Bridging the Gap between Social Software and Business Process Management: A Research Agenda

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***Abstract*—Social software supports various actors in producing user-generated content, developing and maintaining social relationships as well as establishing computer-mediated interaction and collaboration. These capabilities of social software provide manifold possibilities for a more effective and flexible design of business processes. At the same time new process management approaches allow a tighter integration of data in process execution, which leads to less rigid and less prescriptive process definitions. Main goal of this PhD project is the development of a new modeling paradigm that empowers end-users to collectively design and adapt workflows in a bottom-up fashion. The proposed solution integrates data in the process execution and is based upon adaptive models that are open for continuous improvements from end-users in order to take advantage of the collective intelligence of domain experts in an organization. In this paper we present the research agenda for our long-term goal of bridging the gap between social software and business process management.**

I. Introduction

Social software supports the communication and collaboration among individuals and increases the scope of interaction [1]. One of the key concepts of social software is that the desired results are achieved collectively by exploiting the knowledge of the involved stakeholders allowing for continuous improvements of these results. Organizations are increasingly utilizing these concepts from social software, such as Enterprise 2.0, as a new way of business communication that can result in highly productive and collaborative environments for knowledge workers [2].

While these organizations already have a profound understanding of how social software can be used for advertising and marketing purposes, these technologies will be utilized to endorse other organizational activities, e.g., collaboration, innovation, and knowledge sharing, in future scenarios [3]. Hence, we argue that social software provides manifold possibilities in other domains that need to be further investigated.

Simultaneously, organizations search for solutions to quickly adapt their business processes due to rapidly changing market requirements. This leads to business processes that need be constantly refined to meet these new requirements, laws, and structures of the organization. As a result recent research initiatives are paying more attention to improve the flexibility of workflow management systems [4], [5], [6]. Main challenge towards more flexibility is the missing integration between business processes and the data they process [7]. In particular, processes that are data-oriented cannot be treated independently from the data that is stored in applications. This requires a better integration in order to implement evolving business process in the supporting information systems, whereas changes on attribute values of data determine the progress of the process.

With the increasing utilization of social software in organizations and the need for more flexible business processes, we aim at bringing both concepts together to empower users to design and adapt business processes in a bottom-up fashion. We envision a new modeling paradigm that enables the information system to evolve with changing business requirements and information demands from stakeholders. In line with [8], our goal is to improve the performance of process-aware information systems by extending the technology characteristics of existing social software systems without neglecting the utilization of end-users.

Next to the need of organizations for more flexible business processes, the proposed solution in this paper enables a better support for collaborative processes. In [9] workflows are divided into four classes depending on the repetitiveness and predictability of the involved tasks in the workflows:

- *Production workflows* are used to support processes that are repetitive and predictable. They are used to describe the core processes in the business architecture of an organization.
- *Administrative workflows* support processes that are repetitive and predictable as well, but much simpler compared to production workflows.
- *Collaborative workflows* include iterative tasks so that it is much more difficult to predefine the following steps in the process. These workflows consist mainly of tasks that are performed by humans.
- *Ad hoc workflows* are limited to simple communication mechanisms and tracking of states. They are controlled by humans and have no predefined structure.

Given these definitions, this work focuses on workflows for business processes that require a high degree of flexibility and new means for collaboration in organizations. In addition, we aim at empowering users to collectively design these workflows using concepts from social software. The main contribution is a new modeling paradigm for information structures and workflows that evolve with changing requirements and incorporate concepts from social software. Furthermore, we will lay the ground for future research projects dealing with collaboration aspects and utilization of social software in other organizational activities.

After revisiting related work, the paper continues with the research questions for our goal of bridging the gap between social software and business process management (BPM). The research methodology to achieve this goal is presented. Finally, we elaborate the proposed solution before the paper concludes with a summary.

II. Related Work

There is a variety of different approaches targeting a better integration of BPM and social software. Research on BPM is increasingly working on a higher flexibility of workflow management systems in order to adapt to changing business processes.

