Towards an Assessment Model for Balancing Process Model Production and Use

Toomas Saarsen and Marlon Dumas

University of Tartu, Estonia

ABSTRACT

This paper presents a framework for assessing the balance between process modeling effort and process model usage in order to optimize the value of process modeling in an organization. The framework has been tested through case studies in five organizations. The case studies demonstrate different degrees of imbalance in favor of model production as compared to usage. Three of the studied organizations have active and structured process modeling programs but underuse the models. We contend that the proposed framework can form a basis for a value-aware process modeling governance framework.

Categories and Subject Descriptors

H.4.1 [**Information System Applications**]: Office Automation – *workflow management.*

General Terms

Management, Documentation.

Keywords

Business process model, documentation management.

1. INTRODUCTION

Contemporary organizations often rely on Business Process Management (BPM) as an instrument to achieve and maintain operational efficiency. In general, BPM programs rely on process models to document, analyze, automate and monitor business processes [11]. Accordingly, existing BPM tools provide a range of features both for production and use of process models [1].

Anecdotal and case study evidence suggests that BPM programs often suffer from an over-emphasis on process model production and a concomitant lack of monitoring and assessment of process model use [2, 17]. This leads to a situation where process models are not maintained and lose relevance over time due to lack of active use. However, little research has investigated the connection between process model production and use and how to balance these dimensions. In particular, there is relatively little research on process model use [3, 10].

This paper presents a framework for analyzing the balance between process model production and use in a given organization. The proposed framework, namely the Balanced Process Model Production and Use (BPU), is validated via case studies in five organizations − two with relatively recent BPM initiatives and three with several years of BPM experience.

From a methodological perspective, the presented research follows a Design Science approach [4]. First, an analysis of the problem was conducted in light of existing literature leading to an initial definition of the BPU framework. Next, the usability of the model was tested via five case studies. Feedback gathered during these case studies was used to refine the framework.

The paper is structured as follows: Section 2 explains the BPU framework and its theoretical foundation; Section 3 presents the case studies; Section 4 reviews related work; finally, Section 5 draws conclusions and identifies objectives for further research.

2. BPU FRAMEWORK

2.1 Conceptual Foundation

The BPU framework relies on the following view of the life cycle of process models. A modeler discovers and documents a business process, thus producing a process model. Users, such as managers, workers and business partners, use the model or derivatives thereof (e.g. reports) for different purposes, including analysis, automation or monitoring. Business value is derived through usage of the models and derivatives. Models are ideally produced and used in a continuous loop (Figure 1) where usage of a process model generates feedback to improve the model itself.

Figure 1. Life cycle of a process model.

Based on this life cycle, we postulate that an assessment of a process modeling program ought to take into account three dimensions: (i) the production of models, (ii) the models themselves, and (iii) the consumption of models. The BPU framework is derived from further refinement of this postulate.

Table 1. BPU Table

	Modeling			Business process model					Usage	
	Modeler	Method	Governance	Coverage	Structure	Consistency	Completeness	Correctness	User	Use
Optimized										
Managed										
Repeatable										
Defined										
Initial										

At the core of BPU framework is a table for assessing process modeling efforts along the above three dimensions (cf. Table 1). The rows of the BPU table correspond to phases in the evolution of a process modeling program, ranging from an initial (*ad hoc*) phase – wherein an organization that has just started process modeling – up to an 'Optimized' level corresponding to an organization that has well-established procedures for model production, maintenance and use. In this respect, the BPU table follows standard practice for process maturity models [5].

On the other hand, the horizontal axis of the table reflects the three dimensions of process modeling discussed above. Below, we discuss each section of the BPU table in turn. In most cases, we do not define each individual level of maturity along each parameter in full, but instead we collapse multiple levels (e.g. level 1-2) into a single entry, leaving freedom to the assessor to determine whether the actual level is 1 or 2 depending on the extent to which the statement describing the level holds.

