Enhancing Business Processes with Web 2.0 Features

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Abstract: Web 2.0 aims to support human interactions and content creation by combining information from different contributors. It can enhance business processes by improving communication, collaboration and exchange of knowledge between various participants. These benefits led to the emergence of a new form of business processes called Social Business Process (SBP). This paper provides for SBP modelling by proposing a domain-specific language (DSL) based on an extension of the standard BPMN notation to model social elements within an SBP. It is simple and yet generic thanks to the reduced number of extensions and its ability to model SBP regardless of the used Web 2.0 technology. To show the applicability of the proposed notation, we have implemented it within the BPMN2 modeller editor.

1 INTRODUCTION

Web 2.0 offers a range of new online services that increase communication and collaboration inside and outside enterprises (Schmidt and Nurcan, 2009). In the literature, different studies discuss the impact of Web 2.0 on Business Processes Management (BPM) approaches in order to make them more agile (Bruno et al., 2011). These studies have demonstrated the ability of Web 2.0 to improve BPM approaches (Schmidt and Nurcan, 2009) (Bruno et al., 2011) (Schmidt and Nurcan, 2010).

In fact, Web 2.0 may enhance BPM via its four principles: weak ties (Granovetter, 1973), egalitarianism, social production (Benkler, 2006) and service-dominant logic (Vargo and Lusch, 2008). In addition, Web 2.0 may also be used to enhance an enterprise productivity by fostering collaboration and knowledge sharing both among members of the same team or among teams. Motivated by these advantages, many enterprises are putting a lot of effort into adopting Web 2.0 in their day-to-day operations. These enterprises are referred to as *Enterprise 2.0* (McAfee, 2006).

Enterprise 2.0 is characterized by the use of Web 2.0 technologies and applications to reach different goals. Indeed, an enterprise may use Web 2.0 to improve its visibility on search engines, to reduce the cost of some services such as communication and to improve the quality of its provided services especially those related to customer satisfaction, etc. Web 2.0 may also be used to enhance transparency by improving the availability of information and knowledge across enterprises.

In order to reach its goal, an Enterprise 2.0 may need to adapt its business processes to the new context imposed by socialization. In this paper, we focus on examining how a business process can be adapted to become a Social Business Process (SBP). That is, we outline the Web 2.0 features that can be integrated in a business process to provide for the Enterprise 2.0 context requirements. In addition, we propose a modelling notation for SBP.

In terms of modelling, we adopted the "separation of concern" principle where the business and social aspects of an SBP can be modelled separately. To do so, the business aspect may be represented using any existing notation like the UML activity diagram (OMG, 2011b) or the Business Process Model and Notation (BPMN) (OMG, 2011a). However, the social aspect should be modelled using a specialized notation to ensure the clarity and modularity of the business process model. The development of such a notation requires a domain specific language (DSL) that extends an existing Business Process Modelling Language (BPML). In the literature, Brambilla et al.'s extension to model SBPs consists of a set of extensions and is strongly dependent on social

networks (Brambilla et al., 2012). Therefore, it allows only the modelling of an SBP that uses a social network as a Web 2.0 technology. To overcome this limitation we propose a simple and yet generic domain-specific language based on BPMN 2.0 [6], the de facto standard for business process modelling. The number of new extensions is kept to a minimum and all of them are not biased towards any particular Web 2.0 technology.

The remainder of this paper is structured as follows. In Section 2, we concentrate on the use of Web 2.0 by today's businesses. In Section 3, we focus on the ability of Web 2.0 to enrich business processes with social elements. In Section 4, we present BPMN4Social including its meta-model and concrete syntaxes. Section 5 illustrates the BPMN4Social notation supported by its editor. Finally, Section 6 concludes the paper.

2 HOW COMPANIES ARE USING WEB 2.0

In this section, we concentrate on how Web 2.0 applications may be used by enterprises.

