INCREASING THE VALUE OF PROCESS MODELLING

John Krogstie

IDI, NTNU, Sem Sælandsvei 7-9 7030 Trondheim, Norway

Vibeke Dalberg, Siri Moe Jensen

DNV,Veritasveien 1, 1322 Høvik, Norway

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Abstract: This paper presents an approach to increase the value gained from enterprise modelling activities in an organisation, both on a project and on an organisational level. The main objective of the approach is to facilitate awareness of, communication about, and coordination of modelling initiatives between stakeholders and within and across projects, over time. The first version of the approach as a normative process model is presented and discussed in the context of case projects and activities, and we conclude that although work remains both on sophistication of the approach and on validation of its general applicability and value, our results so far show that it addresses recognised challenges in a useful way.

1 INTRODUCTION

Enterprises have a long history as functional organisations. The introduction of machinery in the 18th century lead to the principle of work specialisation and the division of labour, and on to the need of capturing, structuring, storing and distributing information and knowledge on both the product and the work or business process. Business process models have always provided a means to structure the enormous amount of information needed in many business processes (Hammer, 1990). The availability of computers provided more flexibility in information handling, and led to the adoption of modelling languages originally developed for systems modelling like IDEF0 (IDEF-0, 1993). The modelling of work processes, organisational structures and infrastructure as an approach to organisational and software development and documentation is becoming an established practice in many companies. Process modelling is not done for one specific objective only, which partly explains the great diversity of approaches found in literature and practice. Five main categories for process modelling are proposed based on Curtis, Kellner, and Over (1992), Totland (1997), and Vernadat (1996):

1. Human-sense making and communication to make sense of aspects of an enterprise and to communicate with other people
2. Computer-assisted analysis to gain knowledge about the enterprise through simulation or deduction.
3. Business Process Management
4. Model deployment and activation to integrate the model in an information system
5. Using the model as a context for a system development project, without being directly implemented (as it is in category 4).

In an ongoing project on model-based network collaboration, we have investigated the practice and experience of process modelling across four business areas and a number of projects and initiatives in a large, international company. Our objective was to identify possible improvements and facilitate potential sharing of relevant resources, aiming towards an optimisation of value gained from modelling and models. Merriam-Webster Online defines value as: "something (as a principle or quality) intrinsically valuable or desirable". We have aimed for a company-wide, inclusive scope in our use of the term value, guided by what has been deemed relevant by involved stakeholders.

Three important observations were made during the early stages of the project:

• Even within projects a variety of objectives was found, spanning the categories presented above. A corresponding variety was found in tools, methods and attitudes to the potential value of modelling.

• In some initiatives there were significant divergence of expectations to the modelling results and value - between different stakeholders and also over time.

• Communication and sharing of resources between projects were mainly done through more or less ad-hoc reuse of models and personnel personally known by project workers in advance.

From this we made three assumptions:

• Single project value and stakeholder satisfaction could be increased by to a larger degree focusing on, communicating and prioritizing between diverging expectations and objectives.

• This would require a common platform for communication about modelling initiatives expectations, objectives, and other attributes.

• Such a platform could also facilitate reuse of relevant knowledge, tools, models, methods and processes between units and projects.

These assumptions lead to the development of a first version of a framework proposal on best practice for increasing the value of process modelling and models. This proposal consists of a taxonomy, a recommended model of activities for process modelling value increasing initiatives, and links to relevant knowledge and best practices for each step of the process. Work leading up to this work has been reported in (Dalberg et al, 2003; Dalberg et al 2005; Krogstie et al, 2004; Krogstie et al, 2005).

The rest of this paper presents the methods used in our work, from identification of needs, development and assessment. We then give an overview of our first version of the framework of best practice for increasing the value of process modelling and models, and discuss its applicability with regard to challenges identified in earlier projects. Finally, we conclude on the applicability and usefulness within the limitations of our validation, and indicate needs for further development of the framework as well as for more large-scale validation within a wider scope.