2.2 Modeling

The first section − Modeling − focuses on model production. To analyze this dimension, we rely on a previous study on success factors of process modeling [9]. This study identifies 11 success factors related to process model production and maintenance. We group these factors into three categories according to the following questions: Who is involved in producing the model? How are the models produced? And how is the modeling effort managed? This leads us to the identification of three assessment dimensions for model production: Modeler, Method and Governance. With respect to [9], the Modeler parameter covers success factors *modeling team structure*, *modeler expertise*, *user participation, user competence and communication*. The Method dimension covers *modeling language*, *method* and *tool*, while the Governance parameter covers *top management support*, *leadership* and *project management*.

Modeler – This parameter covers the modeling team, modeler expertise and user participation (i.e. participation by future model users, including managers and process participants). Along this parameter, we define the following levels:

Level 1: At this level, there is no modeling team per se, but ad hoc individual modeling initiatives driven. Modeler expertise in the organization is very limited and thus modeling is either done with little expertise or with outside advice [6]. User participation in modeling is low given the lack of experience.

Level 2: At this level, a modeling team with some expertise starts to emerge, for example within the IT or business development department. Users have been confronted to modeling before and have a basis to provide input to the modeling effort.

Level 3: At this level, there is a structured modeling team and wide user participation. Process managers – appointed for different areas –trigger and champion modeling efforts.

Level 4−5: As modeling expertise spreads, the distinction between modelers and users gradually vanishes. Process managers encourage users to be active members of the modeling team. Thus, user participation is very high.

Method – The second parameter in this section (method) brings together success factors *modeling language*, *modeling tool* and *modeling team*. This parameter is thus concerned with methods and tools for data collection, process modeling and analysis [7]. We conceptualize the method parameter of the BPU table as a journey towards increasing sophistication in the way data is collected and analyzed to produce process models, along the following levels.

Level 1: The method and tool are not critical – a simple tool can be used to capture and visualize processes. A simple modeling language, or a minimal subset of a larger process modeling language is employed

Level 2−3: As modeling team grows, systematic data collection and modeling methods are used. A modeling tool is put in place to capture and share process models in a structured and uniform manner. A larger subset of a modeling language is used to capture processes more precisely.

Level 4−5: There is a structured approach not only to construct process models, but also to analyze them. Dictionaries are put in place to ensure consistency of terminology. A sophisticated modeling tool and language are used to their full extent.

Governance – This parameter brings together success factors *project management*, *leadership* and *top management support*, and more broadly issues related to managing the creation and maintenance of process models [2, 5].

Level 1: There is one or a handful of ad hoc process modeling initiatives organized without an overarching governance framework. Typically, process modeling starts initially as a project [14]. For example, an IT project requires a description and shared understanding of business processes so models are created within this project and not maintained thereafter.

Level 2−3: As the modeling team grows, it becomes necessary to establish rules and conventions for modeling to guarantee uniformity. Guidelines for business process modeling are prepared [8], e.g. naming conventions, rules for using different modeling constructs, model update procedures etc.

Level 4−5: At this stage, there is clear governance structure for process modeling. Guidelines are not only available, but widely used, checked and enforced.

2.3 Model

Along the second section of the BPU table (the "Model"), we characterize the maturity of a business process models based on properties of individual models seen in isolation and properties of a collection of process models. Specifically, we propose to characterize an individual process model in terms of *completeness* and *correctness* (encompassing also understandability) [16], while collections of process models are assessed in terms of *coverage*, *structure* and *consistency*, as depicted in Figure 2.
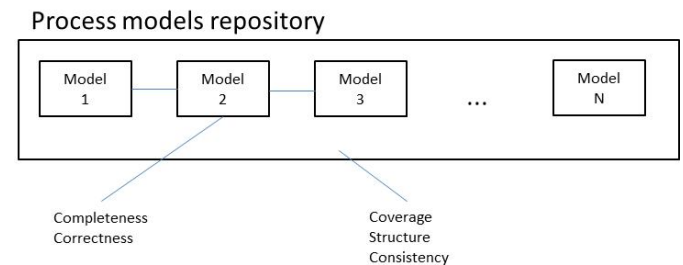

Figure 2. Parameters under section "Model"

Coverage – This parameter captures the representativeness of the modeled processes. To assess this parameter, we rely on a well-

known classification of processes into core processes, support processes and management processes [13].

> Level 1−2: Process models are confined to a subset of the organization, for example only core processes are modeled, or only a specific subset of support processes are modeled (e.g. finance or human resource management processes).

