types of improvements and solutions for proposal development tools. Some of the comments are listed below:

A more advanced taxonomy for searching following the current <client's> request for proposals.

Increasing the contribution to the enterprise knowledge repository since a lot of documents are still kept on local machines.

Information relevant to the type of the proposal being developed should be displayed, based on workgroups or types of offerings, technologies involved etc.
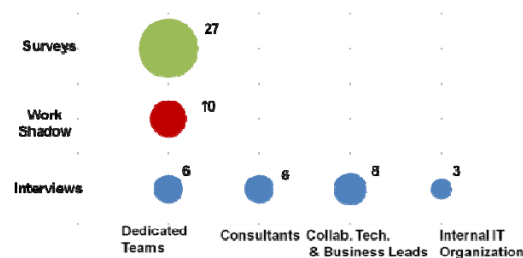

Figure 1: Requirement gathering methods vs. targeted groups within the company with indicated number of participants.

The work shadowing activity of a dedicated proposal support team during the life cycle of the proposal response revealed that: 1) there is no technology support for continuous refinements and updates taking place due to the highly collaborative nature of the proposal writing process spread over multiple locations, 2) there is a high overhead to maintain consistency across the different sections of the final product e.g. naming conventions, acronyms etc.

The final set of requirements was obtained through structured interviews, analyzes of already existing internal IT supported workspace solutions, and comments collected from enterprise social media channels on what should be done to better connect people. We don't go into the details of the requirements here instead we present a comment given by one of the interviewees summarising the general ideas of user requirements:

Easy to initiate group/project work sites with intuitive, user-friendly document collaboration capabilities without a need for job aids or training to learn how to use features.

3.3 Summary of Key Findings

The mentioned methods for requirements gathering produced a rich set of requirements organized around necessary functionalities the workspace should have (e.g. project task list with key milestones, document library, link to the central repository with relevant content, team calendar, issues log etc.).

By analyzing the proposal development process for different groups we reached several conclusions. Firstly, the information that is usually needed is diverse, fine-grained, and context dependent. Examples include information about a specific client, a specific industry, a new project the company is doing in an industry, similar projects that have been recently started (or finished) in related areas, credentials that the company has around a specific technology etc. Secondly, it is

clear that having more prepared and experienced teams will result in higher chances of winning a project but the individuals who make up these teams often rely on tacit, subjective knowledge gained through personal experience. Therefore by capturing different steps and results in their work process assuring knowledge articulation, collaboration and sharing we can help others become more effective.

4 WORKSPACE DESIGN

To address the issues in this case study around informal processes and to increase productivity of knowledge workers two kinds of support tools are being developed: 1) helping knowledge workers find the right information given their current context and task and 2) helping large project teams work collaboratively, supporting knowledge articulation and sharing. The first class of tools considers usage of information technologies mainly relying on Information Retrieval and Knowledge Discovery techniques for knowledge management. In this paper we aim to address the second challenge and help large teams work collaboratively while trying to capture informal tacit knowledge. The goal is to achieve this without introducing considerable overhead to the knowledge worker.

4.1 Semantic Wikis

In (Schaffert et al., 2006) the authors described semantic wikis as solutions merging social software assuring choice of processes and supporting collaboration with Semantic Technologies enabling structuring information for easy retrieval, reuse and exchange between different tools. With this in mind there have been a number of structured wiki projects both as research efforts and in the last years as commercial solutions: Semantic Media Wiki (SMW) (Krötzsch et al., 2006.), IkeWiki (Schaffert, 2006), SemperWiki (Oren, 2005), TikiWiki[1] with Semantics Links extension, Confluence with Wikidsmart[2], 2010), SMW+ Semantic Enterprise Wiki[3]. On one side traditional wikis enable features as: editing in a browser, use of wiki syntax, rollback mechanisms with versioned pages, strong linking between wiki pages and collaborative editing. On the other side, semantic wikis enable machine

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[1] *http://doc.tikiwiki.org/Semantic*

[2] *http://www.zagile.com/products/wikidsmart.html*

[3] *http://wiki.ontoprise.de/smwforum/index.php/Main_Page*

readable representation of underlying wiki structures, by allowing annotation of links between pages e.g. through giving them certain types (Schaffert et al., 2006). **Link annotation** enables: **enriched content** by displaying context relevant information based on the semantic annotation (e.g. pages regarding a company can be enriched by a list of alliance companies); **semantic navigation** through enabling additional information regarding what each link is describing (e.g. Company page can have links hasEmpoyees, isLocated and wasFounded displayed for navigation etc.). **Semantic search** enables searching for related concept instances using the underlying knowledge base (e.g. Company x hasClient would list all annotated clients of a certain company). **Reasoning** offers inference of implicit information by using the wiki knowledge base as well as external sources.