2 RESEARCH METHODS

The research presented in this paper is based on qualitative analysis of a limited number of case studies. According to Benbasat, Goldstein, and Mead (1987), a case study is an approach well suited when the context of investigation takes place over time, is a complex process involving multiple actors, and is influenced by events that happen unexpectedly. Our situation satisfies these criteria, and the work has taken place within the frames of a three year project, including one in-depth case study, and several other less extensive studies. In deciding whether to use case studies or not, Yin (1994) states that a single case study is relevant when the goal is to identify new and previously not researched issues. When the intent is to build and test a theory, a multiple case study should be designed. The intention of our study has been to find out how to increase the value of modelling and models in an organisation. There has not been reported much research within this area earlier, and we have therefore chosen a multiple case approach for the work presented in this paper, in order to investigate this research area closer.

The framework for increasing value of process modelling and models presented in this paper has been developed through an iterative process, refining the model. So far we have been through four iterations.

In the first iteration we studied the modelling initiative in a particular project in detail, using observation, participation, and semi-structured interviews. After initial explorative research, we focused on identifying the expectations and experiences towards the modelling and the models, on their score related to process modelling success factors, as well the extensive reuse of the models across the organisation, viewing this as possible knowledge creation and sharing as a part of organisational learning. An initial hypothesis on process modelling value was established, based on our findings regarding the importance of the relation to the context of modelling versus the context of use.

In the second iteration, we went through semi-structured interviews with representatives of several different modelling initiatives throughout the organisation to survey their experience with modelling, especially with respect to benefits and value of reusing knowledge through models across projects and organisation. A number of initiatives were selected for the study where we were able to get in-depth knowledge from those involved in the process. An interview guide for interviews with key stakeholders was established. These interviews were focused on expected and experienced use and value from the modelling efforts in the case study, aiming at identifying as many expectations as possible, including any that may not have been documented in project documentation, because they were not considered directly relevant for the project goal. After initial open questions, the interviews were structured around keywords from the work of Sedera, Rosemann, and Doebli (2003) concerning

"process modelling success". Documentation of the study is based on these interviews, studies of project documentation and models. The information from the interviews was partly structured through the use of the interview guides. The guides were used as basis for structuring contact summary sheets with the main concepts, themes, issues and questions relating to the contact (Miles and Huberman, 1994).

As a third iteration we carried out a workshop with a group of modelling experts, discussing the framework in relation to their own experiences through numerous process modelling projects. This resulted in an updated version of the framework.

In what has so far been our last iteration, we included the framework in an actual business project using action research, where one of our researchers also acted as a modeller. This was an informal test of the framework, but gave valuable input to updating it. We also saw the value of the framework in a modelling initiative through this test, where it gave positive guidance for the modelling. The next iteration of the development of the best practice framework should be to conduct more formal tests.

Our results and approach this far has certain limitations relative to internal validity (Miles and Huberman, 1994), as representatives of some of the involved roles have been followed more closely than others. As for descriptive validity (what happened in specific situations) the close day to day interaction with the users, especially in the first and the last iteration by one of the researchers, give us confidence in the results on this point. As for the interpretive validity (what it means to the people involved) we have again in-depth accounts from central people in main roles, but again not all the involved roles have been represented to the same degree. The same can be said on evaluative validity (judgements of the worth and value of actions and meaning). That we find many results that fit the categories of existing theoretical frameworks gives us confidence on the theoretical validity of the results.

3 A FRAMEWORK FOR INCREASING THE VALUE OF PROCESS MODELLING

This best practice framework aims to increase the value of the modelling and models through enhanced awareness about current and future stakeholders, any (potential) conflicts of interest, stakeholder expectations and potential value to be gained, as well as any negative effects increasing total cost. Based on this knowledge, decisions regarding resource allocation, modelling methods and tools,

responsibilities etc can be made to optimize the value of a modelling activity and its resulting models, on a project level as well as on an organisational level. The basic elements of the framework are a recommended main *process* (see Figure 1) and some basic *concepts*, elaborated on in the description of each step in the main process.

Context is the surroundings of an initiative that might influence decisions. *Value* is identified in relation to the identified context, but also on potential value outside the initial project scope. The *practice* focuses on the strategies and practice around the modelling and the models.

The recommended process is initiated when a need for modelling has been identified. Its three main steps are detailed below.

