A Combined Framework for Development of Business Process Support Systems

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Abstract. In this paper, a combined modeling framework consisting of goal modeling, process modeling and business process characterizing modeling is presented. The framework is made to guide both business experts and model developers during the life cycle of a modeling-based project development. We consider a business process characterizing model (BPCM) as a starting point for developing an IT system. Then, the start of goal models and process models can be derived from a BPCM model. Process models are then used as inputs for deriving a candidate IT system. A development methodology to guide the development of process models from business process characterizing model is proposed. Furthermore, the development methodology is illustrated by an exemplar in the field of scientific conference organization.

Keywords: Business Process Characterizing Model, Process Modeling.

1 Introduction

Information system development often starts with development of process models. However, being focused on processes from the start might be premature. The process model tends to primarily focus on process-oriented aspect, and might not address some business requirements properly. Some industry projects and case studies [19], indicates that process models are not a good starting point for identifying stakeholder requirements. Many business people want to start a modeling-based project with the development of a business oriented model addressing essential business aspects (i.e. what are the essential requirements of the project, what is offered by whom to whom etc), rather than look at a relative complicated business process model showing how things are executed operationally. Furthermore, when using for instance BPMN [46] the process model might too quickly turn into a diagrammatic representation of the executable solution with implementation attributes added because of technical considerations, which is quite difficult for business experts to understand.

As illustrated in [14], one of the main ways of utilizing models is to describe some essential information of a business case as informal support in order to facilitate communication among stakeholders. In [15], by taking inspiration from this idea, we proposed a business process characterizing model (BPCM), which can be seen as an important early, business-oriented model in a modeling-based project. BPCM aims to provide an enhanced ability to understand and communicate business processes to all

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stakeholders involved in the development lifecycle. Such a model shows some essential elements of the business solution to be developed, anchored to business –oriented terminology. Business experts not being familiar with traditional modeling should be able to produce a BPCM model that can capture the knowledge of an organization and of major business processes. Such an approach allows all stakeholders involved in a modeling-based project to have a holistic perspective integrating human and organizational aspects to gain better understanding of business scenario to ease constructing of other relevant models (i.e. goal model, business process model, etc). Furthermore, BPCM can help to bridge the gaps between business experts and technical model developers towards a better construction of business process models.

Developers of technically oriented models must first understand a business case and explore the business context in which the IT system will function before they can build effective systems to support it. This means a proper understanding of a BPCM model in the earliest stage of an IT project is important for technical model developers to design the IT systems. However, having a good BPCM model does not mean that the IT system can be generated automatically, since this is informal. Thus, the next problem is how a BPCM model can be utilized to facilitate a model-based IT system development. The main objective of this paper is to create a combined modeling framework consisting of goal modeling, process modeling, and business process characterizing modeling.

In this paper, we will illustrate the relation between BPCM, and process models and goal models in a combined framework. In this manner, relevant information from a high level BPCM model on an organizational or business perspective can be integrated into goal and process models. We will provide a development methodology to guide the development of goal models and process models from business process characterizing model. Our primary support is on modeling lifecycle support for both business experts and model developers. We aim at a new approach which can reduce misinterpretations between the stakeholders during development.

The remainder of this paper is organized as follows. Section 2 discusses related work. Section 3 briefly describes BPCM, which in this work is extended with improved links to relevant business ontologies compared to [14]. Section 4 illustrates a combined framework for BPCM, goal and business process modeling. Guidelines for mapping from a BPCM to a BPMN process model are provided in section 5. In Section 6, these preliminary guidelines are illustrated by an exemplar describing a conference arrangement process. The use of exemplars is widely recognized as a technique for early evaluation of modeling approaches [12]. Due to page limitations, only parts of the exemplar and approach are illustrated in the paper. Finally, section 7 discusses some related issues and further work to our approach.

2 Related Work

The notations of a modeling language used for business process management can be classified in several categories, based on their conceptual features [34] [24] [25]. For example, business modeling languages such as the e^3value [18] aims at identifying exchanges of value objects between the actors in a business case; actor-oriented modeling language such as i* [47], is mainly used for describing the situation as networks

of strategic dependencies among actors. In general, it is recognized by analysts that some notations or models are more appropriate towards specific user's types (e.g. technical users / non-technical users).