4.2 Informal Processes

We start from the intuition that tacit informal knowledge of an employee is learned through years of experience. We consider two main issues: 1) How to better capture different steps (or results) of different tasks so that employees referring to the central repository have more information and 2) How to enable the transfer of this knowledge to new employees.

The major differentiator between our setting and typical knowledge management setting dealing with improved navigation browsing and searching is that we focus on the process, in our case the informal process of proposal development, and not only on the end product –the final document.

In (Granitzer et al., 2008) the authors considered using semantic wikis for organised provision and efficient retrieval of information. Through their analysis of different studies they claim that 80% of knowledge which is required for performing knowledge work is a result of informal learning. Wikis were chosen as a supporting tool for informal learning since they naturally foster participation and collaboration. In (Schaffert, 2006) Schaffert introduces ideas around merging social software (wikis, blogs, social networks etc.) dealing with social connections and human readable content dealing with Semantic Web with formal content and its formal connections. Semantic wikis are therefore seen as a solution enabling interrelating of informal unstructured collaboration and conversation records in wikis. However Granitzer et al. only give an example scenario, we take their hypothesis further on and develop a prototype build upon extending initial ideas.

Additionally recent work from (Dengler et al., 2009) extends the Semantic Media Wiki software with process modelling and visualization functionalities. The reasoning is, similar to the proposal development process considered in this work, that formally documented corporate processes insufficiently reflect the reality of daily work. They are also enacted in an informal way with frequent changes. Since our proposed solution is also a collaborative approach to process design where process descriptions are gradually improved by different contributors SMW has been chosen as a solution for developing the proposal development workspace.

4.3 Proposal Development Workspace

The proposals are created as a response to a client's request for proposals and they need to describe how the company plans to address the client's problem and include other relevant credentials and expertise the company has for the client or in the area. This use case is designed to provide context-sensitive support for proposal writing/review that is based on the top-down process defined by Accenture and coupled with the use of informal processes by individual groups and consultants. We show the abstracted top down process for proposal development in Table 2.

Once a client request is identified the project manager can select his team members and create the proposal outline. To help him in this process we developed a set of add-ins for Microsoft Word which enable easy definition of the proposal outline and finding experts based on the document provided by the client. In this paper we don't not go into details for this tool since it is a part of the broader strategy including algorithmic approaches for finding experts in the company and analyzing documents.

Moreover, now a project manager can create a new proposal development workspace from the comfort of the document itself. A preconfigured project workspace is created in a matter of seconds (this is achieved with DotNetWikiBot Framework[4]) and the selected team members are already added to the workspace. The workspace is preconfigured so the data about the team members is added to the wiki directly from the official employees pages. Now a project manager has all the data about his team members. Furthermore the section outline information defined through the Microsoft Word

add-in has been automatically passed and wiki pages for each section are created, with default deadlines and allocation of section owners and section reviewers from the team members. These allocations can be easily updated through form-based editing enabled by the Semantic Forms extension[5].

Table 2: Abstracted steps from the formal process for proposal development.

Step	Description
1	Identify requirements
2	Identify collaborators/team
3	Develop high level themes
4	Create outline with sections
5	Assign sections to individuals
6	Support individuals in finding content to complete sections
7	Support checkpoints and alerts
8	Consolidate drafts of sections and ensure consistency, compliance, high-level theme integration, tracking changes
9	Consolidate to produce final document
10	Review
11	Finalize

Once the workspace is created using the above described 'wizard', a collaborative approach can be taken to develop high-level themes, and add client-relevant information and data tailored to the particular instance of the proposal development workspace. Additional data is also retrieved from Accenture's internal sources. Furthermore the workspace also has a capability that allows the project manager to define the basic set of tasks his team members need to follow either based on a predefined formal process or some modification (e.g. an improved process that has proved to work better on a number of similar projects). By following formal processes or proposing modifications to the process team members can collaboratively develop the document and the workspaces will keep trace of their activity. In the long run some level of the informal process can be captured in the collaborative workspace including collaborative development of best–practice processes to follow.

To give support for steps 8, 9 and 10 from Table 2 the document writers and reviewers have to rely on their own experience and a set of algorithmic solutions being developed as a support but outside of the scope of this paper.