3.1 Identifying Context

Identifying the context is mostly about expressing the circumstances of the identified need for modelling, as a basis for further communication, prioritization and planning. It will usually coincide with the writing of an application for funding, development of a project mandate and/or a project plan. At this step one should keep within the scope of the initial need, usually expressed in traditional project documentation with formal obligations. The main issues to be clarified are detailed in Figure 2, and include:

- Identification of the context of the modelling or model activity/initiative, including users and other stakeholders, uses, and objectives.
- Identification of the organisations installed base, including existing reusable models or descriptions and other relevant tacit or explicit constraints.
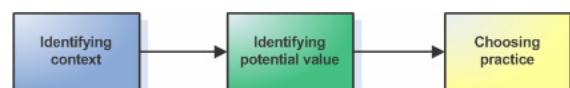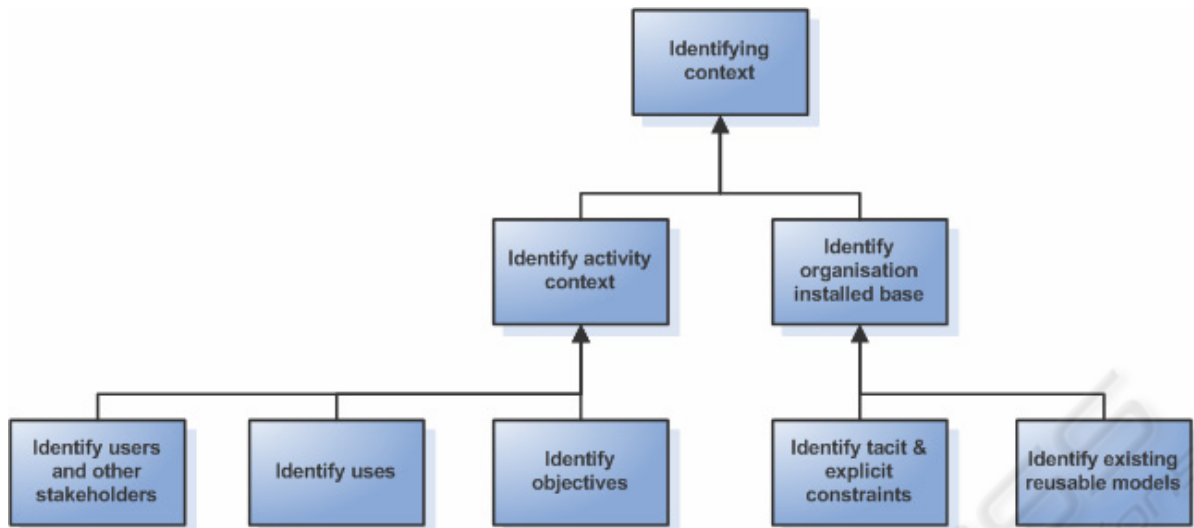

Figure 1: The overall framework.

Figure 2: Identifying context.

There are different actors related to a modelling initiative and a model, holding one or more *roles*. *Users* are using the models or participating personally in the modelling in order to achieve objectives. Other *stakeholders* may not be using the models directly, but extract value from planned objectives. Techniques e.g. from user-centred design is useful at this stage in the identification of stakeholder types. *Use* includes how the modelling and models are going to be used in order to achieve the objectives. *Objectives* are the goals and purposes of the modelling and models. *Installed base* includes tacit and explicit assets already existing in the organisation that will have influence on the modelling and model context. *Constraints* include issues such as personal and organisational knowledge, which may be tacit or explicitly expressed constraints, organisational guidelines or instructions (explicit constraints), existing tools and languages etc. *Reusable models* are models or other documentation that were created for other purposes, but that could be reused in the new project.

3.2 Identifying Potential Value

In step 1, we identified the context where the modelling and the models were meant to play a role. In step 2, *"Identify potential value"*, the aim is to capture any (potential) extra and positive benefits of the modelling and models, exceeding the primary objectives captured in step 1. Value may be connected to the resulting models, or to the modelling activity in itself.

Often the objectives identified in step 1 will relate to the modelling or model initiative, while any potential value to the rest of the organisation will typically be ignored in the formal project documentation developed at this stage – due to a lack of awareness, or to avoid complicating responsibilities and bindings.