In recent years, the problem of relating process models, value models, goal models and IT system prototype models has been extensively studied. Many modeling perspective and notations focus on specific aspects, with limited relation to some important aspects in constructing business process models. This leads to the need for a new modeling perspective integrating various aspects to support the development of business process support system.

Some have considered the business value perspective as a foundation to relate or map to other enterprise models. There exist a number of approaches, and languages for business modeling [4] [11]. E^3value is one example. The e^3value methodology models a network of enterprises creating, distributing, and consuming things of economic value [17]. The basic concepts in the e^3value are actor, market segment, value object, value port, value interface, value activity and value exchange. In [41], they offer guidelines for producing an i* model from an e^3value model and vice versa. In [5], they addressed the problems of aligning business models with goal models and a method for this has been proposed. Also, an approach for deriving a process model from a business model is proposed in [3]. Resource, Events, Agents (REA) [38] is another relevant approach. The REA framework has been designed for representing and reasoning about economic exchanges. The basic REA pattern models an exchange by three components: the events of the exchange, the resources that are exchanged, and the participating agents.

Some studies consider goal oriented analysis as a starting point. In [32], they have presented a design method for modeling business processes in which the concept of the 'goal' is fundamental. This approach can be characterized as being, in the main, concerned with the construction of a process from its functional goals. In [26], they have proposed a method which is called GoalBPM, to support the controlled evolution of business processes. Control is supported through the explicit modeling of stakeholder goals, their relationship, and their evolution traceable to related business processes. GoalBPM is used to couple an existing and well-developed, formal goal modeling and reasoning methodology, i.e. KAOS [33], and a business process modeling notation, i.e. BPMN.

Business process modeling plays a vital role in the business process life cycle. BPMN, Petri nets [40], and EPC [1] are examples of process modeling languages. A business process is a set of one or more linked procedure or activity, which collectively realize a business objective or policy goal, normally within the context of an organizational structure defining functional roles and relationships [7]. Many process models are intended to describe what goes on in a process from the model developers' view, but not why those activities occur or why processes are to be carried out. Therefore, being only focused on process modeling might be insufficient for redesign purposes. As a result, it leaves the model developers at risk for meeting the logistic of the process, but not satisfying the strategic intention of business people. This is also one of the motivations behind BPCM: to ease the communication and collaborate among different stakeholders in a modeling-based project [15].

Enterprise knowledge development (EKD) [36] is another modeling methodology used for modeling different aspects of organizations. EKD describes an enterprise as a

network of related business processes which collaboratively realize business goals. This is achieved by several sub-models: enterprise goal submodel, enterprise process submodel, and information system component submodel [36]. Extended Enterprise Modeling Language (EEML) [29] is another approach resembling EKD used for business process modeling according to five main categories of usage areas of process modeling sketched in [31]. EEML includes four modeling domains: process modeling, resource modeling, goal modeling, and data modeling. In addition to capturing the various tasks and their interdependencies, models show which roles perform each task, and the tools, services and information they apply. In particular EEML combines goal modeling and process modeling in a novel way [30].

Actor oriented approaches emphasize the analysis and specification of the role of actors that participate in the process [25]. The i* modeling framework [47] has been proposed for business process modeling and engineering. Much work has been carried out on supporting guided transformation of i* into other modeling languages [27, 28]. In [9], some preliminary ideas have been proposed for developing a process model given the existence of an i* model. Furthermore, [37] describes how i*, use case, and human activity modeling (HTA) were applied and integrated using synchronization checks to model requirements in an air traffic management case study. The use of HTA in this case resembles the role we see for BPCM, as an informal early model to be used among the stakeholders, potentially in a distributed fashion.

Our argument for creating a BPCM is that we need to base the development of business process models on high level models of the enterprise which can bridge the gap between model developer and business experts, In our work, BPCM is primarily focused on supporting sense-making and communication whereby the concern is for constructing a characterizing model on a sketch level to facilitate the development of detailed business process design. The BPCM modeling methodology can be seen as a business-oriented modeling approach with a consideration of context. Continuous changes of various requirements such as technical and economic, are becoming the nature of business environments. In [15], we have illustrated the capability of BPCM to capture and reflect changes in order to realize a better representation of the knowledge in a sales example. Our aim here is anchor BPCM in relevant business ontologies and describes a model based development framework and design guidelines that can lead from a BPCM model into an implementable IT system.