We are using SMW family of extensions for the MediaWiki to develop our workspace and to help proposal managers optimize the proposal writing

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[4] http://dotnetwikibot.sourceforge.net/

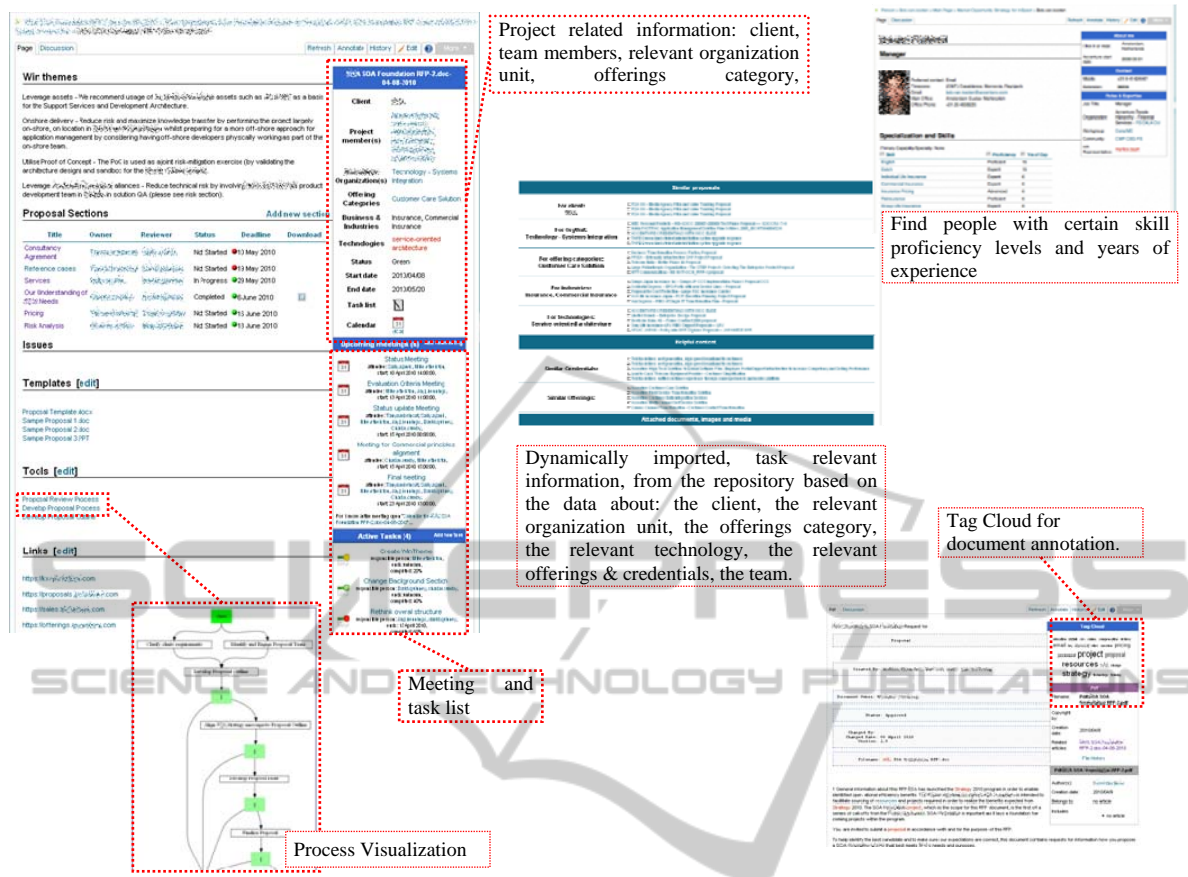[5] http://www.mediawiki.org/wiki/Extension:Semantic_Forms

Figure 2: Collaborative project workspace, with main features and functionalities.

process and to help team members effectively collaborate. The following functionalities are implemented (also see Figure 2):

Automatic Configuration of a **new proposal development workspace** which is customized for proposal development with templates and forms enabling functions as:

- *adding team member by enterprise id,*
- *adding proposal sections,*
- *allocating section contributors and reviewers*
- *allocating, adding and organizing meetings,*
- *adding and organizing tasks,*
- *calendar (including importing data into MS Outlook) and timeline view,*
- *task list etc.*

Dynamic Data Population of a new workspace from live Accenture's sources (employees pages, offerings data, credentials data, similar proposals etc.). This is achieved through exploiting link annotations in SMW. The project manager just needs to define several fields in a generic form description of the workspace as who the client is or to which class of offerings the proposal belongs to

and the relevant information is imported from Accenture's data sources.