> Level 3−4: A significant fraction of processes are modeled, for example all core processes and a subset of support and management processes are modeled.

> Level 5: The organization has a process model collection covering close to 100% of their known processes.

Structure – This parameter captures the structure (also called architecture) of the collection of processes models. It is based on well-known concepts of process architectures [13].

> Level 1: The existing collection of process models is rather flat. There is little or no decomposition of processes into subprocesses and the upstream-downstream relations between processes are not explicitly captured.

> Level 2−3: The collection of process models is structured according to process-subprocess relations as well as upstream-downstream relations, but no systematic criteria are used to decompose and relate processes to each other.

> Level 4−5: There is a clear and navigable process architecture. Criteria are defined and applied to decide when should processes be decomposed into subprocesses and more generally how the process architecture should be updated.

Consistency – Consistency specifies the extent to which uniform modeling rules are followed across different models [8].

> Level 1−2: Inconsistencies are widespread across process models. Each model applies different modeling conventions and different vocabulary.

> Level 2−3: There are subsets of process models that follow uniform conventions and apply a uniform vocabulary. However, different subsets/groups of models follow different conventions and nomenclature.

> Level 4−5: Uniform nomenclature and modeling conventions can be observed across all models in the repository.

The above parameters (coverage, structure and consistency) look at the collection of models as a whole. The next two parameters (completeness, correctness) focus on individual model quality.

Completeness – This parameter assesses the extent to which the models in the collection cover different perspectives of process model. In this respect, we rely on a well-known taxonomy of perspectives of process modeling, which include: the control-flow perspective (tasks, events, gateways, control-flow relations), the information perspective (documents and other artifacts manipulated in a process) and the resource or organizational perspective (actors) [13].

> Level 1−2: Most process models are focused on one perspective, for example the control-flow perspective (tasks and control-flow relations).

> Level 2−3: Most process models cover two or all three perspectives as well as relations between these perspectives.

> Level 4−5: All or close to all process models capture all three perspectives and their relations.

Correctness – This parameter assesses the extent to which the models in the collection are understandable and correct. In this respect, we rely on a taxonomy of correctness of process models proposed in [16], where three perspectives of correctness are identified: syntactic correctness (are the syntactic rules of the modeling language followed?), semantic correctness (are the semantic rules of the modeling language and other relevant semantic correctness rules ensuring executability followed?) and pragmatic correctness (do the models reflect the expected or actual execution of the processes?).

> Level 1−2: The majority of models have significant correctness issues along one or multiple perspectives.

> Level 2−3: The majority of models are correct along all three perspectives.

> Level 4−5: All or close to all models are correct along all three perspectives.

2.4 Usage
The last section of the BPU table (Usage) assesses the extent to which models are used by different users for various purposes. We decompose this dimension using the following two questions: Who uses the models? And for what purpose are the models used?

User – This parameter capture the extent to which use of process models is widespread in the organization [11].

> Level 1−2: The number of users is small and includes mostly stakeholders associated with the process modeling effort.

> Level 3: The set of users extends beyond those involved in the modeling projects. At least some users outside the modeling projects use models regularly.

> Level 4−5: Use of process models is widespread in the organization, both among managers and process participants.

Use – The last column (Use) captures the spectrum of use cases for which process models are used (i.e. for what purpose are models used) and what impact does the use of process model has on the operations of the organization [10].

> Level 1−2: Processes models are used in some project where they are produced but not beyond and used mainly for *documentation*.

> Level 2-3: Process models are used for process *analysis and improvement* and *compliance management*. Process models are used widely in *communication* (process culture) and across different projects (re-use).

> Level 4−5: Process models are used for the above purposes as well as *automation*, *monitoring* and *auditing*.

Note that this parameter does not attempt to cover the financial impact of process model use. The question of financial impact of process models is beyond the scope of the BPU framework and is addressed for example in the context of ROI measurement in [17].

2.5 Applying the BPU Framework
The BPU framework suggests a three-step approach (Figure 3) to assess the balance between a process model and its use in an organization:

1. Firstly, the current context of the organization is described when moving from left to right in the table. First, stakeholders involved in model production are interviewed to understand the modeling practices. Next,

the models themselves are gathered and analyzed. Finally, users of models are identified and the existing uses of models are documented.