Erol et al. [10] analyze the relationship between BPM and social software. They argue that flexibility and adaptability in workflow management research can benefit from social software. They identified three dimensions for Wiki scenarios in organizations. The organization of the involved community describes to which extent stakeholders can participate in the knowledge development, ranging from bottom-up to top-down approaches. With specificity of Wiki objects is the data structure of a Wiki object symbolized and to which extent it underlies a formal definition. The desired completeness describes, whether the content is under continuous evolution or a final version is developed. In order to develop workflows within Wiki systems a higher degree on organization and object specificity is required compared to simple Wikis for knowledge collection. They conclude that a Wiki enabled workflow system seems to be an ideal framework to address the need for flexibility and adaptability. Furthermore, they suggest a methodology that avoids the use of control flows. However, the authors do not detail how a solution for this goal can be achieved.

A social workflow system is presented by Neuman et al. [11]. In this paper some key properties from Wiki systems that are also desirable for lightweight workflow systems are defined. Based on these properties the authors identified the application based state and workflow management as the most predominant missing property. In the proposed solution every Wiki page is extended with a formal definition of a workflow in terms of states and actions. Transitions between these states are triggered by submit buttons. However, the approach suffers some limitations related with the execution of the process and information structures in their approach. It is not possible to create sophisticated information structures, i.e., data types and relationships among them. As a result the process execution is based on submit actions and not on changes of attribute values.

The research group around Künzle et al. proposed a framework for object-aware process management to integrate data in the execution of processes [12]. Based on an analysis of different domains the authors conclude that many processes are not adequately supported by process management systems and they identify the missing integration of data as one major reason. Nevertheless, they do not propose how the data objects and attributes are actually implemented in an application context. In this research project we focus on the extension of social software systems and the required modeling paradigms in a collaborative context. In [13], the authors recognize the need for process flexibility for any process-aware information systems. Especially for processes that are integrated with data require not only evolution of process schemas, but also for data as well. The paper describes concomitant changes of different data schemas as the main challenge in their approach. However, that paper does not propose a comprehensive solution to cope with the challenge of schema evolution.

Dollmann et al. present a tool for collaborative business process modeling in [14]. The authors argue that there is a need for collaborative process management since organizations are increasingly cooperating, e.g. in value chain networks. The approach is mainly supporting during the definition and modeling step in the business process management life cycle. However, the solution is limited to petri nets and event-driven process chains. Furthermore, it does not improve the flexibility of the business processes.

Bruno et al. [15] identified key challenges for enabling agile BPM with social software. They refer to agile BPM when it is able to react quickly and adequately to internal and external events. In order to meet the requirements for agile process management they identify four features of social software as crucial: weak ties, social production, egalitarianism, and mutual service provision. The focus of this paper is to integrate social software in the BPM lifecycle, whereas our research motivation is to enable end-users to collaboratively design, adapt, and execute workflows in social software.

In [16], the authors propose that social software and semantics may be combined to advance organizations' business processes and faster adapt to changing market conditions. In their paper they describe current shortcomings of BPM that were selected from current research projects and literature. These shortcomings are then compared with the possibilities of semantics and social software. They conclude that social software incorporates users into design and implementation of information systems, whereas the focus is on knowledge sharing and collaboration. The authors also mention challenges, which are an initial learning effort due to the increased scope of interaction, security issues, and the quality of process models.

Brambilla et al. present social BPM that combines BPM practices with social networking applications [17]. Main goal of their paper is to allow external stakeholders to participate in the process design and enactment. The approach defines new BPMN tasks for social interaction and basically invokes social networking applications to reach a broader audience. However, the presented approach does not improve the flexibility of the business process.

A social software for modeling business process is presented by Koschmider et al. in [18]. The approach supports the modeling of business processes with a recommender system. Although not directly related to the research goal of this project, the idea of supporting the collaborative act of process modeling might be an interesting extension.

Even though related work addresses the integration of data in the process execution and initial possibilities for a combination of social software and process management, there is no comprehensive solution available in literature regarding both areas of research and a gap between social software and BPM is still prevailing.

III. Research Questions

As outlined in the previous section social software enables manifold possibilities for a more effective and flexible business process management. Nevertheless, successful approaches seeking to integrate process modeling capabilities into social software are still not prevailing. Building on this research gap, we conclude the following research questions:

A. Research Question 1

What are common scenarios in organizations that are currently not fulfilled/covered by existing process management solutions?

We will evaluate different business perspectives and identify common scenarios that are currently not covered by process management systems or their utilization still comprises shortcomings in organizations. Existing social software tools available on the market are analyzed and their support for business processes is evaluated in an extensive tool survey. Deviances in the requirements of the identified scenarios and the available solutions are further investigated.