3 Business Process Characterizing Model (BPCM)

The business process characterizing model is intended not only to facilitate the communication between business experts and model developers, but also to guide and support the development of business process modeling and goal modeling. In particular the model is meant to be applicable in a mobile and multi-channel work environment setting.

The elements of the BPCM are defined as follows:

BPCM= (P, R, A, C, D, G, T)

P: Process: The business process people want to characterize. This element can be related to a common business process ontology such as SCOR [8]. SCOR is a process reference model which has been developed and endorsed by the supply chain council

as the cross-industry standard diagnostic tool for supply-chain management. However, SCOR has a limited scope mainly focusing on the supply chain. We will also look to extend the scope of SCOR to cover a wider set of process-types.

R: Resource: This element is inspired by the resource concept in the REA framework [38]. In order to acquire a resource, an actor has to give up some other resource. The events in REA model have the duality relationship. One of these events usually represents a resource being given away or lost, while the other represents a resource being received or gained. For example, in a purchase process the buyer has to give up money to gain some goods. This element can clearly address what are consumed and what are gained in a business process.

A: Actor: This element describes the people and organizations with different roles involve in a business process. Actor can be at different levels (e.g. individual level, group level, organizational level). This element can illustrate who are important to which business process.

C: Context: Context is a broad concept. [10] describes context as "typically the location, identity, and state of people, groups and computational and physical objects". It is not always relevant to cover all context information in this element. In this work, we focus the channel aspect of the context and working environment information (e.g. mobile working environment over WLAN or over GPRS, fixed working environment). This element can depict the channels that could be supported in the different working environment. Today, mobile workers have increasing demands for better multi channel support model on a variety of mobile computing device. The needs of multi channel support from end users can be expressed in this element. In addition, the multi channel support framework proposed in [16] can be adopted to bridge the gap between the BPCM and business process modeling related to context. Furthermore, [2] discusses the usage of i*/Tropos [6, 47] goal-oriented framework for representing the variable behaviors of a mobile information systems can switch to depending on location properties, and presents location-based goal modeling. When a more detailed characterization of this area is needed, one can use for example the proposed delivery context ontology (see http://www.w3.org/TR/2009/WD-dcontology-20090616/)

D: Business Domain: This element classifies the business domain. We attempt to link to NAICS. The North American Industry Classification System (NAICS) is a standard for the collection, tabulation, presentation, and analysis of statistical data describing the U.S. economy. NAICS is based on a production-oriented concept, meaning that it groups establishments into industries according to similarity in the processes used to produce goods or services. Each business process is labeled with a business domain. This is of help for model users to search or retrieve business processes within specific business domain.

G: Goal: This element can address what kinds of goals need to be fulfilled in the business process. The process items will interconnect to correspondent goals. In this way, the business experts will see how the business process model can contribute to the organizational goals. We would like to describe both hard goal and soft goal in this element. According to [29, 44], some attempts to incorporate goals into process modeling have been made in the past, both addressing the operational goals and strategic

goals. Operational goals can be related to hard-goals, forming the basis for functional requirements; while strategic goals are related to soft-goals, which set the basis for non-functional requirement. The intention for us to incorporate the goal element into BPCM is to make it easier to relate BPCM to goal modeling and process modeling.

T: Process Type: According to REA [22], REA does not model only exchanges but also conversions. Exchange and conversion can be seen as two typical process types. An exchange occurs when an actor receive resource from another actor and give other resources back to that actor. A conversion occurs when an actor consumes resources in order to produce other resources. Unlike an exchange that models the exchanges of resources by agents, a conversion models the creation or maintenance of resources by agents.

As we described above, the key attributes and elements involve in the business process development can be reflected in the BPCM. We aim to manage all the business processes in a universal way in the characterizing model. On the one hand, this model is intended to help business experts to browse and describe the business process for different purposes. On the other hand, since the BPCM model can be organized in the textual table (as illustrated in chapter 6); it is easier for the business experts, most of whom are non-modeling experts, to understand than BPMN or EPC. As a result, the BPCM can lessen the modeling competence gap between model developers and business experts. In other words, it means the BPCM has the potential to help the model developer to build and develop process models and goal models in a more efficient and effective way. Therefore, both business experts and model developers can benefit from this business process charactering model.

