

# Promoting Best Practice Sharing within Organizations

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**Abstract:** In recent years we are witnessing the wide adoption of Web 2.0's social software tools (blogs, microblogs, wiki, forums, shared calendars, etc.) within organizations complementing (or even replacing) existing enterprise applications. This trend is justified by the improved immediacy with which information can flow among the members of the organization and by a better support of agile, emergent cooperation models that re-shape the practices and the processes within organizations, allowing their continuous refinement and alignment with the organizations' missions and evolving know-how. One of the problems that arise in this new scenario is that as more and more practices and processes include interactions with several tools, often not controlled by the organization itself, it becomes more difficult to manage the knowledge they embody. In this paper we present an approach to mitigate this problem that plays nicely with the enhanced participation mechanisms triggered by social software. Our proposal revolves around the use of semantic wiki technologies as knowledge management tools; specifically we focus on dealing with practice and process-related knowledge, emerging from users interactions with Web 2.0 applications, and how this knowledge can effectively be represented, shared and made persistent.

## 1 INTRODUCTION

In recent years we are witnessing a trend that sees Web 2.0-based social software tools complement (or even replace) enterprise applications within the IT landscape of several organizations. This phenomenon, often referred to as Enterprise 2.0 (McAfee, 2006), has seen a steady growth and the use of social software tools is part of the everyday experience of many not just for personal interest but to carry out work-related activities as well.

The integration of social software tools within the enterprise can follow two distinct paths. The first path leads to installing and managing specific tools within the organization. For example a wiki and a shared calendar are installed in the enterprise's servers and are accessed as web applications. The second path leads to the adoption of tools managed by external organizations using a Software as a Service (SaaS) provisioning model. This is the case when, for example, Twitter<sup>TM</sup> and Google Calendar<sup>TM</sup> are used routinely to coordinate the work among members of the organization. Both solutions present distinct advantages and disadvantages but the SaaS-based one opens new issues to deal with. Among these we can list: security, privacy, control of information, processes and

practices-related knowledge. In this paper we focus on this latter issue. The ability to represent, share and reason on this kind of knowledge is of particular relevance within organizations. As per the knowledge management (KM) discipline organizations' knowledge is embodied in persons, practices and processes; not having control on processes and practices-related knowledge means ignoring most of the know-how that supposedly constitutes the main competitive advantage of an enterprise. This problem pre-dates the advent of Enterprise 2.0 but is severely amplified by it: social software is a strong driver for emergent coordination, it improves people participation and pushes them to re-shape the practices and the processes, allowing their continuous refinement and alignment with their missions and evolving know-how. In this agile environment, mostly when knowledge-workers are involved, structured processes show their limits and evolve into less well-defined entities that we call *organizational best practices*. If, on top of that, these practices include interactions with lots of different IT tools not managed by the organization, it is clear that capturing this evolving knowledge is not a trivial task.

In this paper we propose a method and a platform to describe and share organizational best practices and the knowledge they embody. The method we propose

revolves around the use of a classic Enterprise 2.0 tool: wikis; this allows us to use social software to deal with social software-related knowledge, easing the integration of our method with the IT landscape it is meant for. In order to allow a more structured representation of this knowledge and ease searching and automated reasoning we decided to use semantic wikis. Other research works exist that make use of semantic wikis to manage process-related knowledge (a brief state of the art is presented in section 2) but the nature of structured processes is quite different from that of organizational best practices so these works are not directly applicable to the context we are focusing on; also: we explicitly limit our method to practices enacted by using social software tools or, more generically, Web 2.0 applications. The platform we present, that can be used to enact our method, is based on Semantic Media Wiki (SMW) (Krötzsch et al., 2006) and on a web browser extension, WikiRecPlay, used to ease the creation of the process-related knowledge and to recommend available best practices to the users depending on their navigation context.

It should be noted that, while the main focus of the paper is on enterprise environments, most of the concept we are going to develop are applicable to any structured organization and, with some distinctions, to generic communities as well.