2. Secondly, different possibilities are analyzed in order to achieve a more active and efficient use of the process model within the organization.

3. Thirdly, we evaluate whether the cost related to the improvements of the process modeling practices will provide sufficient returns or direct or indirect profit for the organization through an active use of the model in future.
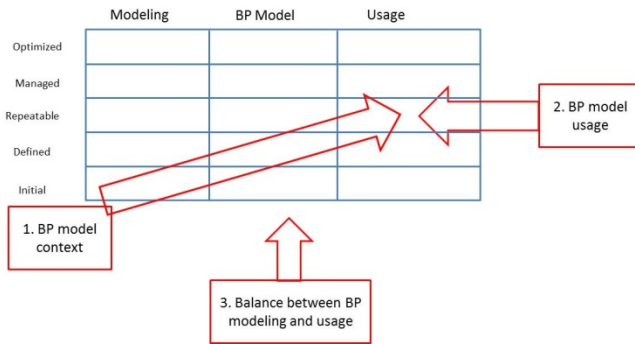
Figure 3. Phases of creating a BPU table

3. CASE STUDIES

The BPU assessment was applied in five organizations in Estonia which differed in size and BPM experience:

- O1 − Labour Inspectorate of Estonia,
- O2 − Estonian Energy Technology Industries,
- O3 − Estonian Tax and Customs Board,
- O4 − Estonian Rescue Board,
- O5 − Estonian Agricultural Registers and Information Board (ARIB)

The case studies were conducted during the first half of 2013. Below we sketch the case study protocol and the findings.

3.1 Case Study Protocol

Each case study proceeded according to a standard protocol. First, an initial contact was established with a member of the organization to present the broad vision of the BPU framework and the possible benefits it could bring to the organization.

Secondly, a 2-to-4 interview was organized with two or three stakeholders in the organization. This interview was structured into three parts, according to the sections of the BPU table. First the current status of business process modeling efforts was mapped. From this initial map, information was gathered to assess the parameters under the Modeling section. Second, the process architecture (if existing) as well as representative process models were examined to gather information for the second section of the table. Finally, the different users of process models were mapped and for each class of users, different use cases were identified (documentation, communication, compliance management, process improvement, automation, monitoring, auditing).

Based on the information collected during this previous interview, a BPU table was compiled by the first author. The table, together with explanations of the assessment, were sent one week later to the stakeholders involved in the study. A second follow-up interview was held, structured into three parts. First, the BPU assessment was discussed parameter-by-parameter to assert the accuracy of the assessment. Second, the stakeholders were asked to comment on conclusions they drew from the table regarding the current status and future path of the process modeling initiatives in the organization. Finally, the stakeholders were asked to give feedback regarding the levels of maturity in the table. The collected assessments were used to derive the descriptions of each maturity level for each of the parameters in the table.

Below we summarize the findings of each of the case studies in turn. For space reasons, we do not present the case study findings one by one but we group them according to the similarity of the findings. First we present the findings in the two larger and more mature organizations (O1 and O2). Next we present the case of O3, which is in an earlier stage of process modeling. Finally we discuss the cases of O4 andO5, which were just about to start their first process modeling effort.

3.2 Case Studies 1 and 2 – Estonian Labour Inspectorate and Estonian Energy

The Labour Inspectorate of Estonia has approximately 120 employees. Its main area of activity is inspecting the working environment in different organizations.

Estonian Energy Technology Industry is a manufacturer and supplier of metal structures, energy and other industrial equipment; it also offers a wide range of competitive and environmentally sound technological project solutions. The Estonian Energy Technology Industry has approximately 900 employees.

Along the "Modeling" dimension, both organizations had well-established and structured modeling teams with significant expertise. A number of managers and process participants were familiar with process modeling and general user participation in modeling efforts was frequent. Estonian Energy uses ARIS as a modeling tool and repository and has clear guidelines in place both for producing new models and for maintaining existing ones. The Labour Inspectorate on the other hand was using a relatively simple tool, which only supported diagramming and generates basic reports that allow to view the model from different perspectives. Modeling conventions and guidelines were in place and there are process managers (owners) and a procedure for maintaining models.

