What Makes Process Modelling Effective – Modelling or Project Factors?

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Abstract: Process modelling is a central topic in the information systems field. This paper reports from an empirical study of 34 Norwegian process change projects where process modelling was used. The paper investigates which factors that were most important for effective process modelling: project-specific factors or modelling-related factors? By comparing the practices of the most effective initiatives with those of the less effective, this paper concludes that project-specific factors matter more than modelling-related factors.

1 Introduction

Process thinking has become an important approach in organisational practices such as organisational change, system development, quality management, performance measurement, and e-business [DA93, JV06, IS01, KN92, EL01]. In order to understand, analyse and design business processes, process modelling is widely used and accepted as an integral part of any process-thinking approach [CKO92, OU95]. Several process-modelling methods, modelling languages and tools have been proposed [MWFF92, OU95, SC98, EP00, WH04]. A comprehensive overview can be found in Kettinger et al. [KTG97] and in Aguilar-Savén [AG04].

Several authors have discussed the pros and cons of process modelling in process thinking [KK97, KCS03] and another body of research has demonstrated and assessed process modelling in various domains [BST05, MC03, MMST03, DC02]. Others, again, have developed guidelines for choosing the right technique and tool [SWZCB04, AG04].

In contrast to these efforts, there has been little attention paid to organisational process-modelling practice. How should process modelling be conducted in order to achieve the desired results? What are the success criteria for process modelling? What constitutes a

good process-modelling process? An exception is the work of Sedera, Rosemann and Doebeli [SRD03] and of Sedera, Gable, Rosemann and Smyth [SGRM04], who have proposed a *success model* for business process modelling, which defines two types of success factors: 1) project-specific factors and 2) modelling-related factors [SGRM04]. Although the primary focus in Sedera et al's research has been to develop and validate the success model through case studies, they also report from a multiple case study, which indicates that project-specific factors may be more important than modelling-related factors when it comes to process-modelling success [SGRM04, p. 494].

This paper uses data from an empirical study of 34 Norwegian model-based process-change projects to investigate Sedera et al's findings further. The research question is: Which is more important for effective process modelling, modelling-related factors or project-specific factors? In other words, we ask which is more important: 1) choosing the most suitable modelling method, modelling language and tool or 2) planning and conducting a well-managed process-modelling project? We will answer this question based on a recent study of model-based process-change practice in Norway. The rest of this paper first presents a brief literature review and explains the Process Modeling Success Model proposed by Sedera et al. [SGRM04]. Next, our research method is presented, followed by analysis and discussion of our findings. The paper concludes by discussing results, limitations and paths for further work.

2 Theory

2.1 Theory of process modelling

Process modelling is a popular approach to visualising how businesses operate. Business process models can be used to document existing practice, analyse this practice and document future design. Models are useful in order to structure the vast amount of information that materializes in many business process-change projects. Furthermore, process models are used in the development of applications that support business processes, for example in requirements analysis. Several modelling techniques have been proposed for visualising business processes. Among them IDEF0 and IDEF3, EPC, RAD, BPMN, UML and Yawl are frequently mentioned in the literature. An overview of existing process-modelling techniques can be found in Kettinger et al. [KTG97], Aguilar-Savén [AG04] and Shen et al. [SWZCB04].

The literature on process modelling discusses a variety of topics: how to divide a business into processes [LI01], advantages and disadvantages of using models [KCS03], and the use of process modelling [BST05, MC03, MMST03, DC02]. Guidelines that support the selection of the right technique and tool can also be found [AG04, SWZCB04]. Despite this rich literature on process modelling, there are few empirical studies of process-modelling practice and of which factors that make process modelling effective

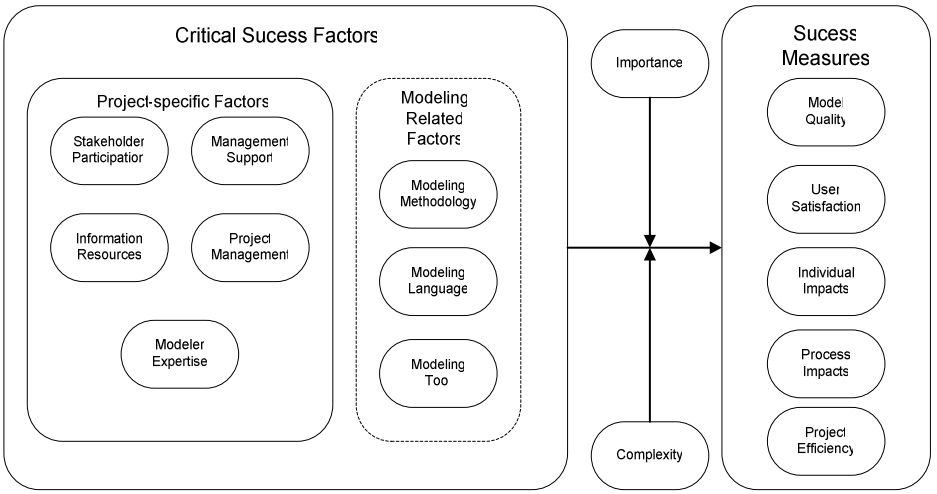

Figure 1. Sedera et al's Process Modeling Success Model [SGRM04]