Faceted (Dynamic) browsing for querying pages of the imported content through the use of *Semantic Result Formats extension[6]*.

Content Annotation (extension developed specifically for this use case) of uploaded documents to SMW based on Accenture's vocabulary (~4000 terms) in order to reduce the burden of manually tagging documents when uploading to the central repository enabling knowledge sharing. For each uploaded document a tag box displays discovered properties e.g. for every pair of property name and property value (e.g. PertinentToCountry :Latvia, PertinentToDomainSpecialty: BusinessIntelligence) from the vocabulary the appearance of a value in the text enables the annotation of that text with the property name.

Desktop-based Access and import capabilities from SMW to MS Word for facts, sections, offerings,

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[6] *http://wiking.vulcan.com/dev/index.php/SemanticWikiTag_extension*
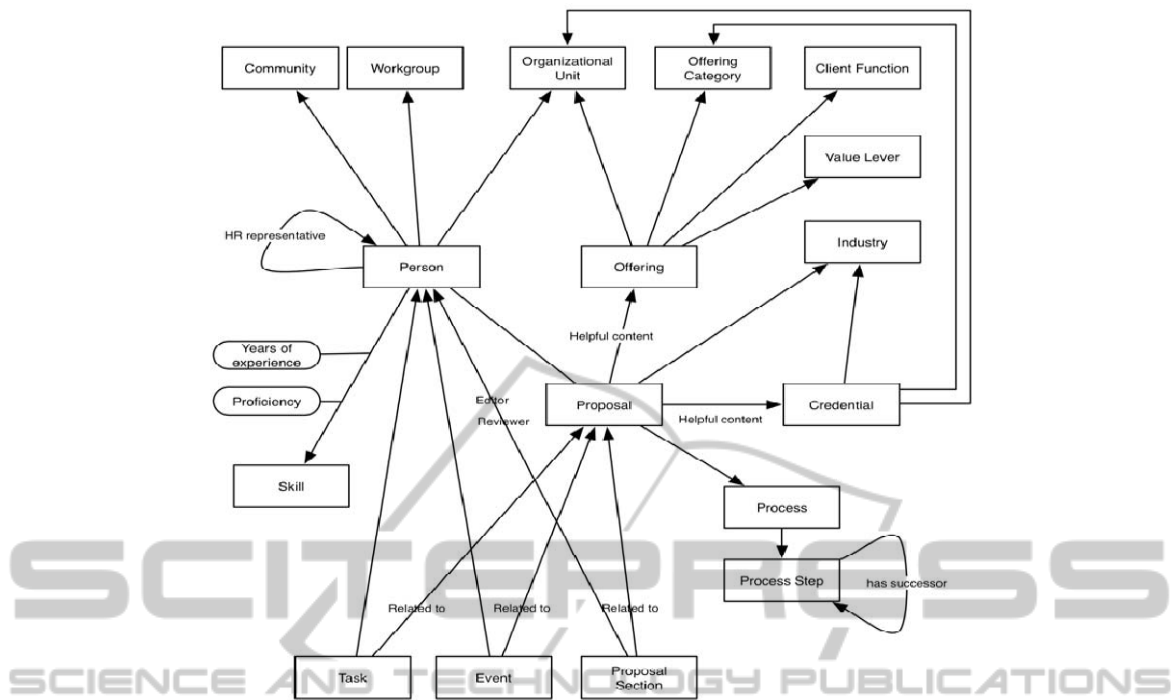
Figure 3: Knowledge elements and relations among them for the proposal development workspaces.

etc. The Semantic WikiTag extension enables to access data on the wiki through a Wiki Office Add-in[7].

Process Visualization allows representation and visualization of formal processes (Dengler et al., 2009).

Additional expansions as Halo[8] with an advanced annotation mode allows easier semantic content annotation through *what you see is what you get* WYSIWYG-like manner. So there is no need for use of *cryptic* wiki syntax.

In Figure 3 we can see a simplified view of the underlying knowledge structure for the proposal development workspace. The initial steps when designing the workspace were governed by the existing requirements (section 3) and by inherited structures from the companies knowledge exchange e.g. employee's pages already had attributes as name, location, level, skills, proficiency, organizational unit etc.

In a similar manner each automatically imported knowledge element had a predefined set of attributes Table 3. These details are omitted in Figures 3 to assure simplicity. We can see that every person has a *skill* and *years of experience* and *proficiency level*

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[7] *http://semantic-mediawiki.org/wiki/SRF.*

[8] *http://semanticweb.org/wiki/Project_Halo*

for that skill.