Along the "Model" dimension, both organizations had process models organized according to an explicit architecture. Processes were modeled along the control-flow, information and resource perspectives. All core and a significant number of support processes are modeled. There was more attention put to process model correctness and consistency in Estonian Energy than in Labour Inspectorate.

Along the "Use" perspective, the process model was part of the documentation of the organization and different derivatives of the model were used by almost all employees in the organization.

However, after reviewing the usage possibilities of the model, we found several additional options:

- Expressing the vision and goals of the organization in the model − a clear link between general topics and specific actions (communication, understanding).
- The model is not used in all projects; nevertheless, it should be used as a basis in the future (re-use, knowledge management).
- The model contains important information about the organization; however, if there is a possibility for an even wider use, then a business process repository should be managed as a main and central source of information about the organization – we found new possibilities for generating different reports and documents from the business process repository (documentation).

In summary, it can be said that in these organizations a balance between model production and use has been achieved. Although in case of these organizations several areas were identified where the process model could be used more actively, these new ideas were highly appreciated − every new idea improves the use of information and increases the benefits gained from the model.

3.3 Case Study 3 –Tax and Customs Board

The Estonian Tax and Customs Board has about 1,500 employees. Its main areas of activity are administration of taxes and customs duties.

Along the "Modeling" dimension it was observed that the processes were mainly modeled by a handful of modelers from the development department. Managers and process stakeholders were not directly involved in the process modeling phase (except for interviews to gather data for process modeling). Process owners were not yet appointed. A simple tool was used for business process modeling and the governance structure was not in place. Unfortunately, a number of people from the development department left after the project. These departures stopped different modeling activities.

At the time of the assessment, the organization was seeking to rebuild a modeling team and restart their modeling effort.

Along the "Model" dimension, it was found that the coverage was wide, but the consistency was relatively low. It was clear the models had been produced without process modeling conventions and guidelines nor a uniform vocabulary. Correctness was perceived to be satisfactory but completeness was heterogeneous, with some models being more detailed than others.

Along the "User" perspective, the process models were not deployed and used in the organization. During the last interview, the stakeholders made the following key reflections on the directions for their future process modeling initiative:

- Models should be shared and different derivatives of the model should be made available to managers and process participants across the organization (documentation);
- Training should be provided to managers and process participants (communication, understanding);
- Models should be designed in such a way that they could be re-used in different projects (requirement

specification, re-use, process analysis, process improvement).

In summary, this organization is an example of what could happen when too little attention is paid to the BP model deployment and active use in long term – if process model is not used by different users in the organization, then it will remain a tool for the development department only and also very vulnerable to different changes in the organization.

As a result of the discussion, different possibilities for developing the BPM and for starting to use the existing BP models were identified. The BPU table provided a comprehensive context for recognizing the current situation of the process model usage and revealed its new possible uses.

3.4 Case Studies 4 and 5 – Estonian Rescue Board and ARIB

The Estonian Rescue Board is a government institution with approximately 1,700 employees. It leads the process of planning for emergencies and operates Regional Rescue Centers. Its main areas of activity are rescue works, national fire safety supervision, crisis management, emergency prevention, explosive ordnance disposal, and handling emergency calls.

ARIB is a government agency that implements the SAPARD (Special Assistance Program for Agricultural and Rural Development) program in Estonia. ARIB has approximately 400 employees.

From the viewpoint of the case study, these organizations differ significantly from the others in that they had not engaged in process modeling in the past; they were still in the starting phase of the process modeling project. Accordingly in the case of these organizations we modified the case study protocol. Instead of basing the discussion on an existing process modeling effort, the discussions were made on the basis of a project plan for a process modeling project.

Along the model production dimension, the plan did not explicitly state what was the aimed coverage of the model collection, nor any standards for ensuring consistency across models. Also, no *a priori* approach was defined to structure the collection of models. There was a general expectation that the models would be correct and complete, but no specific targets in this respect.

Along the "Use" dimension, the following was highlighted:

- The BP models to be produced should be integrated with daily documentation.
- The main aim of the process models to be produced is to simplify understanding different processes and support internal communication (two main use cases).
- The process models should be designed so that they can be used in the context of IT projects (automation), audits, process improvement and organizational change.