4 The Combined Framework

In this section, the combined modeling framework, as presented in Figure 1, is discussed. In this framework, we consider a BPCM Model as a starting point for developing an IT system. It is possible to have other approaches, e.g. starting with a goal model and then deriving use cases from a goal model [43], but we will not pursue this here. In our framework, we will start with a relatively informal model, more specifically BPCM here, which can ease the communication and cooperation between business experts and technical model developers, and then will derive and develop the BPCM into the visual models and executable models. In [37], they also argued that it is often beneficial to start a modeling-based project with an informal model and then develop the visual models.

In our combined framework, as a first step, data about all components of BPCM are gathered and recorded in a textual table according to the elements presented in the last section. Some early stage requirement engineering techniques [23] can be used to gather this information. Then, we will try to derive the start of goal models and process models from the BPCM model. The goal model will typically need to be extended, and this will also provide input to the process model. Lastly, those models can be used as inputs for deriving a candidate IT system.

4.1 Business Process Characterizing Model

While process execution is crucial from the technical developers' point of view, it is equally important to have models that can express characteristics of business processes in their organizational context, which can ultimately be able to support the development of the executable business process models. In today's fast paced changing world, understanding characteristics of business processes and impacts of proposed or underlying changes is a must. Previous experience from large and complex business process projects indicated that many of them fail to achieve desired results because of overlooked organizational issues. Therefore, identifying the important business process characteristics in the early phase is as important as building the executable process models. At this level, the BPCM is used as a sketch to describe the key attributes and elements involve in the business domain or problem description in order to facilitate the communication between business experts and model developers. Although the BPCM does not directly address the construction of business process models and goal models, the elements in the BPCM are close to the concepts of process models and goal models , e.g. actor, resource, hard goal etc.

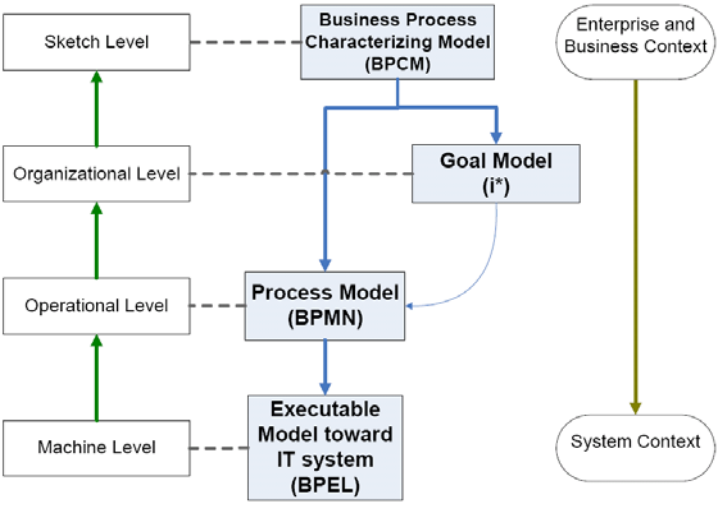

Fig. 1. The Combined Modeling Framework

4.2 Goal Model

According to [35], goals express intentions and capture the reasons of the system to be built. Goal models are used to elicit and make the goals of an enterprise. Goals are essentially optative as they refer to what an organization or its desired IT system is to ensure [48]. Goals may be formulated at different levels of abstraction for different purposes, from high level strategic concerns to low level technical concerns, by using different modeling notations (e.g. i*, KAOS). Goals are also useful in validating system requirements in the context of business or enterprise objectives.

A clear understanding of goals is essential to guide the design of process models and evaluate the operational quality of the solution. Goals can be used to systematically guide the development and refinement of processes during the design. In our framework, the goal model is defined at the organizational level based on information in the BPCM. In this context, goals are defined as statements to declare the states to be achieved. In connection to the process model at the operational level, goals are used to state what has to be achieved in the context of process modeling.

i* supports modeling rich organizational contexts by offering high-level social abstraction (such as goals, soft goals and dependencies) as modeling constructs for reasoning support during business process redesign [24] [47]. Furthermore, there has been some work on translating i* to process models. i* has also recently been standardized by ITU. For those reasons, we use i* for goal modeling. Goal modeling is not discussed in detail in this paper due to space limitations.