B. Research Question 2

How can existing social software solutions benefit from an extension with process management capabilities?

Organizations already utilize social software as a new way of business communication. Next to the use of social software for advertising and marketing purposes, these organizations will increasingly use this technology to endorse collaboration, innovation, and knowledge sharing in future. We will evaluate how an extension of social software with process management capabilities will allow this tools to tackle these new application scenarios.

C. Research Question 3

Is it possible to empower end-users to collaboratively design and adapt process models according to their specific requirements?

Rapidly changing business requirements force organizations to quickly adapt their business processes in order to receive strategic advantages over market competitors, ensure compliance with governmental regulations, and adapt to changing organization structures. Empowering end-users to collectively design and adapt business process would allow information systems to evolve with these changing requirements. We will evaluate to which extent end-users are able to perform this task and to which extent the flexibility of process-aware information systems can be increased.

IV. Research Design and Methods

In this section, the research methods applied to solve the aforementioned research questions are explained in detail. The research design consists of a combination of design science [19] and natural science [20]. Natural science research, in general, consists of the two major activities discovery and justification and provides the foundation for the research conducted in this project. In information systems research, design science has been propagated as more important and successful when creating new artifacts that can also contribute to the knowledge base when proper evaluated. Figure 1 illustrates the interaction between design science and natural science in the applied research framework.

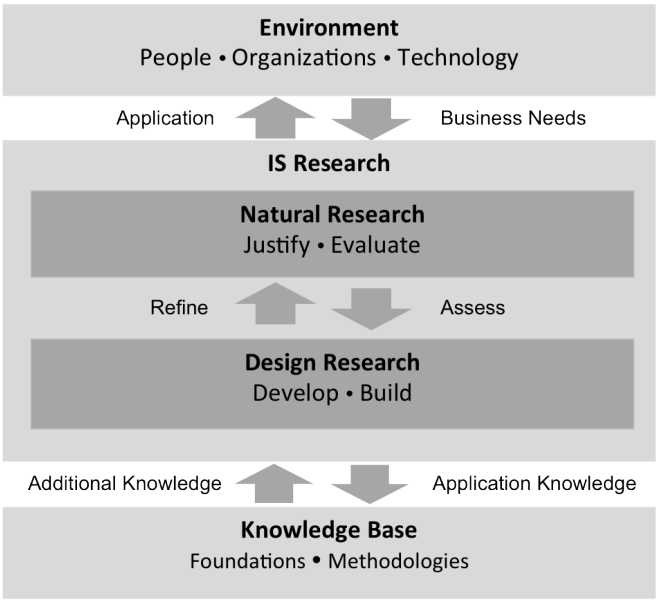

Fig. 1. Applied design science research framework in this project [19]

The research project starts with an identification of required properties of a process-aware social software solution. This step builds on an extensive study of existing solutions and an evaluation of the business needs in order to answers research questions 1. Based upon these findings, we develop a prototypical implementation using existing foundations from both, business process modeling and social software, to answer research question 2. Ultimately, we will answer research question 3 by assessing our prototype in experimental settings and contribute our findings to the knowledge base.

A. Natural Research

Properties for the research artifact to develop are identified by evaluating existing solutions available for process support in social software applications and comparing them with the actual requirements from organizations. These properties are gathered from a new and extended edition of the Enterprise 2.0 tool survey we conducted in 2008 [21]. Furthermore, the tool survey will identify upcoming developments and support organizations selecting a matching tool. The actual requirements from organizations are gathered based on an empirical evaluation and our experience with industry partners working on related issues. Results from this analysis are justified by findings from an extensive study of relevant literature.

B. Design Research

The solution design of the prototypical implementation will be performed in an iterative manner [22]. This allows us to evaluate several diverging approaches and improve steps that are repeatedly executed. The solution artifact is evaluated in experimental settings and actual use cases from organizations. Furthermore, we will evaluate the artifact in several different

domains, for instance, Enterprise Architecture Management (cf. e.g. [23], [24], [25], [26], [27]). In the following, we will describe implementation aspects of the proposed solution.