Value can be explicit and easy to grasp, but also tacit. Tacit value, e.g. the improved understanding of a work process for a modeller originally producing models for others, are often not explicitly captured in traditional project documentation, but may still affect decisions before or during a project, or the perceived value of the project in retrospect. Future reuse of the models can be an added value of the current modelling and models, especially if this potential is taken into account at an early stage.
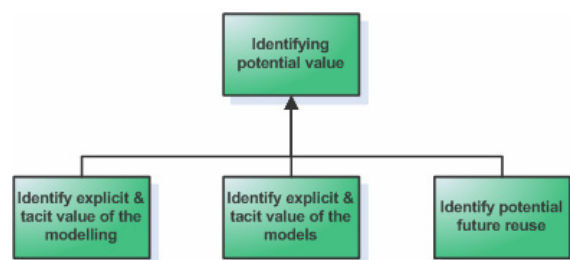

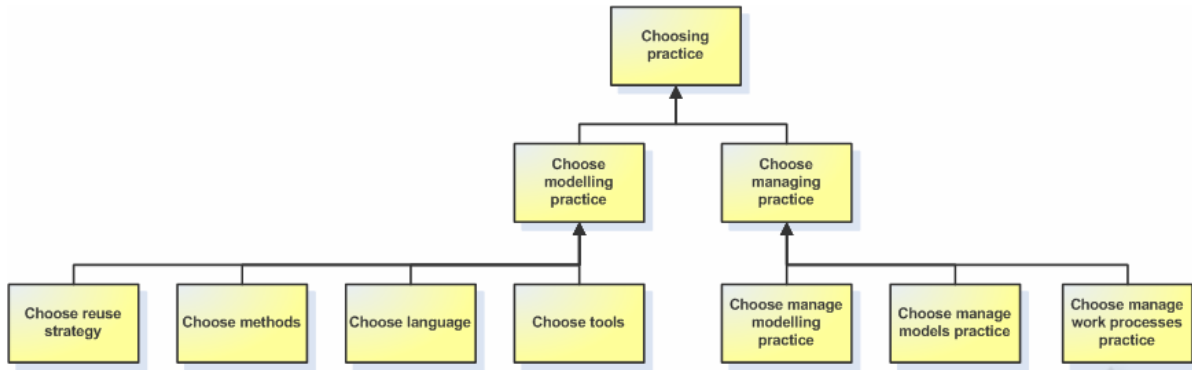Figure 3: Identifying potential value.

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Figure 4: Choosing practice.

3.3 Choosing Practice

The choice of a suitable practice should be based on the identified contexts of the modelling and models, as well as the identified expected value. Modelling practice include reuse strategy, methods, languages and tools, while managing practice define how to manage the modelling, the models and the work processes. The general framework of quality of models and modelling languages inspired by organizational semiotics (Krogstie and Sølvberg, 2003) is especially helpful here relative to modelling practice related to methods, languages, and tools, having the stakeholders of the models and the goals of modelling already defined. When goals or stakeholder types are changed during a modelling project, one needs to reassess these aspects, and potentially select a new modelling language, method or tool.

Sense-making versus corporate memory

We have chosen to differentiate between modelling for *sense-making* and for *corporate memory*. These concepts can be helpful for expressing fundamental differences in expectations to a modelling initiative, often rooted in personal worldviews emerging as strong opinions on modelling use and approaches. Totland (1997) addresses modelling for sense-making and corporate memory, and the relation to objectivistic and constructivistic worldviews.

The corporate memory models are reflecting the organisation, and will exist as a reference point over time. The sense-making models are used within an activity in order to make sense of something in an ad-hoc manner, and will usually not be maintained afterwards. Sense-making and corporate memory can be seen as the two endpoints of a scale, where you have examples of mixed types of models in between.

These concepts express and explain one type of differences and disagreements between stakeholders, drifting within projects, or conflicting approaches in modelling activities that would otherwise be expected to have much in common.

The choice of the formality of the modelling practice should be based on the previously identified contexts, and where these fit on the line with sense-making and corporate memory as the two extremes. Sense-making initiatives generally require a low level formality of practice.e When the context is corporate memory, a more formal approach is needed. The choice of methods, tools and languages, as well as the choice of managing practice should reflect the level of formality needed. High formality requires more managing than low formality.