2.1 Internal Social Business

Web 2.0 is used inside enterprises to improve communication and collaboration using specialized functionalities such as messaging, profiling, commenting, etc. (Bennett, 2012). Many enterprises have considered connecting their employees through Web 2.0 applications. One of the most popular examples is "Salesforce.com" which uses a social network called "Chatter" to foster communication and collaboration between employees (Bennett, 2012). Bennett has shown how enterprises can benefit from social networking to simplify interactions with employees of other departments (Bennett, 2012). According to Bennett, social networks "*turned the company into a community, where people feel connected despite geographic and functional divides.*" Fortino et al. pointed out that approximately half (52%) of the enterprises, that embrace social networking sites, use them in order to keep employees connected (Fortino and Nayak, 2010). The same authors propose an architecture that consists of four forms of social communication inside the enterprise: "*professional networking*", "*professional communication*", "*professional knowledge base*" and "*professional collaboration*".

2.2 Social Business-to-Consumer

Web 2.0 aims at improving interactions between enterprises and customers. In fact, different studies have shown the role of Web 2.0 in improving these interactions. According to some studies (Zhu and Chen, 2012) (Paniagua and Sapena, 2014) (Jussila et al., 2014) (Samuel, 2012), B2C marketing is the most suitable area where Web 2.0 could be used. Aihua et al. argue that using Web 2.0 sites, enterprises can adopt a new advertising model that attracts and allows interactions with different customers (Zhu and Chen, 2012). This new model can be put in place through Facebook pages or a Twitter account, for example. Furthermore, the use of Web 2.0 in marketing allows enterprises to freely advertise products and collect online customers' feedback.

According to Paniagua in (Paniagua and Sapena, 2014) enterprises can benefit from social media to improve their financial performance using three social media resources: *conversations, sharing and presence*. Each social media resource may be used by one of the two proposed channels named "*revealed preferences*" and "*social marketing*" to assess financial performance (Paniagua and Sapena, 2014).

2.3 Business-to-Business and Web 2.0

According to Jussila et al., (Jussila et al., 2014), there are many differences between the Business-to-Business "B2B" and Business-to-Consumer "B2C" in terms of complexity and exchanged products. These differences affect the possibility to improve B2B using social media in the same manner that B2C is improved.

In this context, Jussila et al. highlight security issues that need to be carefully considered when using Web 2.0 in a B2B context. In fact, the authors state that the dissatisfaction of customers or leakage of critical information is fatal when combining social media and B2B (Jussila et al., 2014). Nevertheless, social media used in B2B improves communication between different parties (Jussila et al., 2014).

The use of Web 2.0 in B2B was also considered in the framework proposed by Paniagua in (Paniagua and Sapena, 2014). This framework encompasses a channel called "*social capital channel*" to represent how social media affect intercompany relationships. According to Michaelidou et al. in (Michaelidou et al., 2011), social networking sites may be used to develop and maintain relationships between B2B firms. The authors claim that these media can help B2B enterprises in different manners such as creating direct relations with customers, increasing sales,

identify new business opportunities, distributing and collect content and reducing marketing budgets, etc. In (Michaelidou et al., 2011), the authors mentioned also some barriers that can slow the use of social media in a B2B context. Indeed, the relevance of these technologies depends on the application domain and it requires some investments.

3 COMBINING BUSINESS PROCESSES AND WEB 2.0

In this section, we focus on the benefits and risks of Web 2.0 usage within enterprises. Then we propose a definition of the social business process.

3.1 Key Web 2.0 Features for Improving BP

Web 2.0 provides a set of features that can be used to enhance BP. These features are essentially communication, collaboration, sharing, and collecting knowledge (Turban et al., 2011).

- *Communication:* Web 2.0 improves communication between various participants and allows different forms of free communication (e.g., multicast, broadcast, chat, and videoconference) (Bennett, 2012) (Fortino and Nayak, 2010) (Muntean et al., 2014) (Turban et al., 2011). These forms may be used to upgrade BP by improving the communication between its executors. On the one hand, this Web 2.0 feature may be used to maintain the synchronization between different enterprises' departments when executing BPs (Fortino and Nayak, 2010). On the other hand, the use of Web 2.0 can improve communication with external parties such as clients and partners in order to better satisfy them.

- *Collaboration:* The execution of collaborative business activities is enhanced when Web 2.0 applications are used. Actually, there are numerous available Web 2.0 applications which may be used to foster collaboration among participants (Bennett, 2012) (Fortino and Nayak, 2010) (Turban et al., 2011) (Weinberg et al., 2013). These applications can be used to execute collaborative activities inside the business process. In fact, Web 2.0 allows business process executors to work on the same artifact, if needed. Web 2.0 may also be used to ameliorate the collaboration between business actors and external engineers to resolve some problems that appear during BP execution.