V. Proposed solution

The proposed solution is based upon Hybrid Wiki that empowers users to collaboratively design and adapt information structures [28]. Basically, wiki pages are extended with structured information elements, i.e., types and attributes, that can be interlinked with each other in order to create complex data models in a bottom-up approach with participation of several users. The primary goal of Hybrid Wiki is to lower the barriers for non-experts, so that no special syntax or modeling concepts are required to utilize the structured information elements. The Hybrid Wiki concept has already been successfully used in several application contexts (e.g. [29]).

Main advantage of Hybrid Wiki for our solution is, that it enables a high degree of specificity of Wiki objects [10], that is necessary to develop a Wiki enabled workflow system. Furthermore, the adaptive nature of the information structures in the Hybrid Wiki allows the collaborative design of flexible data-oriented business processes [13]. We will extend Hybrid Wiki by enabling users to define, in the same way, data-oriented processes that are build upon these adaptive and structured information elements. In line with [11], Wiki pages are extended with a state machine to describe the behavior of the related type. Transitions between the states are either triggered by the attribute values of the inherent type derived attribute values from other types.

The extended data model of Hybrid Wiki in our solution is illustrated with the most important entities in Figure 2 and explained in the following. It consists of a set of spaces that contain *Pages* and *TypeDefinitions*, whereas the TypeDefinitions must be unique within the given space. Every TypeDefinition is associated with several *States*. These states are connected with transitions and can be changed by particular *ActivityDefinitions*. An ActivityDefinition, in turn, is associated with *AttributeDefinitions* that specify the behavior of the TypeDefinition. The AttributeDefinition can be mandatory or optional for a given TypeDefinition. ActivityDefinitions can only be assigned on AttributeDefinitions that are declared as mandatory by the user. A *Validator* is used to check whether an *Attribute* fulfills a set of specified constraints, e.g. to make sure an attribute is not null, for the process execution. These Validators only indicate violations of the constraint in the user interface to sustain the flexibility of the data model.

A. Types

Objects are structured using type definitions and attribute definitions that are added as tags on pages, whereas these elements can be assigned after the objects are instantiated in the systems. Every page can have one type that conceptually describes the content of the page according to the user. These types are also used to suggest attributes that were assigned by other users in the system for the same type. Types can also be removed from the pages or changed if needed due to changing requirements or specifications. Every type in the data model can have a specified behavior that consists of a set of states and transitions between the states describing the lifecycle of the type.

These types can be searched in the user interface and are also used to generate lists of pages with objects of the same type, e.g. all pages having the type ”project”. This allows users to access the data objects at any time as long as the required access rights are granted to the user. Therefore, user can comprehend the current state of data objects in the progress of the business process.

B. Attributes

Every type can have several (unique) attributes assigned, whereas the list of assigned attributes of a type can easily be supplemented with new attributes. Attributes that were assigned by other uses for this type are recommended in the user interface. The value of an attribute can either be (in the simplest case) a string or a link value. Link values are used to define associations to other types or resources, e.g., attachments, urls, users in the system.

The proposed solution differentiates between optional attributes and mandatory attributes, whereas latter ones are used to depict the progress of the workflow as recommended in [12]. Mandatory attributes always appear for this type and the attributes can have validators indicating conflicts of unresolved constraints in the user interface. Changes of mandatory attributes values, from e.g. users modifications, external events, can release state transitions in other types or automatically create activities. Every type also has an attribute to store the current state in the lifecycle of the page.

The user interface for editing the attributes of a page needs to be designed in a way that is intuitive, intelligible, and easy to use. Depending on the current state of the type and the role of the user, some attributes might be more important than others or not relevant at all. Hence, these attributes have to be emphasized or not shown at all in the user interface or only shown with certain restrictions.

C. Activities

Processes usually result from the interaction of several types since users can access types and manipulate attribute values. In case mandatory information is missing or a decision needs to be made by the users, activities are generated automatically to the right users at the right time. Activities are related to the attributes and the current state of a type, i.e., they can only be executed or triggered if a certain current state holds and defined constraints of the related attributes are fulfilled. Similar to the aforementioned types, activities can be instantiated from ActivityDefinitions already created by other users.

These activities are divided into human and black-box activities, while the latter one allows complicated computations or the integration of other functionalities, e.g., batch processing of many types, sending e-mails, invoking other applications. Human tasks can relate to missing mandatory attributes that need to be provided by the users or decisions to be made at a particular time. They are necessary to ensure the progress of the process execution and are shown in the worklist of the user. Depending on the missing attribute values or the decision that needs to be made, the activities need to automatically generate an appropriate form for this task.