At the conclusion of the case studies, the stakeholders in both organizations perceived that the BPU table gave them an understanding about the boundaries between the short-term and the long-term contexts of their modeling project. They also perceived that not enough focus had been given to the aims of the project in terms of coverage, structure and quality of the process model collection to be delivered by the project. Following the

case study, the stakeholders decided to extend their project plan with specific targets along the "model" section of the BPU table.

Both organizations recognized it was too ambitious to have a single modeling project aimed at capturing all processes in details (coverage and completeness). Accordingly, the projects were divided into two sequential sub-projects. The first would focus on core processes and capture them in depth. The second would cover both core and support processes, but support processes would only be modeled to the extent of their perceived importance.

3.5 Discussion

Table 2 summarizes the assessment of the five organizations. It should be emphasized here that the maturity of organizations O4 and O5 was assessed with respect to their expected level of maturity after implementing their process modeling project plan, as these organizations had only started their modeling effort.

All organizations demonstrated a similar pattern in the BPU table (sketched in Figure 4). In a nutshell, the BP models are actively used by business development departments (section 'Modeling' in the BPU table); however, BP models are not widely used within the organization (section 'Usage' in the BPU table). The table also highlights a certain lag between modeling effort and the quality of the resulting models (cf. Model) dimension, in the sense that even in the studied organizations where modeling methods and governance of process modeling are in place, it is possible to find significant inconsistencies, lack of structure and correctness issues in their process model collection.

Table 2. BPU table of different case studies

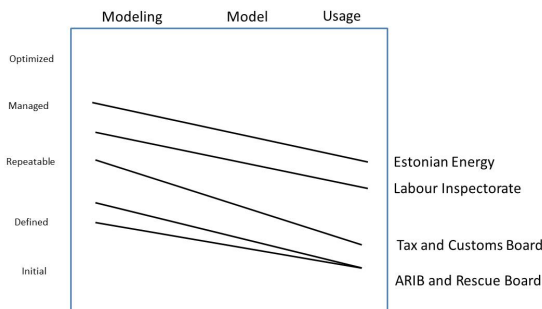|	Modeling			Business process model					Usage	
	Mode-ler	Method	Gover-nance	Cove-rage	Struc-ture	Consis-tency	Correc-tness	Comple-teness	User	Use
Optimized										
Managed	O1, O2	O2	O2	O1, O2, O3	O1, O2	O2	O2	O1, O2		
Repeatable	O3	O1, O3	O1		O3	O1,O3	O1, O3	O3	O1, O2	O1, O2
Defined	O4, O5	O4, O5	O3, O4, O5	O4, O5	O4, O5	O4, O5	O4, O5	O4, O5	O3	O3
Initial									O4, O5,	O4, O5,

Figure 4. Characteristics of case studies

3.6 Limitations

All case studies that were analyzed were conducted in the same geographical region – in Estonia. Also, the organizations in question were either starting their process modeling efforts, or were at a medium level of maturity. This is a limitation of the research and should be considered before using the BPU framework in other countries and in organizations with highly evolved BPM programs.

Another threat to validity is the potential bias created by one of the authors of the paper having been involved in the assessment. This shortcoming could be addressed in future by conducting additional studies in which the BPU table is filled out by the stakeholders inside the organization.

4. RELATED WORK

The design of the BPU framework draws inspiration from existing frameworks for assessing the organizational structure, context and maturity of BPM programs [12, 5]. However the BPU framework does not aim at providing a tool for assessing a BPM program as a whole, but instead it focuses on process modeling. More specifically, the BPU framework focuses on the problem of assessing if and to what extent production and use of process models is balanced in a given BPM program.

The BPU framework relies on a general assessment of the quality of individual process model models and collections thereof, but without systematically analyzing the contents of the BP models directly. In this respect, the BPU framework could be used in combination with models for quality assessment of BP models and model collections [8, 15].

A preliminary study into the organizational impact of process modeling is reported in [3]. This study concludes that perceived sources of impact of process modeling fall in the areas of understanding, communication and coordination, and process improvement. The BPU table takes into account these areas of impact in the "Use" column.