Table 1: Comparing modelling for sense-making and corporate memory.

Sense-making	Corporate memory
The modelling process is the goal	The model itself is the goal
The actual use is often documented	The intended use is often documented
Collects the natural structures	Collects the formal structures
Identified people important	General user-roles important
Less formal methods, tools and languages	Formal methods, tools and languages
Roles not important, more ad-hoc	Roles important.
Often used only for a specific activity or project	Often re-use across the organisation
The models are "thrown away" after use	The models are stored and re-used
Management of the work process, models and modelling not important	Management of the work process, models and modelling important

When identifying the context of the modelling activity, the optimal position on the sense-making – corporate memory axis is crucial in order to be able

to choose appropriate methods, languages and tools, as well as formality for the managing practice.

4 APPLYING THE FRAMEWORK

During our research we have studied and documented several cases throughout the organisation. Through this we have identified expected and experienced value of modelling work and models, as well as experienced challenges. In this chapter we quote some of the reported (potential) value. We will then look into how the framework addresses the reported challenges.

4.1 Identifying Potential Value

The stakeholders in our case studies indicated many valuable outputs in addition to those initially intended from modelling initiatives and the use of models. Some of these are:

Communication:
- The high-level models encouraged an agreement among the management participants that was vital for the rest of the project, creating important common references, identification and enthusiasm.
- The models triggered communication, being something that everyone could relate to.
- "Three boxes and some arrows: This is a fantastic communication tool".
- Communication was initiated and facilitated by and through the models.
- The models help the participants understand.

Learning:
- The modelling process itself turned out to be a learning experience for the participating domain experts, increasing their knowledge about the processes.
- Through the workshop sessions the participants learned a lot from interacting with each other, "new" information was uncovered, and understanding improved.
- People understand themselves better after a modelling session.
- The participation in the modelling process of domain experts is important. The result would not have been the same if modellers from outside created the models based on interviews.
- The models helped taking care of and storing the *competence* of people in the organisation.
- Modelling is seen as a mechanism to extract knowledge from people's heads.

- Training takes less time when process models were used.

Long-term benefits:
- The process model gives the organisation one language and one tool for everyone in the organisation; a common frame of reference.
- Simple and effective diagrams show what is important for the organisation.
- Through modelling AsIs, and not only ToBe, best practise is secured and not forgotten.
- The models are used in *marketing* towards potential customers.
- There is a marketing value in telling the world that they have documented processes.

5 CHALLENGES OF MODELLING AND MODELS

In order to extract more value from the modelling initiatives and the models, we will in the following address some of the major identified challenges in our case studies, and examine how the framework could solve or indicate a solution to these. For each paragraph we state the challenge, then how it is addressed in the framework.

Challenge 1: To keep the models and other descriptions updated and consistent

Example: It becomes difficult to keep the models updated as the complexity increase, and the number of non-integrated tools increases.

Framework application: The framework suggests careful analysis of the expected model context before choosing the modelling practice. Considering the future complexity when choosing methods, language and tools will make model management easier. The framework also states the importance of viewing the management of the models as a specific activity, stressing the importance of appointing a model responsible. This is a different role than the modelling responsible or the work process responsible (process owner).

Challenge 2: The models are used in situations they were not intended for.

Example: Models are often created primarily for one objective. This is challenging when others want to use them as basis for other work, especially if the original assumptions are not documented.

Framework application: Through an analysis in the early phase of the modelling activity, identify the primary use as well as potential future use and additional potential value. Accommodation of indications of future use of the models should be

considered when choosing the modelling and the managing practice.

When in a re-use situation, where a modelling initiative is going to re-use earlier developed models, it is important to investigate the context the models were created for, and what modelling and managing practice have been used. The decision of a re-use strategy should be based on this investigation.

Challenge 3: To handle situations when the modelling starts out as an informal activity, but the resulting models develop into a process defining tool. The original language and tools often do not meet new expectations for the model to be kept updated, be scaleable, and extendable with new functionality. The experience is that the chosen tool and language often do not fit into this new scenario.