A person can be a member of a community of a workgroup and can be either an editor or a reviewer of a proposal section. Furthermore he is a participator in a task or an event. Every process is made out of successive steps. A person, task, event and process are all members of the proposal workspace, which on the other side has helpful content e.g. offerings and credentials.

Table 3: Knowledge structure of some of the imported knowledge elements.

Knowledge element	Attributes
Credential	id, free text, type, organization, industry, service line etc.
Offerings	id, free text, offering category, relevant function, development status etc.
Proposals	id, client, free text, offering category, organization, technology, industry etc.

Hence every time a new workspace is created the information in the workspace is organized alongside defined categories and properties. Overtime for every project detailed information will be captured, including steps that team members took to reach the final product, as well as results of intermediate steps, and issues confronted with. Through the detailed log of their actions and the attached documents at different phases, the informal processes can be better

captured. Furthermore the participants will have an option to modify formal processes and help build best practice processes, collaboratively. In case that they are willing to annotate the free content and build-up the underlying knowledge structure they can do so either by using the basic functionality we provided (automatic annotation using Accenture's vocabulary or other external sources) or they can benefit from an easy annotation interface (Halo extension).

5 RESULTS

We performed a number of tests regarding basic technical requirements, stability, robustness and acceptability of performance of the developed prototype by interviewing domain experts. The goal was also to assure compliance of the prototype workspace with the requirements. In addition to the tests, we also interviewed potential users of the system and found that the process-editing functionality needed to be easier to use (similar to Microsoft Visio) and that some of the search functionalities needed to be faster.

During the tests the prototype was both demonstrated and domain experts stepped through user procedures to identify usability defects and further user requirements. These tests were aimed at project managers who would initiate the usage of a collaborative proposal development workspace and consultants (team members who would use the collaborative features of the workspace).

6 CONCLUSIONS AND FUTURE WORK

This paper describes efforts around the development of a process-centric solution for a specific proposal development process in Accenture based on semantic wikis, and early efforts at deploying such a solution to a small group of users.

Through using semantic structure in a wiki the proposal development workspace aims at tackling the issues of collaborative knowledge articulation and sharing while allowing proposal managers to allocate, track, and manage the work of the proposal development team. This approach enables individuals to collaborate while using data that is relevant to their current task (e.g. dynamic imports from the company repository). We also enable them to benefit from lightweight semantics, facilitated

through structured data, to easily organize tasks and meetings, create automatic reports, reuse information and correct inconsistency problems.

The developed solution offers project leaders the ability to organize documents (e.g. proposal documents) by allocating sections to different team members, keeping track of deadlines and tasks through a calendar and timeline view, exploiting version control, enabling new ways of data aggregation etc. At the same time the workspace is designed to support team members by automatically displaying helpful and reusable content related to the project. For example a team workspace for proposal development offers content like similar proposals, offerings and credentials. They are imported from Accenture's repository based on the client, and organizational unit, offerings category, industry and technology the proposal document is related to. On the other hand information can be easily pulled from the wiki into documents with an add-in for recognizing wiki entities in the written text and offering import and browse functionality.

Several issues around the adaptation of such a technology have appeared in an environment which already offers a solution for team workspaces that has limited capabilities but is supported by the IT organization. By including the new user requirements coming out of this study and assuring compatibility with existing internal IT solutions we believe we can overcome this problem.

We believe that the initial success of our prototype was due to the integration of the SMW with internal enterprise data sources (containing data about people, vocabulary terms, etc.), and integration with document editing tools (MS Word). The key features we plan to implement in order to improve the adoption of this prototype are improving the user interface (giving better section editing and process editing interfaces), and improving process visualization.

We also plan to analyze activity logs to algorithmically detect steps in an informal process and display it in the wiki for comparison with formal processes. Assuring factual consistency for content being shared and used by team members while writing the proposal document is another direction for future work. This is planned to be addressed through knowledge leveraging on the underlying wiki structure and the facts stored in the proposal workspace.

We believe that the possibility of having a semantic wiki enabling a workspace in an enterprise opens many doors for better knowledge capturing, collaboration and knowledge transfer. We believe

that starting from a solution that offers more integration with mentioned internal IT supported solutions will assure better adaptation.

Overall the predefined team workspace, the imports of knowledge from Accenture's repository and the connections to the familiar work environment aim at facilitating the use of the wiki as a collaborative project workspace offering possibilities and incentives to exploit the collaborative nature of Web 2.0 technologies that have been so successful on the open Web.

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