This paper is structured as follows: in section 2 we present a survey on how (semantic) wikis are used to represent enterprise knowledge. In section 3 we introduce our model, how we represent organizational best practices and how we use semantic wikis to organize and share the related knowledge. Section 4 is about the platform we implemented and its two main components: a semantic wiki and a web browser extension. Conclusions are sketched out in section 5.

## 2 ENTERPRISE, WIKIS AND KNOWLEDGE MANAGEMENT

After their explosion in educational and public settings, wikis are increasingly used to create, refine and share knowledge within enterprises as well. In (Majchrzak et al., 2006) authors surveyed 168 corporate wikis, proving that these tools are sustainable even in long-term projects, a result confirmed also by the analysis of (Kusssmaul and Jack, 2009); in (Voigt et al., 2011) authors discuss issues and benefits of the adoption of wikis for small and medium-sized enterprises (SME) too.

Nonetheless, the unstructured nature of wikis is still an obstacle to the full automatic processing of knowledge. Semantic wikis, such as Semantic Media

Wiki, have been introduced to overcome such limitations: even if not yet widespread within enterprises, they have great potentialities in this context too.

Basically, a semantic wiki is a wiki system enabling users to write collaboratively semantic data about a given domain. Wiki pages, in fact, map concepts of the domain and usually are composed of both unstructured text and formal assertions, that can be exploited by reasoners and semantic query engines.

The interesting point for our discussion is that semantic wikis can be used for enterprise modeling too. Moki (Ghidini et al., 2009) is one of the most relevant projects in this area. It is a wiki-based environment designed to let users with different skills working together and create a sound enterprise model. Different MoKi users can access and create content at different degrees of formality, according to their competencies. MoKi is based on Semantic MediaWiki. It associates one wiki page to each (simple or complex) element of the model. The page contains both an informal description of the element in natural language and a formally structured part, with assertions about that element and relationships with other elements.

KnowWE (Baumeister et al., 2007) is another interesting knowledge engineering tool, designed for supporting decision-making. Basically, it is a semantic wiki that is further extended to parse additional markup and to process problem-solving instructions. The system, in fact, includes interfaces for expressing rules, decision-trees and fault models and an engine that parses those instructions and automatically evaluates solutions.

An application of semantic wikis particularly relevant for this work is the modelling of (enterprise) processes. The most relevant proposals were surveyed in (Dengler et al., 2011). In (Hussain et al., 2009) authors proposed a wiki-aided process to create business process specifications. They basically extended the MediaWiki syntax to allow users (business domain experts) to describe the requirements of a system in a semi-structured natural language, that can be exported into RDF and BPEL.

Wikiing Pro (Dengler and Vrandečić, 2011) and BP-MoKi (Francescomarino et al., 2011) integrates Semantic MediaWiki with Oryx<sup>1</sup>, a graphical editor that users can exploit to build the model. In particular, BP-MoKi is a customization of MoKi that also supports constraints definition and validation (through an external validator).

<sup>1</sup><http://code.google.com/p/oryx-editor/>

### 3 CAPTURING AND SHARING ORGANIZATIONAL BEST PRACTICES

The main goal of the research we present in this paper is to investigate how to support enterprises in collecting, persisting and sharing knowledge about best-practices and processes that users carry on by interacting with social software tools.

Considering the successful experiences presented in the previous section, wikis are good candidates for these tasks but a challenging issue needs to be faced: how to model and capture such know-how. In fact, the dynamic and non-predictable flow of information characterizing organizational best practices makes it impossible to use structured, prescriptive approaches. In most cases, in fact, users refine their activities incrementally and improve the process at each iteration but the global process is not encoded anywhere. The visibility of each user is “local” but the interplay of their activities generates distributed and emergent processes. Our goal is to capture this kind of interactions as well as their related knowledge.