Framework application: Awareness of where on the scale of sense-making versus corporate memory the models were initially created, and where on the scale the models have ended up (and where they can be expected to end up). Sense-making models do not require a very high level of formality, while corporate memory models often do. Being conscious about this will make it easier to identify what has to be changed in the modelling and managing practice in order to align with the new situation.

Challenge 4: To produce views of the model according to different needs and users.

Example: Not being able to produce views of the models adapted to the specific user and the objective of the use creates challenges. Specific users and specific objectives of use require adapted views of the model. The creation of these is a challenge, both technically and as regards content.

Framework application: Identify the users and other stakeholders as parts of the context, analyse their background knowledge and needs, and what each of them are going to use the models for. Methods, language and tools should then be chosen based on this.

Challenge 5: The models often restrict and limit the communication.

Example: High level models are easy to agree upon, but real gaps between the model and current situation stay uncovered. A model is only one view of the world. When a model is the communication generating artefact, the discussions often leave out those issues not included in the model.

Framework application: Carefully identify the context and the potential value of the modelling and models before creating the models. Consciousness about how to increase the potential value of communication will potentially help creating a more fitting model. Awareness of the limitations of a model and its restrictions is the key.

Challenge 6: To implement the models in the organisation, particularly outside the modelling team.

Example: It is a challenge to make the models an integrated part of the organisation, and to involve the users to the extent that they feel an ownership and responsibility for them. When the person doing the modelling leaves the project and the modelling is left to the domain experts to finish, implement and keep updated, experience shows that the focus on the models often fades. If the modeller leaves too early, the models may not be implemented.

Framework application: Identify all the expected users and other stakeholders during the initial phase of the modelling activity, look into their expected areas of use and identify potential value. By choosing a modelling practice to increase the value across all identified stakeholders, ownership and usefulness is improved even for stakeholders not participating in the modelling. If many stakeholders should be involved in the modelling one can use techniques such as "modelling conferences" (Gjersvik et al 2004)

Challenge 7: To be conscious about distributing the responsibility of the modelling, models and processes correctly.

Example: One person was responsible for everything that had to do with the processes *and* the models.

Framework application: The framework makes distinctions between the activities of managing the modelling, the models, and the work processes. One role is related to the management of the modelling, another to the management of the models, a third to the management of the work processes.

Challenge 8: During organisational changes, models may have to be merged as processes are unified. Different modelling tools and languages increase the challenge.

Example: Several as-is processes were to be harmonized and their documenting models merged into one common process model. The models were created for different user groups, originated in different organisational units and also countries. The modelling processes were also different, involving different types of people.

Framework application: Such models are most likely based on different methods, languages and tools, created for different objectives, uses and users and other stakeholders. The historic context and the modelling and managing practice of each of the models should be investigated in order to establish a re-use strategy and choose the correct current modelling and managing practice.

6 CONCLUSION AND FURTHER WORK

Based on extensive research across units and projects in an international company, we have identified expectations, challenges and experience pointing to potential increase in value from modelling activities. To support the realization of these values, a Modelling Value Framework has been developed.

The Value Framework has been evaluated against challenges and experiences of earlier modelling initiatives, as well as tested in a modelling project. There are clear indications that further development and use of the framework will facilitate communication and alignment within and between project initiatives and organisational units, thus potentially increasing value from projects through improved relevance and quality of results as well as reduced cost.

Our research has been practically oriented, aiming towards identification of the important issues in real-life modelling projects and activities, both with regard to the actors' motivation and their experience. Based on the broad investigations we have made, we are confident that our results are valid for the case company.

We expect our findings to be reproducible for other enterprises of similar size and complexity, but this still remains to be shown.

Even within the presented enterprise, on a practical level, there is still a way to go to implement and collect real-life experience with the framework. Our studies demonstrate feasibility and advantages of use, but do not address the actual adoption of the framework by practitioners not involved in the development.

We have identified advantages both on a project and organisational level, and we expect that the project level advantages will be sufficient to motivate for the use of the framework – and that the organisational level advantages can be realized this way. This assumption however still has to be tested – and a successful implementation in the whole organisation will, as a minimum, require a dedicated dissemination and marketing effort.

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