- *Sharing knowledge:* Web 2.0 provides a set of applications that enable knowledge sharing between known and/or unknown actors (Bennett, 2012) (Fortino and Nayak, 2010) (Paniagua and Sapena, 2014) (Turban et al., 2011) (Weinberg et al., 2013). Social media and Wikis are examples of Web 2.0 applications that are often used to share content between participants. This ability of sharing knowledge can be used to enhance BP by promoting the exchange of user created content either between internal or external actors. The sharing-of-knowledge feature can improve several processes such as the marketing ones by facilitating advertisement exposure.

- *Collecting knowledge:* Each Web 2.0 application offers its own services that allow the online collection of knowledge (e.g., profiling and commenting) (Bennett, 2012) (Paniagua and Sapena, 2014) (Turban et al., 2011) (Weinberg et al., 2013). Collecting knowledge may improve business processes in different manners. For example, it may improve the recruitment process by the possibility of online evaluation of candidate profiles as well as the selection of the best ones. Thanks to this Web 2.0 feature, it is also possible to online collect customers' feedbacks on enterprise services and products.

3.2 Risks of Combining Web 2.0 and Business Processes

The improvement of business processes using Web 2.0 results in many changes that affect the business process model and execution (Brambilla et al., 2012). Hence, new social interactions and social activities coexist with the traditional business process components to form a SBP. This combination of social and business elements inside the SBP may raise some concerns.

In the literature, many studies focus on the negative effects on enterprises of Web 2.0 use (Turban et al., 2011) (Davidson and Yoran, 2007) (Sophia van Zyl, 2009) (Braun and Esswein, 2013).

- *Security Risks:* Security is one of the most important challenges that must be considered when combining business processes and Web 2.0. In the literature, there are many studies have shown the impact of using Web 2.0 on enterprise security (Turban et al., 2011) (Braun and Esswein, 2013). When we deal with security there are different entities that may be affected such as data, networks, devices, etc. (Davidson and Yoran, 2007).

- ***Decreasing Productivity:*** The combination of Web 2.0 and BP may result on decreasing the productivity of employees. Indeed, employees may use Web 2.0 outside work and for personal reason (Sophia van Zyl, 2009). These practices could result in a loss of time and resources.

- ***Data analysis Problems:*** Combining Web 2.0 and enterprise business processes can produce a large volume of data which is difficult to analyze and interpret. Indeed, the analysis of the data produced by social media is a current research topic that is not solved yet (Braun and Esswein, 2013).

In spite of the above-mentioned risks a lot of companies are adopting Web 2.0 and trying to socialize their business processes (Cerenkovs and Kirikova, 2014). In the following sub-section we will present a definition of the social business process.

3.3 Social Business Process Definition

The migration towards Enterprise 2.0 involves different changes in every-day work and affects various business entities such as business process and security policy. The goal of these changes is to make these entities more adequate to the new environment and fit with the Web 2.0 applications which are used. Certainly, the business process is one of the most entities that are affected by socialization since it encompasses the enterprise's activities. In the literature, many studies focus on the benefits of the use of Web 2.0 to improve business and where Web 2.0 may produce a benefit (Schmidt and Nurcan, 2009) (Badr and Maamar, 2009) (Erol et al., 2010). As shown in Section 2 there are different forms of business (internal business, B2B, or B2C) that can be improved thanks to Web 2.0. These benefits encourage many enterprises to combine their business processes with Web 2. ; e.g., Salecforce.com adopted some form of SBP.

Despite the importance of SBP to Enterprise 2.0, there is no clear and consistent definition to this concept up to now. Brambilla et al. consider the social business process implementation as "Web applications integrated with public or private Web social networks." (Brambilla et al., 2012).

Yet, without a concise definition of SBP, it is difficult to explain how business processes and Web 2.0 can be combined together. What is an SBP? And what is the added value of an SBP compared to regular processes? To answer these questions, we define an *SBP as a business process that uses any Web 2.0 technology or application to achieve the enterprise's business goals and to foster communication, collaboration and exchange of knowledge either among internal or with external actors in everyday work.* This type of process aims to benefit from the advantages of social content made available through Web 2.0 (e.g. profiling) and consists of two types of elements, business elements that do not require Web 2.0 use and social elements that are accomplished through Web 2.0.