We are seeking a more flexible approach that, on the one hand, is able to capture such knowledge and to make it representable, documented and processable and, on the other, it is not difficult to be deployed to the final users. Our solution basically consists in capturing interaction paths with social software by directly monitoring browser’s activities and using a semantic wiki as back-end to store, organize, search and share such know-how. In order to present it, we discuss separately how to (1) model, (2) share and persist and (3) search/recommend such know-how.

**1 - Processes as Event-based Parametric Synchronizable Interaction Sequences.** in order to embrace a broader definition of process that is also able to capture organizational best-practices as described so far, we model them as the interplay of sequences of activities carried out by single actors. These activities take the form of interactions with web applications, sequences composed by (parametric) interaction steps and synchronization steps.

Each interaction step is associated to an event occurring on a web page. Clicking on a link, filling a form, selecting a menu option, copying&pasting a piece of content, refreshing an iframe are only a few examples of such events.

The fact that interaction steps can be *parametric* is another very important aspect. It is useful, in fact, not only that sequences are repeatable (so that can be shared within the enterprise) but also that users can repeat them with different input values.

Finally, synchronization steps are used in order to model cooperation and distributed activities. This means that interaction sequences can be suspended until a given event occurs, or another step is completed (even belonging to another process) or a timeout expires.

Consider, for instance, a wiki page describing the requirements of a project that, in order to be approved, need to be checked by three different people in a team. The approval process can be implemented by using a page associated to the requirements’ one and by requiring reviewers to publish reviews as distinct sections of that page. The sequence for the approval process includes a step that halts the sequence waiting for the three reviews to be posted. Each reviewer will then follow his/her own process to fill the proper section in the review page. When all sections will be filled, the synchronization step will resume and the main sequence can be resumed.

A detailed discussion of this coordination model is out of the scope of this paper, but can be found in (Rossi, 2012). It should be clear, however, how sophisticated interplay among activities can be modeled easily with this approach.

**2 - Using Wikis to Share and Persist Sequences.** after making explicit the best practices-related knowledge, we need to persist it and make it promptly accessible. The easy way in which users can read and write content, the sophisticated surfing capabilities (backlinks, indexes, recent changes and special pages) and the versioning/tracking features pointed us to wikis, supported by the promising results of previous research in this field. We propose to store each sequence in a wiki page following syntactical guidelines to write information about each step, its associated event and its execution. From a technical point of view, this is not an issue.

A relevant feature of our proposal is the possibility of intermixing structured descriptions of sequences with text, allowing users to enrich pages with contextual information that others can exploit to better understand and share knowledge. This, however, opens challenging issues with respect to the coexistence of structured and semi-structured information. Since wiki pages can be freely edited, in fact, users could ‘corrupt’ the descriptions of sequences making them not in line with their textual counterparts. Apart from non-technical considerations (i.e. wikis are meant to be writable and their open editing model is a strength instead of a risk, leveraging on the community enthusiasm and skills), researchers have proposed different solutions to mitigate this issue such as using templates, automatically generating forms and implementing validation post-processors. For in-

stance, Light-Constraints wiki is a framework to deal with constraints and validation rules on wiki content, that does not alter the wiki open editing philosophy (Di Iorio and Zacchiroli, 2006). It basically consists of encoding constraints as validator functions that can be associated to pages and used to check whether the constraints have been respected, when viewing or saving those pages. While it would still be possible for users to de-synchronize the formal representation of a sequence with its textual (and graphical) description, the use of validators should prevent this from happening in most cases.

