SUPPORTING BUSINESS MODELING USING MULTIPLE NOTATIONS
A Case Study

Moshiur Bhuiyan
School of Computing and Mathematics, Charles Sturt University, Study Centre, Darlinghurst, Sydney, NSW, Australia

Sohel Rana, Kamrul Hasan
OptInfra Systems, Sydney, Australia

Keywords: Agent Oriented Conceptual Modelling (AOCM), Requirement Engineering, *i**, BPMN, Process Modeling.

Abstract: In this paper, we present a case study that illustrate the use of an approach that facilitates and supports the combined use of *i** and BPMN for performing business modeling in a synergistic fashion on a complex project for a large government agency in Australia. We used a constrained development methodology to facilitate this modeling practice. The purpose of this case study is to further demonstrate the applicability of our proposed methodology in a real time, big scale industrial project.

1 INTRODUCTION

Many notations have been developed for the task of modeling business processes, and each have their own focus of application and appropriate audience (Bider et al, 2002) (Katzenstein et al, 2000) (Kavakli et al, 1999) (Yu, 1995). In particular, high-level conceptual models provide an understanding of an organization from an intentional and social perspective for reasoning support during redesign (Yu, 1995). In comparison, lower-level technical models are especially suited for applications in the description, execution and simulation of business processes (Yu, 1995b).

We argue the analysts need to base business process development on principled high-level models of the enterprise and the business context. Commonly, processes are formulated in an ad-hoc fashion without reference to these high-level models. Some of the most prominent modeling notations enlisted are primarily focused towards technically-oriented data, and process modeling notations such as ER, Data-Flow, Systems Flowcharting and UML and workflow modeling (Davies et. al. 2004).

In this paper we present a case study on a large scale project in a government agency in Australia. This case study illustrates how the business modeling phase of the project was implemented with the support of multiple modeling notations and a constrained development methodology proposed at (Ghose et al, 2006) (Koliadis et al, 2006a) (Koliadis et al, 2006b).

The following section starts with background information about the project. We then describe the business modeling strategy that was followed along with a brief discussion on the notations used. We then provide an illustration of the methodology, techniques and templates. Finally we have a discussion section about the project and some concluding remarks.

2 PROJECT BACKGROUND

This case study is based on a large public department in Australia. The organization structure is a complex array of directorates and business units with varying needs. It required an enterprise software solution, which can accommodate its strict security requirements while supporting standardized and decentralized processes for time tracking, project management, resource management, financial management and reporting. The department chose to configure the CA Clarity™

Bhuiyan M., Rana S. and Hasan K..
SUPPORTING BUSINESS MODELING USING MULTIPLE NOTATIONS - A Case Study.
DOI: 10.5220/0003510703010306
In *Proceedings of the 13th International Conference on Enterprise Information Systems* (ICEIS-2011), pages 301-306
ISBN: 978-989-8425-55-3

Project system (CA Clarity™, 2010) since its ability to provide the solutions to the organization's above-referenced requirements under the terms of strict tender.

The department's highest priority at the time of the project was "client success". This was to be accelerated by improving corporate capabilities to ensure the success of initiatives introduced for this purpose. The project was a result of the department's need for a long-term project governance solution that will also be used to manage a variety of critical variables such as resource management, project portfolios, and demand for services in a number of major programs.

3 MODELING NOTATIONS BACKGROUND

3.1 *i** Modeling

It has been argued that notations such as *i** help answer questions such as what goals exist, how key actors depend on each other and what alternatives must be considered. Furthermore, *i** has been acknowledged as illustrating the key social/strategic inter-relationships between actors (Katzenstein et al, 2000) (Yu, 1995) required for effective business process redesign. This is achieved via support for reasoning about organizational activities and their assignment to various organizational agents (Loucopoulos et al, 1995) in respect to: the ability, workability, viability, and believability of their routines; and, level of commitment (Yu, 1995).

The *i** framework consists of two modeling components (Yu, 1995): Strategic Dependency (SD) Models and Strategic Rationale (SR) Models. The SD model consists of a set of nodes and links. Each node represents an actor, and each link between the two actors indicates that one actor depends on the other for something (i.e. goals, task, resource, and soft-goal) in order that the former may attain some goal. The depending actor is known as *depender*, while the actor depended upon is known as the *dependee*. The object around which the dependency relationship centers is called the *dependum*. The SR mode further represents internal motivations and capabilities (i.e. processes or routines) accessible to specific actors that ensure dependencies can be met.