4.3 Process Model

According to [20], a business process can be seen as a set of partially ordered activities intended to reach a goal. Since BPMN has relatively higher expressiveness and ability to map directly to executable process languages such as business process execution language (BPEL) [21] and XPDL [13] compared to other process modeling notations, it has been widely accepted by the BPM community [42] for the purpose of business process modeling. In [39], an analysis of BPMN also stated its high maturity in representing concepts required for modeling business process. Therefore, we have chosen BPMN for the construction of process models derived from BPCM.

As presented in Figure 1, process models can be constructed based on the BPCM and goal models. In our framework, the process model is defined at the operational level. The operational requirements derived from BPCM should be reflected in the process models including: involved participant (who), functional goals (what), coordination and cooperation (when). The model developer is supposed to design and develop the business process models based on models from the upper two levels (sketch level and organizational level) as a blueprint for the IT systems to be implemented. In order to build the IT system, these models should be understandable by the system developers and IT experts. If necessary, XML scheme will be defined and embedded into business process models to make them executable.

4.4 Executable Model

In recent years, some initiatives have emphasized process models which can be directly executed. Business process execution and deployment can be achieved by using BPEL. Since model developers are able to convert some resources into XML schema before annotating the associations between tasks with XML type in BPMN, it is possible to design an executable model directly. For instance, the Intalio designer, which is a tool used for BPMN modeling, allows the developers to open the XML schema in the process navigator and design and drag XML types into the associations between pools in the process models.

Some formal models are executable. In an ideal case, the executable system can be generated automatically, which will facilitate developing IT systems. Otherwise,

some manual steps will be involved in developing and realizing the final IT systems. In particular, aspects relating to supporting multi-channel solutions must typically be addressed manually.

5 Ideas to Guide Process Modeling Based on a BPCM

In this section, we describe some preliminary ideas to guide the development of process modeling given the availability of a set of BPCMs. Our methodology relies on establishing relationships between the meta-models of BPCM, goal models and process models similar to the approach in [32].

The intent of our methodology for the process model extraction is to derive as many cues for these models from BPCM as possible. Once the BPCM has been established and agreed upon, the translation from BPCM to process models and goal models can be started. A BPCM can be obtained by collecting relevant information from business stakeholders in terms of filling a BPCM table (as shown in Table 2).

The following describes guidelines to map a BPCM model to a BPMN model:

1. Identify the actors in a BPCM. Each actor within BPCM is a candidate to be a pool in a BPMN process model.
2. Map actors. First of all, we need to identify internal and external actors from the actors identified from a BPCM. This is required because BPMN separates internal organizational actors by representing them as lanes within pools whereas external actors are assigned their own pool. Then, the relevant lanes and pools can be labeled in a BPMN process model.
3. Identify the resources in a BPCM. For each resource in a BPCM, it should include a message flow which links two associated tasks in a BPMN process model, whereby the source of the message flow connected to the dependee's task and the destination of the message flow connected to the depender's task. Since we do not have element in a BPCM to address the relevant tasks in the business process domain, some additional efforts need to be put into tasks discovery in process modeling. Therefore, we proposed the complementary requirement table in Table 1. The complementary requirement table is a table specifying the related tasks in a source pool (lane) or a destination pool (lane), associated to various resources in a BPCM. A complementary requirement table can be filled by model developers with their understanding of a BPCM model.
4. Map tasks and resources. After getting the defined tasks name from the last step, those tasks can be labeled in a BPMN process model. An association flow link is also used to represent the dependencies going from a source pool (lane) to a destination pool (lane), as shown in the complementary requirement table. In the meantime, the message flow between the associated tasks can be labeled with the resource names.
5. Sequence the labeled tasks. The intention of this step is to make sure the clear placement of tasks and messages in a BPMN process model. The sequence of tasks needs to be consistent with routine requirement specified in the specification. The model developer can sequence tasks guided by the process element

(e.g. SCOR) in a BPCM. Furthermore, a start event and an end event must be placed to the correspondent actor's pool or lane.

6. Revisit the BPMN process model. This is intended to rearrange the layout of the already represented tasks to improve the empirical quality of the model.