**3 - Searching and Recommending on Semantic Wikis.** Semantic wikis have pushed forward the potentialities offered by wikis such as text-based searchers, recent changes lists, backlinks, indexes, and so on. They enable users to write collaboratively semantic data about a given domain. Wiki pages, in fact, intermix unstructured text and formal assertions, that users can write quite easily by exploiting ad hoc interfaces and/or natural-language syntaxes. These assertions can be exploited by reasoners and semantic query engines, and provide a rich knowledge base to the final users. Our framework relies on a semantic wiki and users are allowed to annotate wiki pages: by annotating pages associated to sequences, they enrich sequences with a network of information that can be used as basis for knowledge representation and diffusion. Semantic descriptions of sequences can be exploited to search sequences related to the current one, to search sequences of a given author, to mine data on sequences and so on. Sophisticated recommendation tools can be built on top of such information. The list of semantic properties that can be set on a sequence is completely open. Users might decide to characterize them by their scope, by their application domain, by their reliability, stability and so on. Some of these properties can also be generated automatically, derived from the information about versions and page history (i.e. frequency of modifications, size of modifications, authorship, etc.) and integrated in the overall knowledge-base. The interesting point is that the community of users could agree on a set of properties useful for characterizing sequences, supported by the open editing model of wikis, and refine that set incrementally. Finally, note that semantic data could also be integrated with other information collected on wiki pages, in order to build a richer knowledge-base. Some wiki modules, for instance, allow users to rate pages (that can be useful to measure the popularity of sequences), or to manage users' profiles (that can be useful to measure the reputation of an author) or to tag pages (useful to create a folksonomic characterization of sequences).

## 4 A PLATFORM TO SUPPORT ORGANIZATIONAL BEST PRACTICES

Here we present a software platform able to support the approach described in the previous section; this platform includes two main components: a semantic wiki, and a web browser extension. In our current implementation of the platform we are using Semantic Media Wiki and WikiRecPlay respectively. SMW provides support for sharing interaction sequences (each sequence is represented in a separate wiki page), for making them persistent and for searching them; WikiRecPlay provides support for recommending potentially relevant sequences to the users from those stored in the wiki, for extracting sequences from users browsing sessions and for automated replay of sequences available in the wiki.

The page describing a sequence contains all the details needed to acquire the knowledge about how to replay the sequence and describes each interaction and synchronization steps that it includes. Specifically, the wiki page contains both a human-readable and a machine-processable representation of the sequence. The human-readable representation contains all the details about the elements of the web page shown to the users that they have to interact with (form fields to be filled, buttons to be clicked and so on) and how the browser contents changes in relation to these interactions. The machine-processable representation is used to formally describe all the details of a sequence; it is included both for semantic disambiguation purposes as well as a potential input to automatically replay the sequence.

Consistently producing sequence pages can be perceived as a daunting task for most users (and probably it is), this is why WikiRecPlay can be used to automate it. WikiRecPlay is a web browser extension (currently available for Firefox) that (among other things) records the interaction of the users with the web page they are visiting. At any point in time users can review their browsing session and decide that a certain sub-session constitutes a sequence. They can then mark the first and the last step, the data fields that have to be considered parametric and insert synchronization steps where needed (these are the steps that pause the replay of a sequence until a given event occurs). Basic semantic metadata can be specified at this point; further semantic information can be entered later by directly editing the corresponding page in the wiki. It is also possible to mark which step description has to contain a screenshot of the web page that is shown when the step has to be executed. Once this is done the sequence can be automatically uploaded to



application have been presented in the past, the most notable one being CoScripter(Leshed et al., 2008). While also CoScripter makes use of social software tools to share the interaction sequences, the similarities between the two approaches end there. In our approach a best practice is not determined by the interaction of a single actor with a web application but it is (possibly) the result of the interplay between several actors' interactions. We also have a more refined way to semantically enrich the information related to the best practices and we provide a more general knowledge framework of which what we presented is just a part.

The maturity of the project is another difference between CoScripter and our work. We have not tested yet our proof-of-concept implementation with a large community, while CoScripter has been successfully adopted by thousands and thousands of users. A full evaluation of our approach cannot prescind from such a real-world analysis. Thus, this will be the next step of our research. We are planning to deploy our solution in an enterprise context; at the same time we plan to open the access to the software tools to the broad public in order to create other feedback channels.

Interesting results could be also obtained by monitoring users' interactions with the social software tools and with WikiRecPlay we can collect a significant amount of data that can be mined in order to extract further knowledge. These and other interesting research ideas - such as improving the recommender system, integrating profiles and sophisticated visualizations processes embodied by sequences - can enrich the approach we proposed in this paper.

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