3.2 Business Process Modeling with BPMN

Many existing Business Process Modeling notations primarily focus on technical process aspects including the flow of activity execution/information and/or resource usage/consumption (Loucopoulos et al, 1995). This perspective is aimed at describing the sequence of activities, events and decisions that are made during process execution, however social and intentional components lack representation. The technical focus of these notations is especially suited for applications in the description, execution and simulation of business processes but is lacking in support for process redesign and improvement (Yu, 1995).

One such notation is the Business Process Modeling Notation (BPMN), developed by the Business Process Management Initiative (BPMI.org). BPMN can be seen as primarily a technically-oriented notation that is augmented with an ability to assign activity execution control to entities (e.g. roles) within an organization with 'swim-lanes'. This effectively provides a view of the responsibilities and required communications between classes of process participants, but does not provide a view of other social and intentional characteristics including the goals of participants and their inter-dependencies.

Since its initial publication BPMN has been accepted by the greater Business Process Management community (Becker et al, 2005) (Smith et al, 2003), due to its expressiveness and ability to map directly to executable process languages including XPDL (Fischer, 2005) and BPEL (White, 2004) (Ouyang et al, 2006). The wide uptake of the notation by most BPM2 tool vendors is also a sign of its longevity (Hall et al, 2005). Some practitioners have hailed BPMN as supplying a rich representation that allows Business Process Management Systems (BPMS) the ability to control the required interactions with humans and 3rd party applications (Miers, 2004). Furthermore, an analysis of BPMN (Becker et al., 2005) also stated its high maturity in representing concepts required for modeling business process, apart from some limitations in terms of representing state, and the possible ambiguity of the swim-lane concept.

4 BUSINESS MODELING STRATEGY

The project management team decided to conduct

detailed business modeling in order to configure the Clarity Systems based on requirements of the stakeholders. The project team put special emphasis to make sure the individual directorate and business units' requirements were addressed. There were few challenges; the department was very large with complex organizational structure making it harder to implement the software solutions by eliciting and analysing requirements from every directorates and business units. Also changes at the organization level as well as the operational level were very common; so there was a need for a methodology that could track these changes both at organizational and operational level so that the changes to the software can be supported comfortably without losing consistency at these levels. On the other hand, CA Clarity (Clarity™ Project) itself is an extensive project and program management tool covering variety of organizational requirements with its own configuration complexity. The idea was to perform business modeling exercise using two different notations *i** and BPMN with the help of a constrained development methodology mentioned at (Ghose et al., 2006) (Koliadis et al., 2006a) (Koliadis et al., 2006b).

The business modelling strategy examined the requirements for developing and maintaining one or more business models within the project, recommended the most appropriate approach and defined the techniques, standards, roles and responsibilities for developing and maintaining the required models during the course of the project. The business modeling strategy informed the Project Plan, the Stage Plans, the Project Quality Plan and required Business Models.

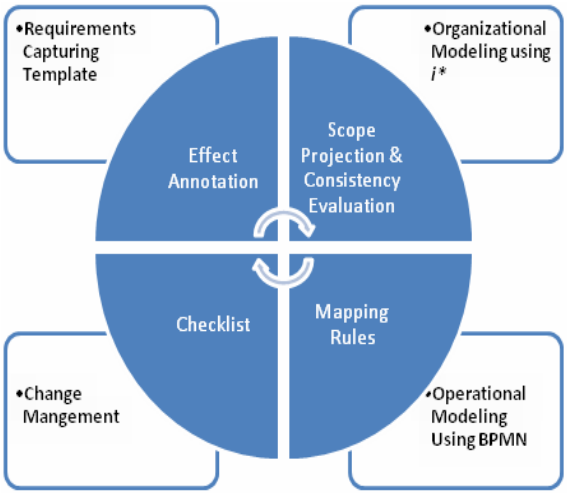

Figure 1: Proposed Modeling Strategy.

As mentioned earlier, proposed products of business modeling were: High Level Organizational Model (in *i** organizational modeling notation), Operational Business Process Model (in BPMN). Given the organizational size and complexity of the department it is quite normal to have a varied and large range of business requirements models. The large scope of the business units leads to greater complexity. It was decided that a combination of notations will be used in order to facilitate the maintenance of the models in lieu of changes in the context of their usage over the course of their lifecycle.