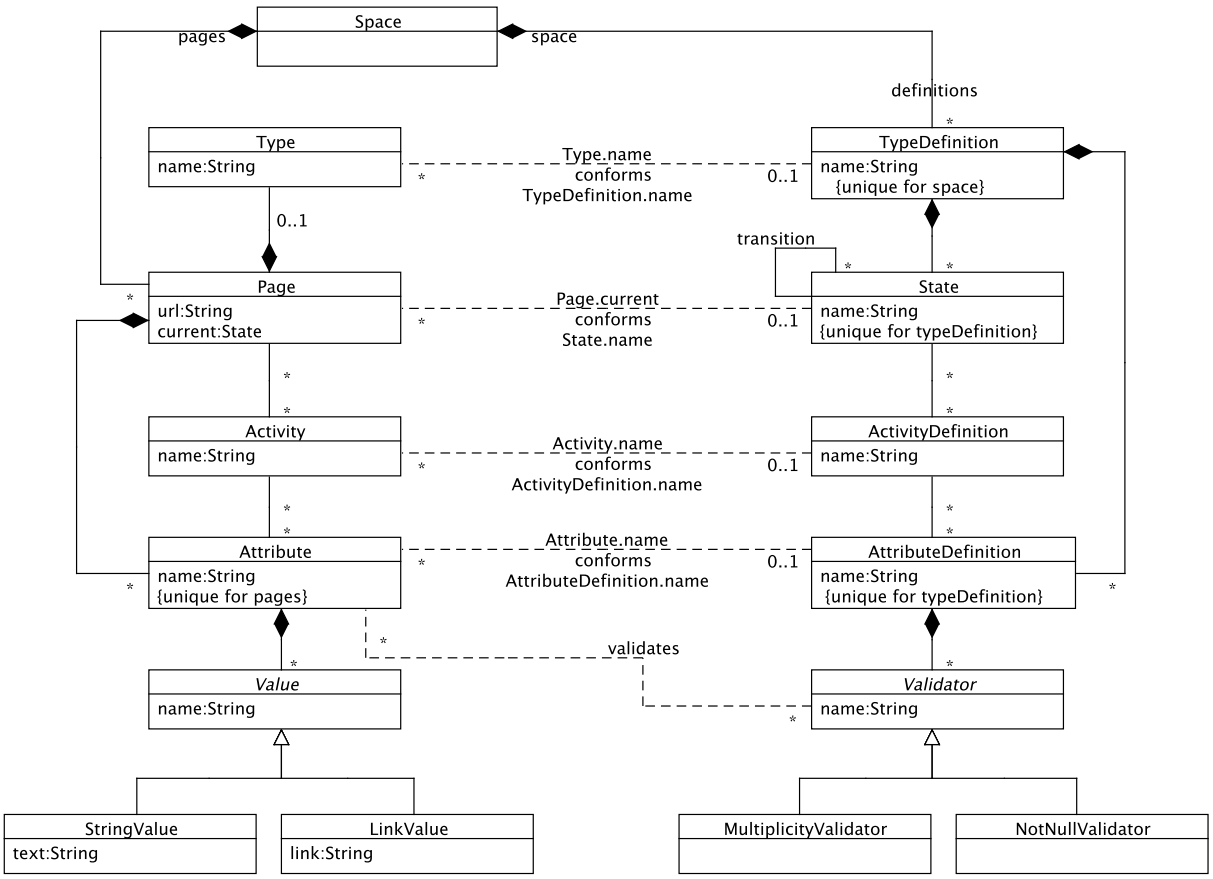

Fig. 2. Extended data model of the proposed solution with new entities for the state, activity definition, and activity to support processes in social software

VI. Conclusion

The capabilities of social software provide manifold possibilities for the management of business processes in terms of flexibility and enable a better support of collaborative tasks in organizations. Main goal of this research project is to develop and evaluate a new modeling paradigm that enables information systems to evolve with changing requirements and to empower business users to design and adapt business processes collectively in a bottom-up fashion. A research agenda for the integration of social software and process management has been presented and a solution solution building on flexible information structures in Wiki systems proposed for our goal of integrating social software and process management.

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