Table 1. Complementary Requirement Table

Resource	Source Pool or Lane	Destination Pool or Lane	Related Task in Source Pool	Related Task in Destination Pool

6 Exemplar

In this section, we apply our preliminary guidelines to a conference organization exemplar. The exemplar is an extension of the original conference case used e.g. in the IFIP CRIS conferences in the eighties. Whereas the CRIS-case primarily looked upon the paper handling process, the extended exemplar also includes the interaction between different actors needing to arrange the practical parts of the conference. Parts of the overall case are presented here: *Prior to holding a conference, an organization committee and a program committee are established. All services involved in a conference cost money, which have to be balanced by the income from registration fee from participants and sponsors. In order to get funds from sponsors, a call for sponsor is sent out by the organization committee. The program committee consists of a number of researchers working within the theme of the conference, whom are normally distributed across the world. In order to get good papers, on the behalf of the program committee of the conference, the organization committee announces a Call for Papers. Potential researchers receive this, and some of them decide to submit one or more papers for review. The paper is distributed to between 3 to 4 members of the program committee for review. Then, based on the review made by the program committee members within an announced deadline, the program chair makes and distributes paper acceptance decisions of the submitted papers. Researchers of accepted papers are requested to make a final version of their papers, a so called camera ready copy (CRC) and a copyright form to a professional conference proceeding publisher within a predefined deadline. Next, the program chair makes the conference program. In addition, the social program of the conference is also important to attract larger number of participants. In order to have a well-organized social program, the organization committee sends a social program request to a local tourist office. When both of programs are ready, the organization committee announces the conference program and registration method. Then, researchers make registration and payment to the organization committee. The conference proceeding is published by a professional publisher a couple of days before the conference.* Whereas most services are provided over internet, some services (e.g. entering of reviews, registration, information services) is planned to be possible to do using a mobile device. After characterizing this conference organization case using the characterizing model proposed in section 3, we summarize the derived BPCMs in Table 2. Note that this actually is a summary of a number of BPCMs, but it is here described in one table due to size limitations of the paper.

Table 2. Conference Organization Case in a BPCM Model

BPCM Name / BPCM Elements	Conference Organization Case
Process	Plan conference (P1 Plan supply chain, P2 Plan Source, P4 Plan Deliver) Source Conference (S2 Source make-to-order Product (Proceedings) Deliver Conference (D2 Deliver Make-to-order Product), Enable (Manage Capital Assets)
Resource	Call for Sponsor, Funds, Social Program Request Form, Social Program, Call for Paper, Paper, Review Form, Acceptance Result, Paper Presentation Program, CRC & Copyright Form, Conference Program, Registration Information, Registration Payment, Conference Proceeding
Actors	Organizational Committee, Sponsor, Local Tourist Office, Researcher, Program Committee, Program Chair
Context	Multi-channel (PC over LAN/WLAN/UMTS/GPRS). Some services PDA over WLAN/UMTS/GPRS
Business Domain	561920 Convention and Trade Show Organizers (some of the suppliers are in other business domains e.g. 561591 Convention and Visitors Bureaus, 51113 Book Publishers)
Goal	Soft Goal: A conference is well-arranged Hard Goals: Attendance at a conference, higher; Balance positive Paper Reviewing Process, Acceptance rate 15-20%.
Process Type	Conversion

Table 3. Complementary Requirement Table: the conference organization case

Resource	Source Pool or Lane	Destination Pool or Lane	Related Task in Source Pool	Related Task in Destination Pool
Call for Sponsor	Organizational Committee	Sponsor	Publish Call for Sponsor	Receive Call for Sponsor
Fund	Sponsor	Organizational Committee	Sponsor Conference	Receive funds
Social Program Request Form	Organizational Committee	Local Tourist Office	Inquiry Social Program	Receive request form
Social Program	Local Tourist Office	Organizational Committee	Make a social Program	Receive a social program

Figure 2 is a part of the BPMN process model thus extracted from the BPCM of the scientific conference organization case (depicted in Table 2) (a derived goal model is not shown, due to page limitations).