For initial requirements engineering exercise *i** organizational modeling technique was used. These models represented the scope, organizational actors/roles and their dependencies and intentional rationale. We then mapped the *i** organizational models into operational BPMN models and vice versa (when required) using our constrained development methodology.

5 MODELING APPROACH AND METHODOLOGY

Early-phase RE activities have traditionally been done informally (Yu, 1995), beginning with stakeholder interviews and discussions on the existing systems and rationales. Initial requirements are often ambiguous, incomplete, inconsistent, and usually expressed informally. We added some structure to this informal consultation process via the use of Requirements Capture Templates (RCTs).

In effect, these were forms that the modeller seeks to fill out in the course of a stakeholder consultation session and that were eventually signed off by both the modeller and the stakeholder. The process of filling out these forms provided structure to stakeholder interview sessions. In addition, these forms were designed to seek information specific to the need of the underlying agent-oriented conceptual model (*i**) that the modeller seeks to build. As we will show below these templates were designed in a manner that makes it easy to systematically transform them into SD and SR models.

Stakeholders were thus able to provide focused input to the conceptual modeling task, while being shielded from the complexity of understanding and using the conceptual modeling language.

Table 1: Requirements Capture Template.

Requirements Capture Template			
Function Elaboration for the department			
Department Name			
Function Name (Use separate sheet for each function)			
Function Rationales (Use separate sheet for each function)			
Activity Details for the Function			
Activity Name and Description (Use separate sheet for each activity under the function)			
Activity Rationales			
Responsible Actor(s) involved in the activity (Unique list of Actor(s))			
Relationship / dependencies between responsible actor(s) to achieve / satisfy the above activity (Relationship is described as the dependency from source actor on to target actor, use separate row for each relationship And dependency)			
Source Actor	**Relationship / Dependency**	**Target Actor**	**Additional information**
Modeller Signature		**Stakeholder Signature**	

Once the templates were finalised and the *i** models were developed, we applied constrained development methodologies proposed at (Ghose et al., 2006) (Koliadis et al., 2006) (Koliadis et al., 2006) to guide the derivation or maintenance of one type of model given the availability of the other. Figure 2 illustrate a sample SR model that was developed for Demand Management modeling.

The development was supported with the introduction of two concepts: fulfilment conditions and effect annotations (i.e. as described in (Fuxman, Liu, Mylopoulos, Pistore, Riveri and Traverso, 2004). An effect is broadly defined as the result (i.e. product or outcome) of an activity being executed by some cause or agent. An effect annotation is a specific statement relating to the outcome of an activity, associated to a state altering construct in a given model. During BPM, effects are annotated to atomic tasks/activities or sub processes within an actor's lane. The execution of a number of activities in succession results in a cumulative effect that includes the specific effects of each activity in the sequence. We also note the fact that certain effects can undo prior effects (i.e. in the case of compensatory activities). Effect annotations may possibly be formalized using the formal layers of some currently well-developed Goal-Oriented Requirements Engineering (GORE) methodologies (Fuxman et al., 2004) (Lamsweerde, 2001), however, we only state their applicability in this work.

Fulfilment conditions were annotated to tasks and goals assigned to actors in an SR diagram, and dependencies (i.e. not including soft-goals as these are used during assessment of alternatives and describe non-functional properties to be addressed) in an *i** model. A fulfilment condition (Fuxman et al., 2004) is a statement specifying the required conditions realized upon the completion of a given task, goal or dependency. Fulfilment conditions recognize the required effects on a business process model.

The application of the methodology was divided into phases. Phases were annotating the *i** organization model, scope projection & consistency evaluation, mapping rules.

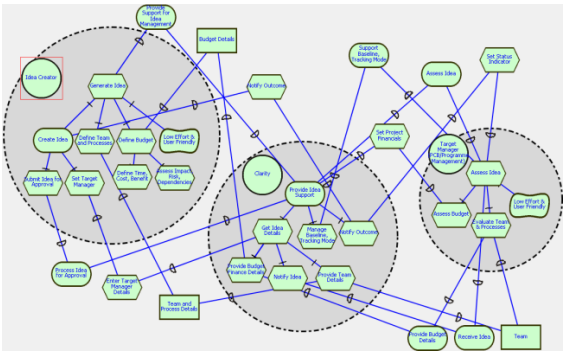

Figure 2: SR Model of Demand Management.