2.2 The Process Modeling Success Model

As an answer to this lack of research, Sedera et al. [SGRM04] have proposed the Process Modeling Success Model. They first derived an a priori model from a review of the literature, and the resulting model has since been revised through several case studies [SRD03]. The model has two main parts: critical success factors and success measures. Critical success factors are further grouped into project-specific factors and modelling-related factors. Figure 1 describes the current state of the model, as presented in [SGRM04]. The critical success factors defined by Sedera et al. [SGRM04] are as follows;

Project-specific factors

- **Stakeholder participation**: The degree of input from process roles for the design, approval and maintenance of the models.[1]
- **Management support**: The level of commitment by senior management in the organisation to the process modelling project, in terms of their own involvement and willingness to allocate valuable organisational resources.
- **Information resources**: The resources available to inform the modelling project.
- **Project management**: The management of the process modelling project, including defining the project scope, aims, milestones and plans.

[1] This factor was initially called *User participation* and focused on those who are using the models, but were renamed *Stakeholder participation* to reflect participation in general and specifically the participation of process roles (those who have a role in the process being modelled).

- **Modellers' expertise**: The experiences of the process modellers in terms of conceptual modelling in general and process modelling in particular.
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Modelling-related factors

- **Modelling methodology**: A detailed set of instructions that describes and guides the process of modelling.
- **Modelling language**: The grammar or the syntactic rules of the selected process-modelling technique.
- **Modelling tool**: Software that facilitates design, maintenance and distribution of process models.

The success model does not indicate causal relations among the factors, but identifies the overall success factors and process modelling measures [SGRM04]. But, as Sedera et al. point out, "The identified success factors can be usefully applied by practitioners to plan and conduct a modeling project" (p. 496).

As mentioned in the Introduction, a multiple case study of nine process-modelling projects in three large Australian organisations is also reported [SGRM04]. The study was conducted to verify and, possibly, revise the success model through in-depth interviews with process modellers and project sponsors. Citations were gathered and analysed for each model construct. Sedera et al. *found that modelling-related factors overall had less to say for process-modelling success than project-specific factors.* This may indicate that project-specific factors play a relatively more important role in process-modelling projects than do modelling-related one, and it calls for further empirical investigation; which is most important: the modelling method, modelling language and tool, or planning and conducting a well-managed project?

3 Research design

This paper is part of a project that investigates the relationships between process-modelling *purpose*, process-modelling *process*, *model artefact* and process-modelling *outcome* [IEOO06]. *Purpose* refers to the anticipated outcomes that are intended by process modelling, including artefacts produced and how modelling effects the organisation's processes. *Modelling process* refers to a particular course of action intended to achieve a result by process modelling, carried out in cooperation with a group of participants in context of a wider organisation and involving a particular view of models and modelling. *Model artefact* refers to a man-made representation of a process taken as a whole, with a particular scope, span and style and often supported by a tool. *Outcome* refers to the phenomena that follow and are caused by process modelling, including attainment of purpose and the effect of process modelling on processes.

The overall research model was established in the autumn of 2004 based on existing literature. An interview guide was formulated based on the model. A series of eight pilot

interviews were conducted between December 2004 and February 2005, during which the guide was repeatedly revised. The interview guide was frozen in April 2005, when it was composed of 22 open questions. A series of 25 interviews were conducted from April to September 2005. Most interviews lasted one hour or a little less. A majority of the interviews were conducted in person, but a few of the final interviews were conducted over telephone. In most cases we also collected samples of process model artefacts. We selected informants that were central in internal process-change projects in their own organisations, typically acting as project leaders and facilitators and, often, involved in quality management in their organisations.

On average, our informants had worked with process change for seven years. The projects had a considerable variation in duration, scope and size. The largest projects involved around 200 people, while eight projects had less than ten participants. The longest project had lasted seven years and the shortest one for three months. A majority of the projects lasted between one and two years. When it comes to project goal, we found three main categories: to standardise internal practices, to improve internal practices, and to implement a new information system. All the process-change projects had used some kind of process models. Most of them (26/33) used a swimlane-based modelling notation. Two used IDEF specifically. Others used a variety of simpler flowchart notations. Around half of the projects (16/33) used specialised tools like ARIS and Metis. The rest (13/33) used a general drawing tool (often MS-Visio), except for a few projects (4/33) that used MS-Office.