4 BPMN4Social

In this section, we will give an overview of BPMN4Social, our DSL for social business process modeling, and then we will discuss the meta-model of BPMN4Social. Finally, we will introduce our graphical editor for SBP modeling.

4.1 Overview

BPMN (OMG, 2011a) is the OMG standard for BPs modelling. Its graphical concepts are organized into four categories: objects flow (i.e., activities, events, and gateways), connecting objects (i.e., sequence flow, message flow, and association), swimlanes (i.e., pools and lanes) and artefacts (i.e., data object, group, and annotation). The syntax of BPMN is extensible as new markers that can be defined on the graphical notation to model specific types of processes like social processes. The specification of social concepts inside SBP at design time was dealt with only in the BPMN extension proposed by Brambilla et al. (Brambilla et al., 2012). This extension allows the modeling of SBP by means of various extensions of BPMN elements. Three types of pool named internal performer, internal observer and external observer extend the BPMN pool. A BPMN task is extended by several specific tasks such as commenting, invitation to activity, voting, etc. A new social relationship link and an invitation's acceptance/rejection are examples of specialized BPMN events. Last but not least, a BPMN gateway is extended by two specialized decisions, which are choices performed by users or automatically. This extension is closely related to social networks and allows the modeling of only social business processes that use a social network as Web 2.0 application. Brambilla et al. proposed a technical framework that allows the design, implementation, deployment, and monitoring of SBP. In the implementation phase, the proposed framework allows enterprises to implement social business processes as Web applications combined with any social network.
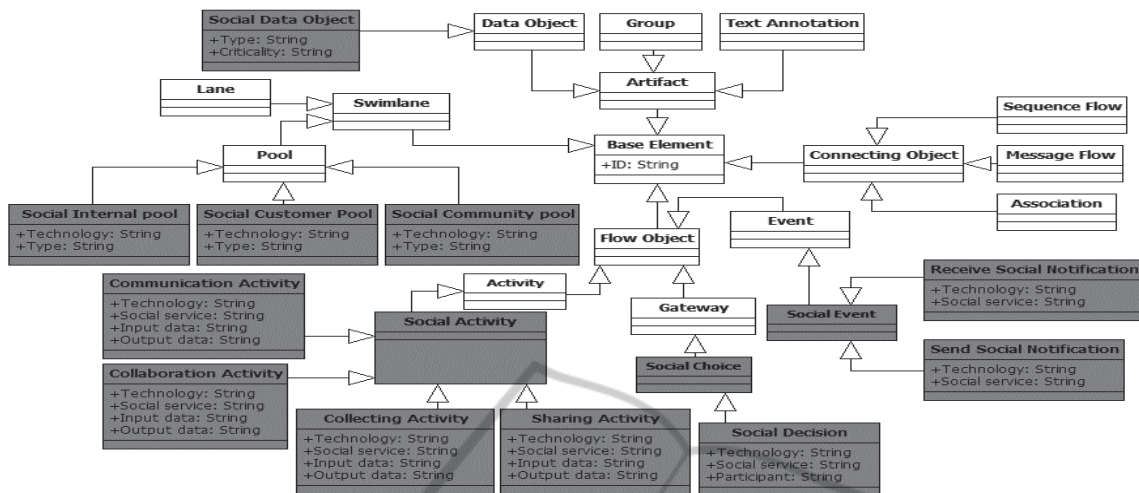
Figure 1: BPMN4Social Meta-model.

To overcome the limitations of Brambilla's extension, we define BPMN4Social as a BPMN extension for SBP modelling. This extension distinguishes social elements from business ones and represents social interactions in the SBP model. Our aim is to provide a simple and yet generic notation that can be used easily by business analysts and independent from any Web 2.0 application. On the one hand, to ensure the simplicity of the notation it is important to reduce the number of new extensions. On the other hand, to guarantee independence from technology, we will not consider any particular Web 2.0 service when defining the extension. BPMN4Social consists of three activities, three pools, a data object, a gateway, and two new events. Each new extension is identified by a set of additional attributes. BPMN4Social is detailed in the next sub-section.