5. CONCLUSION

The BPU framework provides a structure for assessing different activities related to the production and use of business process models in an organization, and to find a balance between effort and benefits in ongoing process modeling efforts. We have preliminarily tested the BPU framework in five organizations. The assessment put into evidence a general imbalance, wherein model production activities are given more emphasis than model use. All organizations stated they will continue using the BPU framework for planning their process modeling activities in future.

In the next phase of this research, we will aim at validating the framework in larger organizations with highly mature BPM programs, and in an international setting. We will also seek to refine the "Usage" dimension of the BPU framework so as to link use of models with measurable business impact [3].

This study demonstrated a need for further international empirical studies on cost-benefit tradeoffs of process model production and usage in organizations. Existing empirical studies on process modeling benefits and impact [3, 10] have focused on the "Usage" dimension of the BPU framework, but not on the balance between model production and use. A study into financial impact of process modeling projects is reported in [17], but with a specific emphasis on financial assessment of process redesign efforts based on process models, whereas the impact of process modeling usually goes beyond process redesign as discussed in [3, 10].

6. REFERENCES

[1] Indulska, M., Recker, J., Rosemann, M., Green, P.F. Business Process Modeling: Current Issues and Future

Challenges. In *Proceedings of the International Conference on Advanced Information Systems Engineering (CAiSE)*, Springer, 2009 pp. 501-514.

[2] Rosemann, M. Potential pitfalls of process modeling: part A, *Business Process Management Journal* 12(2):249-254, 2006.

[3] Bernhard, E., Recker J. Preliminary Insights from a Multiple Case Study on Process Modelling Impact. In *Proceedings of the Australasian Conference on Information Systems*, 2012.

[4] Hevner, A.R., March, S.T., Park, J., Ram S. Design Science in Information Systems Research. MIS Quarterly 28(1): 75-105, (2004).

[5] Rosemann, M., Bruin, T. Towards a Business Process Management Maturity Model. In *Proceedings of the European Conference on Information Systems (ECIS)*, 2005, pp. 521-532.

[6] Davies, I., Green, P.F., Rosemann, M, Indulska, M., Gallo, S. How do practitioners use conceptual modeling in practice? *Data & Knowledge Engineering* 58(3): 358-380, 2006.

[7] Ryan, K. L. A computer scientist's introductory guide to business process management (BPM). *ACM Crossroads* 15(4) 2009.

[8] Mendling, J., Reijers, H.A., Aalst, W.M.P. Seven process modeling guidelines (7PMG). *Information & Software Technology* 52(2): 127-136 2010.

[9] Bandara, W., Gable, G., Rosemann, M. Factors and measures of business process modelling: model building through a multiple case study. *European Journal of Information Systems* 14 (4), 347-360, 2005.

[10] Indulska, M., Green, P.F., Recker, J., Rosemann, M. Business Process Modeling: Perceived Benefits. In *Proceedings of the International Conference on Conceptual Modeling (ER)*, Springer, 2009, pp. 458-471.

[11] Harmon, P. Business process change A Guide for Business Managers and BPM and Six Sigma Professionals. MK/OMG Press, 2007.

[12] Lee, J., Lee, D., Kang, S. An Overview of the Business Process Maturity Model (BPMM). In *Advances in Web and Network Technologies, and Information Management,* Springer 2007, pp 384-395.

[13] Weske, M. Business Process Management: Concepts, Languages, Architectures. Springer, 2007.

[14] Reijers, H.A., Wijk, S., Mutschler, B., Leurs, M. BPM in Practice: Who Is Doing What? In *Proceedings of International Conference on Business Process Management (BPM)*, Springer, 2010, pp. 45–60.

[15] Heravizadeh, M., Mendling, J., Rosemann, M. Dimensions of Business Processes Quality (QoBP). In *Proceedings of the Business Process Management Workshops*, Springer, 2009, pp. 80-91.

[16] Becker, J., Rosemann, M., Uthmann, C. Guidelines of Business Process Modeling. In van der Aalst, W., Desel, J., Oberweis, A., eds.: *Business Process Management. Models, Techniques, and Empirical Studies*, Springer, 2000, pp. 30-49.

[17] von Brocke, J., Recker, J., Mendling, J. Value-oriented process modeling : integrating financial perspectives into business process re-design. *Business Process Management Journal* 16(2) 333-356, 2010.