As presented in the BPCM, there are seven actors in this conference organization process. The seven actors can directly map to seven pools in the BPMN process model. More than ten resources are identified in the BPCM. In order to discover the tasks related to the resources, the complementary requirement table is filled as shown in Table 3 (due to space limitation, only part of the table is presented here). Then, both resources and related tasks can be mapped to the BPMN process model, and flow links are placed to associate tasks between pools. In the next step, the already labeled

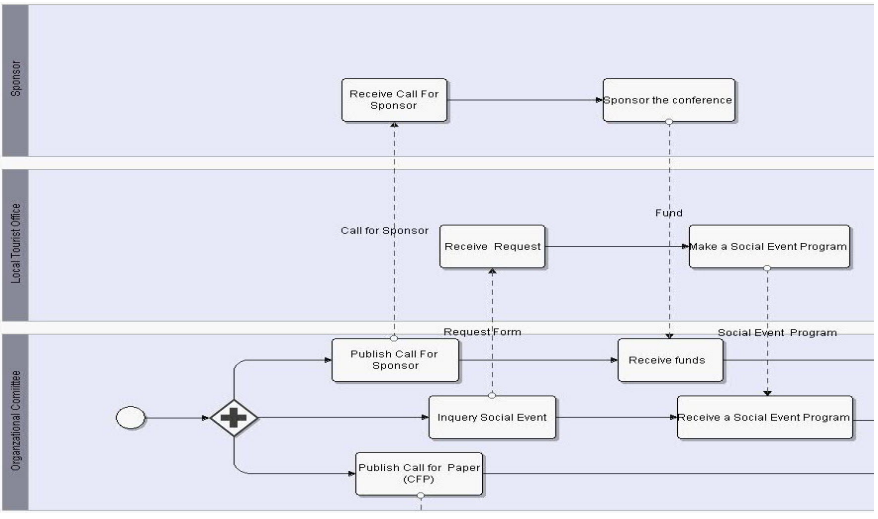

Fig. 2. The BPMN process model[1]

tasks are sequenced in a logical manner guided by process element in the BPCM (e.g. the link to SCOR) and a start event and an end event are added to the BPMN process model. Lastly, the BPMN process model is revisited to enhance the layout.

7 Discussion

In this paper, we have described how to utilize a BPCM as shown in the combined framework to guide the design and construction of business process models in the life cycle of business process modeling development. However, it must be admitted that the evaluation and validation of the BPCM in the combined framework is currently quite limited since we only illustrated the usage of the BPCM in an exemplar. In this section, we discuss some problems we found from the exemplar study and propose some future research directions.

7.1 Lessons Learnt from the Exemplar

In applying our preliminary ideas on mapping a BPCM to a BPMN process model in the case, we found that the projection process is straightforward. However, in practice, the case might be more complicated than what we proposed in the last section. We also recognized some potential limitations to the preliminary ideas we described in section 4. First, we do not address the issue on control flow. Second, we do not set up the criteria to evaluate how well a BPMN process model can meet hard goals or soft goals proposed in a BPCM. Third, we need to have a better solution to deal with the consistency check between a BPCM and a BPMN process

[1] Full Size Image of the whole BPMN process model is available at:
`http://www.idi.ntnu.no/~shanggao/BPMN/Conference.jpg`

model. From the exemplar it appears that we basically capture high level activities. On the other hand, if we performed a further drill-down according to the identified processes in SCOR, more detailed processes would have been identified.

7.2 From a BPMN Process Model to IT System

BPMN is often used when designing and improving the business process, whereas BPEL is used when implementing it. The main approach for execution of a BPMN process model is a translation from BPMN to BPEL. If BPMN can be transformed into BPEL, the BPEL process can be executed on BPEL engines. There are many tools on the market that transforms BPMN into BPEL, which makes implementing IT system from a BPMN process model possible. In [45], the authors present an approach for combining process modeling notations such as BPMN and user interface modeling. Here it is identified a need to translate analysis level BPMN models to a design time BPMN model. Since BPCM in our framework can take care of the analysis level, we map directly to the design level BPMN and can add aspects relevant for user interfaces that can take the multi-channel aspects into account.

7.3 BPCM Related Issues and Future Work

You might find that some of the elements in the BPCM are not used in mapping from a BPCM to a BPMN process models. You may question that those elements are useful? The answer is yes, but for other purposes. For instance, the context element can help the model developer to develop the models with a consideration of the mobile working environment and multi channel supports issues. Different processes might be needed for the provision of services over different channels. Moreover, some elements of the BPCM can be used as a key for querying purposes. For instance, the element business domain can be used to identify solutions from similar areas.

Future research will address the problems we proposed in this section. In addition, we will validate and evaluate our combined framework in case studies. In particular we will use the approach in connection to supporting a loosely organized conference series with a firmer framework. Also further comparisons with related approaches for multi-model integration (e.g. [36]) will be performed.

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