4.2 Meta-model

The extensions introduced by BPMN4Social are shown in Figure 1. In this figure, only the relevant classes of the BPMN meta-model are shown in white. The BPMN4Social classes are shown in gray:

- **Social Internal Pool:** This extension is used in order to model internal departments of the company that use Web 2.0.
- **Social Customer Pool:** This extension is used in order to model the individual customers of the company, in the case of B2C, who use Web 2.0.
- **Social Community Pool:** This extension is used to model the partners of the company that use Web 2.0.

Each new pool is characterized by two supplementary attributes:

- *Technology:* It identifies the used Web 2.0 application.
- *Type:* It distinguishes between authenticated and anonymous users.
- **Communication Activity:** It is used to model communication activities such as the exchange of messages between the various internal and external actors.
- **Collaboration Activity:** It is used in order to model the collaborative activities, such as joint drafting activities, among the various internal and external actors.
- **Collecting Activity:** It is used to model activities that allow the collection of information and knowledge using Web 2.0. Such an activity may be used to collect customers' feedback.
- **Sharing Activity:** It is used to model activities that allow the sharing of information and knowledge using Web 2.0. Such an activity may be used to share knowledge with various actors whether known or unknown in advance.

Each new activity is characterized by four additional attributes:

- *Technology:* It identifies the Web 2. application used to execute the social activity.
- *Social Service:* It describes the service provided by the Web 2.0 application (e.g., messaging and commenting) that permits the accomplishment of the social activity.
- *Input Data:* It describes the data required to accomplish the social activity.
- *Output Data:* It describes the data produced by the social activity.

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▪ ***Send Social Notification:*** It is used to notify an actor to participate in a new social activity. The sender of a social notification can invite the receiver to execute some tasks. A social notification is communicated through the used social software.

▪ ***Receive Social Notification:*** It waits until a new notification is received from a participant through the used social software.

These two new notifications have two additional attributes:

- *Technology:* It identifies the used Web 2.0 technology or application.
- *Social service:* It describes the service provided by Web 2.0 that permits the reception or the transmission of the notification.

▪ ***Social Data Object:*** We define a social data object as an extension of the BPMN 2.0 object to model the data required or produced by social activities. A social data object has two additional attributes:
  - *Type:* It identifies the type of social data object. It may be for example a text, an image, a video, etc.
  - *Criticality:* It allows distinguishing between critical data, which require setting up specific security procedures, from general data.

▪ ***Social Decision:*** The social decision notation allows the modeling of distributed decision made by different actors through Web 2.0. A social decision has three additional attributes:
  - *Technology:* It identifies the Web 2.0 application used by the social business process.
  - *Social Service:* It describes the service provided by the used Web 2.0 application that permits distributed decision-making.
  - *Participant:* It describes the different actors that must be involved in the decision making process. An actor may be internal (e.g., company employees) or external (e.g., customer and partner).

4.3 Graphical Editor

Table 1 shows our proposed concrete syntax for BPMN4Social which defines a visual representation for the proposed notations. This concrete syntax hastwo advantages: It is simple to use thanks to the few new notations that are added to the standard BPMN; also, new concepts of BPMN4Social have a

different representation and as a result, they are distinguished from other BPMN concepts. We implemented a graphical editor supporting this syntax as shown in Figure 2. This editor extends the open source editor BPMN2.0 modeler. Each new notation is created as a customization of a standard BPMN2 element. The attributes of each new concept are accessible, like standard attributes, via the property sheet once selected.

Table 1: Concrete syntax for BPMN4Social.

BPMN element	Social extension	Notation
Pool	Social Internal Pool	
	Social Customer Pool	
	Social Community Pool	
task	Communication Activity	
	Collaboration Activity	
	Collecting Activity	
	Sharing Activity	
event	Send social notification	
	Receive social notification	
Data object	Social data object	
gateway	Social decision	