All through the business modelings exercise, the following criteria were followed:

- Reference models are aligned with the Project Approach
- Modeling approach and technique meets the modeling requirements in the most efficient and cost-effective way
- Cost of tools and training provided are kept to a minimum

- Models are easy to maintain and lend themselves to an iterative approach
- Models require minimum specialist skills or training to be interpreted by the project team members

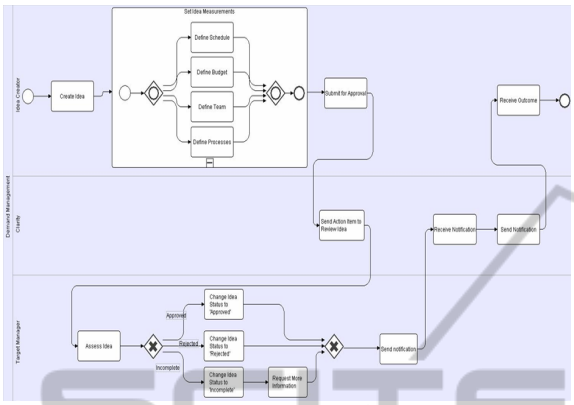

Figure 3: Represents a sample BPMN model derived from the Demand Management SR model using the constrained development methodology.

6 DISCUSSIONS AND LESSONS LEARNT

Combined business modeling helped the project in the following ways:

It helped the project to define its scope, identify associated roles, their dependencies, represent the processes embedded in the projects and clarify the developers to design the test cases and implement the configuration of the system.

Combined models acted as a common language for communication for varied stakeholders' goals, policy implications, and/or operational constraints by creating a contextual environment.

It helped to increase the department's organizational and operational management capability by representing 'what business process exists', and 'what business process is required to exist'.

The constrained development methodology used in this exercise helped the modellers in two ways. Firstly, it made the model transformation (*i** to BPMN and also BPMN to *i** when required) smooth and consistent. Secondly, in model management when a change was required. This methodology supported to tracing and managing changes in organizational models and process models. We plan to discuss this part in details in a separate work at a later stage.

The RCTs presented here can ease the requirements elicitation process. However, these templates serve other useful functions as well. They can provide a structured repository and record of stakeholder interviews that can be revisited when requirements must re-negotiated or revised (for instance, when changes are made to models, or when inconsistencies are detected). The detailed rationale recorded in these templates can also be of value in business process re-engineering. To anticipate and support future business process re-engineering efforts in the context of the department, we are also detailing alternative solution scenarios by completing additional RCTs that answer "how else" questions (while the primary RCTs represent the "as is" scenarios).

We do not claim this modeling effort was successfully completed without any problems. We did continue to get feedback from all parties involved on the use of this methodology and modeling exercise. Some of the concerns that rose from the analysts are:

Firstly, model management is an important issue/challenge perceived by many academics, practitioner and vendors (Indulska, Recker, Rosemann and Green, 2009). Hence, it is not surprising to see that some of the analysts believe that the implementation and management of two business process models simultaneously might be a quite difficult asks for many organizations.

Secondly, planning to integrate these methodologies would bring various management-related challenges such as change management and resource commitment. This initiative would require clear planning and goal setting which must be accepted by the executives of the organization. Without this and the commitment to the methodology the initiative is unlikely to succeed. Organisations with little or no expertise in the process modeling area will likely to hire consultants/ modeling experts. While external consultants might bring expertise and specialist knowledge into the organisation, ROI need to be carefully examined.

Thirdly, according to Indulska et al (2009), business process model's ease of use is another attribute that is highly regarded by many credential practitioners, vendors and academics. Some of our analysts believe that individuals without relevant knowledge and expertise in the BPM area might find this methodology quite challenging. This process model should be fully understood otherwise it could cause legitimate problems.

We believe the modeling implementation and management implementation needs to be sustained. The responsibility for this usually lies with

modellers, quality group, auditors or even the senior project managers to ensure the methodology lives long past it implementers and original sponsors. We argue the implementation of this business modeling is a long term goal. Once the exercise is complete the aim is to keep them available and ensure the benefits are realised full potential.