At the end of the interviewing period, we decided that the eight pilot interviews were sufficiently similar to the rest of the interviews to be included in the main analysis, although each of them contained a few unanswered questions. In some of those cases, we went back to the informants to collect additional information. In total, 34 interviews in 30 enterprises were thus available for analysis. All the interviews were transcribed. The transcriptions were coded as tables using a spreadsheet. A preliminary analysis was performed based on a subset of the coded questions in November 2005. The analysis results for each project were abstracted into an analysis story, a short (5-6 sentences) description of the project. The analysis stories for each project were then compared to the transcripts of the corresponding interview, in order to ensure that the coding and analysis categories (which had produced the analysis story) appropriately reflected the information collected in the interview. The comments were used in a second round of coding and analysis. All the interviews were coded twice by different investigators and inconsistencies were sorted out after discussions among the coders.

The data analysis was carried out by dividing the projects into three groups based on the extensiveness of their *outcome* in terms of goals achieved, artefacts produced and practices changed. The *high-outcome group* comprised those projects in which process modelling had contributed to the most *extensive* outcome, i.e., where process modelling was most *effective*, whereas *t*he *low-outcome group* contained projects with *limited* outcome in terms of goals, artefacts and practices. Projects that had produced neither clearly high nor low outcome were placed in an intermediate-outcome group, which was

not used further in the analysis. The next section will contrast the two groups to highlight what distinguishes their projects, with focus on project and modelling factors.

Table 1. Project-specific and modelling-related factors analysed in this study

Project-specific factors	Modelling-related factors
Management support	Modelling framework
Types of participants	Modelling language
Breadth of involvement	Modelling tool
Process ownership	
Training	
Resistance	

4 Findings and discussions

Results from Sedera et al.'s multiple case study indicate that project-specific factors might play a more important role than modelling-related ones in determining process-modelling effectiveness [SGRM04]. Will findings from the Norwegian study support or discard this proposition? Although our project was not directly based on the Process Modelling Success Model, it was one of the inspirations behind our investigation, and many of the factors we investigated match Sedera et al's factors well. This section will therefore compare our high- and low-outcome projects with respect to the project-specific and modelling-related factors shown in Table 1.

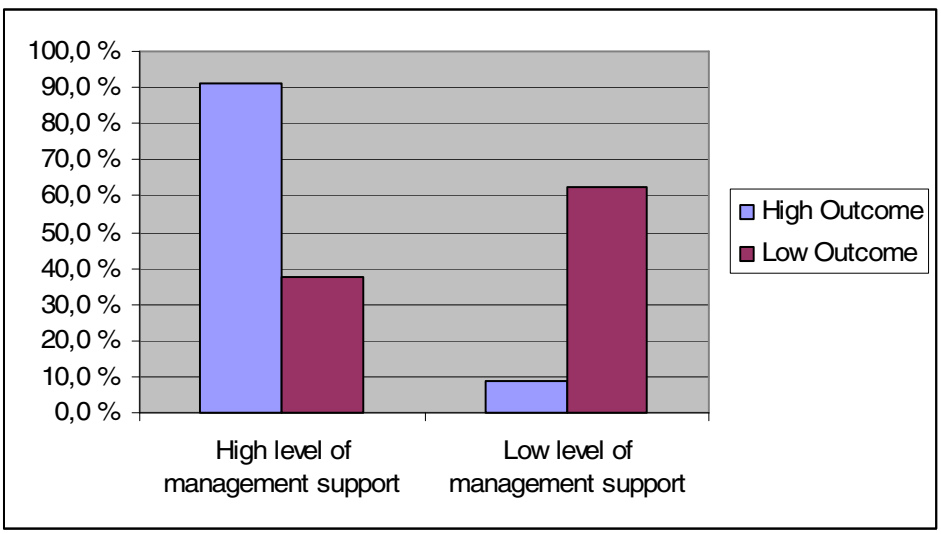

Figure 2. Management support. A comparison between the high- and low-outcome projects

4.1 Project-specific factors

Management support

We define management support as the commitment and involvement by senior management to the process-modelling project, in terms of explicitly giving support to process orientation, explicitly initiating or supporting the initiation of the project and giving explicit support during the project. The more of these activities that were identified in each project, the higher score has been achieved on this factor.

Our research question for this factor is *Will projects with high score on management support exhibit a more extensive outcome than projects with a lower score on management support?* Results from the Norwegian study suggest a connection between levels of management support and of outcome. Our analysis clearly shows that more projects in the high-outcome group had initial and ongoing management support than those in the low-outcome group.