5 EXAMPLE

To illustrate the use of our graphical editor and the benefits of the proposed extension, we consider an online course planning business process. In such a business process, the audience is a critical factor as it should be taken into account at the different stages of the preparation of the course. First of all, the company must maximize the learners number to secure better profit. Consequently, an advertisement phase is requi-
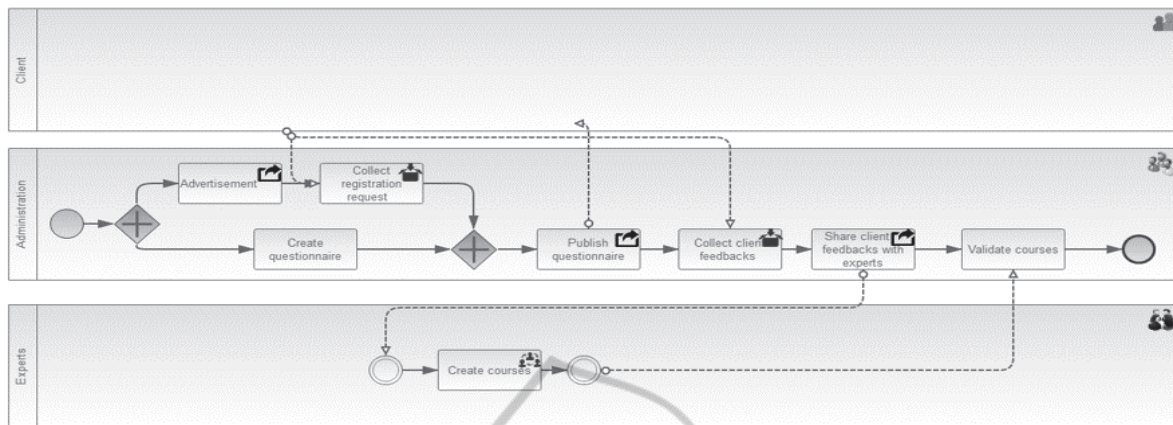
Figure 2: Online course planning process modelled with BPMN4Social.

red at the beginning of the project. Secondly, it is important to customize the learning process according to the audience in terms of goals, content, structure, etc. Therefore, the company must know the audience's learning skills, their jobs and capabilities to access online courses, etc. Finally, the company experts must focus on the course content, which plays a critical role in how the audience learns the material.

During the development of the course, the experts must collaboratively focus on how the course should be organized. However, without using Web 2.0 applications, this process may become difficult due to challenges such as advertisement costs, difficulty to collect learning requirements, etc. The use of Web 2.0 applications may simplify this process in different manners. For example, the advertisement phase may be freely accomplished using a social network. In fact, social media are considered as a suitable tool for advertisement. Then, the company can collect online learners' feedback using Web 2.0. Finally, the set of available Web 2.0 collaborative-writing tools may play an import role in order to simplify the course development task.

This example shows how a business process can be improved using Web 2.0 in terms of advertisement, online feedback collection and collaborative execution of some tasks. This example shows also the limitations of the extensions proposed by Brambilla et al. which do not provide any specific notation for modeling knowledge collection and collaboration activities. These two social activities are very important since one of the major contributions of Web 2.0 is that it facilitates collaboration and online knowledge collection. If this process had to be modelled using a standard modeling language like BPMN, the distinction between social and regular interactions would not be clearly illustrated. Nevertheless, by using our graphical

editor, the model will be clear and developers can easily distinguish these interactions and activities thanks to the new notations. Figure 2 shows the process of planning an online course modelled via the use of BPMN4Social.

6 CONCLUSIONS

Web 2.0 enhances business processes with new functionalities that improve the exchange of knowledge and information between various business actors. Thus, new communication forms between enterprises and stakeholders are created. In fact, several studies have shown the added value of Web 2.0 practices inside the enterprise like the improvement of enterprise productivity thanks to collaboration between actors. The combination of business and Web 2.0 leads to several changes in BP and thus SBPs are rolled out. SBPs differ from traditional ones as they are enriched by new social features like commenting, sharing, etc. to allow executors to accomplish some internal tasks or to interact with either internal or external parties using Web 2.0 applications. These new social elements must be represented explicitly; therefore, it is important to use a specific notation during the modeling stage.

In this paper, we developed an extension to the BPMN notation towards modeling SBP. The proposed DSL consists of extending the BPMN visual language for process design with new notations like communication and collaboration activities, which express social interactions between actors. These new notations are defined as a customization of the standard BPMN notation. This extension is characterized by its simplicity and independence

from Web 2.0 technology. Our graphical editor is implemented as an extension of BPMN2 modeler.

As a future endeavor, we plan to implement an automatic code generator that generates an executable code from the social business process model. The generator development will benefit from model transformations a la MDA.

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