7 CONCLUSIONS

In this work we have presented an industrial case study that discussed the business modeling phase of a project. We have illustrated the modeling strategy and modelling approach. We have also discussed how we used the constrained development methodology and the requirements capture templates. In our future work, we plan to elaborate more details on the management of the multiple models produced. We also plan to illustrate the fact of how it was possible for us to implement the transition to the "to be world" from the "as is world".

REFERENCES

Ghose, A., Koliadis, G., Bhuiyan, M., 2006. Correlating Business Process and Organizational Models to Manage Change, *Australasian Conference on Information System* (ACIS2006).

Becker, J., Indulska, M., Rosemann, M., Green, P., 2005. "Do Process Modelling Techniques Get Better? A Comparative Ontological Analysis of BPMN," in Campbell, Bruce and Underwood, Jim and Bunker, Deborah, Eds. *Proceedings 16th Australasian Conference on Information Systems*, Sydney, Australia.

Bider, I., Johannesson, P., 2002. "Tutorial on: Modeling Dynamics of Business Processes – Key for Building Next Generation of Business Information Systems," in *The 21st International Conference on Conceptual Modeling* (ER2002), Tampere, FL, October 7-11, 2002.

CA Clarity™ Project system at http://www.ca.com/us/, Accessed: 02/07/2010.

Fischer, L., 2005. Workflow Handbook, Workflow Management Coalition, (WfMC).

Fuxman, A., Liu, L., Mylopoulos, J., Pistore, M., Roveri, M., Traverso, P., 2004. Specifying and analyzing early requirements in Tropos. In: Requirements Engineering, Springer London, 9(2) 132–150

Koliadis, G., Vranesevic, A., Bhuiyan, M., Krishna, A., and Ghose, A., 2006a. Combining *i** and BPMN for Business Process Model Lifecycle Management. In the *Proceedings of the BPM-2006 Workshop on Grid and Peer-to-Peer based Workflows, Lecture Notes in Computer Science Series*, ISBN 978-3-540-38444-1, 416-427, Springer Verlag.

Hall, C., Harmon, P., 2005. The 2005 Enterprise Architecture, Process Modeling & Simulation Tools Report, Technical Report, bptends.com.

Indulska, M., Recker, C., Rosemann, M., and Green, P., 2009. Business process modeling : current issues and future challenges. *In: 21st International Conference on Advanced Information Systems*, 8-12 June 2009, Amsterdam, The Netherlands.

Katzenstein, G., Lerch, J., 2000. Beneath the surface of organizational processes: a social representation framework for business process redesign. ACM Transactions on Information Systems (TOIS), 18(4), (pp. 383-422).

Kavakli, V., and Loucopoulos, P., 1999. "Goal-Driven Business Process Analysis - Application in Electricity Deregulation," Information Systems, Vol 24, No3, pp. 187-207, 1999.

Koliadis, G., Vranesevic, A., Bhuiyan, M., Krishna, A., and Ghose, A., 2006b. A combined approach for supporting the business process model lifecycle. *Proceedings of the Asia-PacificConference on Information System*

Lamsweerde, A., 2001. Goal-Oriented Requirements Engineering: A Guided Tour. *In: The 5th International Symp. In Requirements Engineering* (RE'01), Aug.

Loucopoulos, P., and Kavakli, E., 1995. "Enterprise Modeling and the Teleological Approach to Requirements Engineering," *International Journal of Intelligent and Cooperative Information Systems*, Vol 4, No1, pp. 45-79.

Miers, D., 2004. "The Split Personality of BPM," Business Process Trends, bptrends.com.

White, S., 2004. Business Process Modeling Notation (BPMN), Version 1.0, *Business Process Management Initiative* (OMG.org).

Yu, E., 1995. Modeling Strategic Relationships for Process Reengineering. PhD Thesis, Graduate department of Computer Science, *University of Toronto*, Toronto, Canada, pp. 124.

Yu, E., 1995b. "Models for Supporting the Redesign of Organizational Work," *Proceedings, Conf. on Organizational Computing Systems* (COOCS'95) August 13-16, Milpitas, California, USA. pp. 225-236.

Smith, H., Fingar, P., 2003. Business Process Management – The Third Wave, Tampa, FL: Meghan-Kiffer Press.

Ouyang, C., van der Aalst, P., Dumas, M., and ter Hofstede, M., 2006. "Translating BPMN to BPEL," BPM Center Report BPM-06-02, BPMcenter.org, 2006.