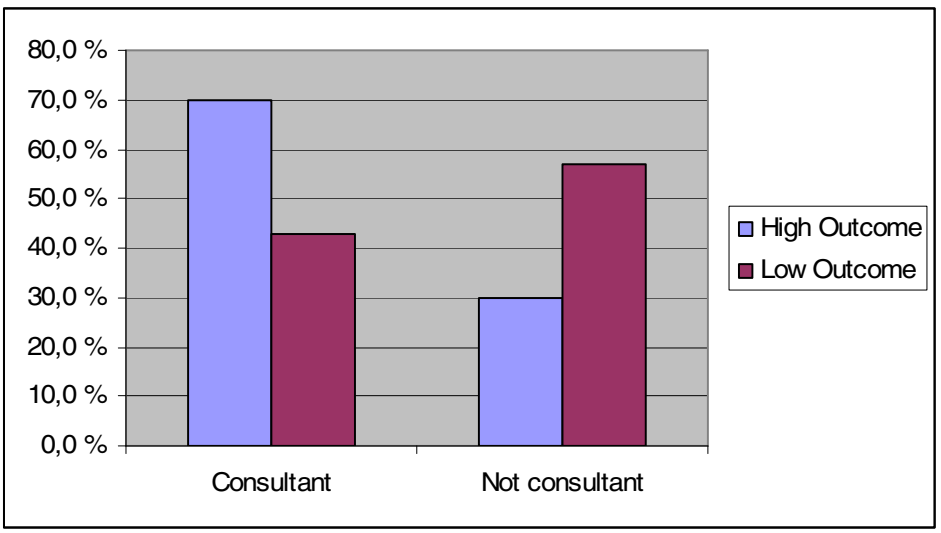

Figure 3. Types of participants. A comparison between the high- and low-outcome projects when it comes to involvement of external consultant(s)

Types of participants

We define types of participants as the set of internal organisational roles that are formally engaged in the process-modelling workshops. In our study we have identified the following types of participants: *process role representative*, *business analyst*, *manager* and *IT specialist*. The more of these types of roles that have participated in the modelling process, the higher the score on this factor.

Our research question for this factor is *Will projects with high score on participants exhibit a more extensive outcome than projects with a lower score on the participants*

factor? We found no clear connection between the numbers of types of participants involved and the extent of outcome. However, we find a connection between the use of one or more external consultants and outcome. Our analysis indicates that more projects in the high-outcome group have involved external consultant(s) than those in the low-outcome group.

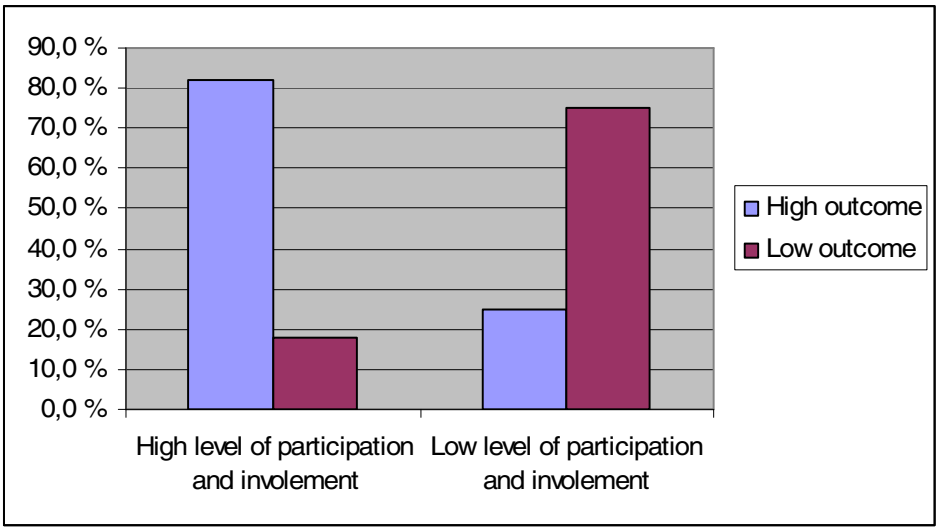

Figure 4. Breadth of participation and involvement. A comparison between the high outcome and the low outcome projects

Breadth of participation and involvement

We define breadth of involvement as the extent to which the participation of employees (process-role representatives) in process-modelling workshops was an explicit goal, the extent to which employees participated as initially desired and the extent to which employees participated directly in workshops (and were not only indirectly involved through hearings and presentations of workshop results). The more of these characteristics that were identified, the higher score has been achieved on this factor.

Our research question for this factor is *Will projects with a high score on participation and involvement exhibit more extensive outcome than projects with a lower score on participation and involvement?* From the Norwegian study, we find a clear connection between the breadth of involvement and the extent of outcome. More projects in the high-outcome group have broad involvement than in the low-outcome group.

Process ownership

We define process owner as a person, appointed by senior management, who is responsible for the process in the organisation. In our analysis, we separate projects that had appointed a process owner prior to process modelling from those that had not.

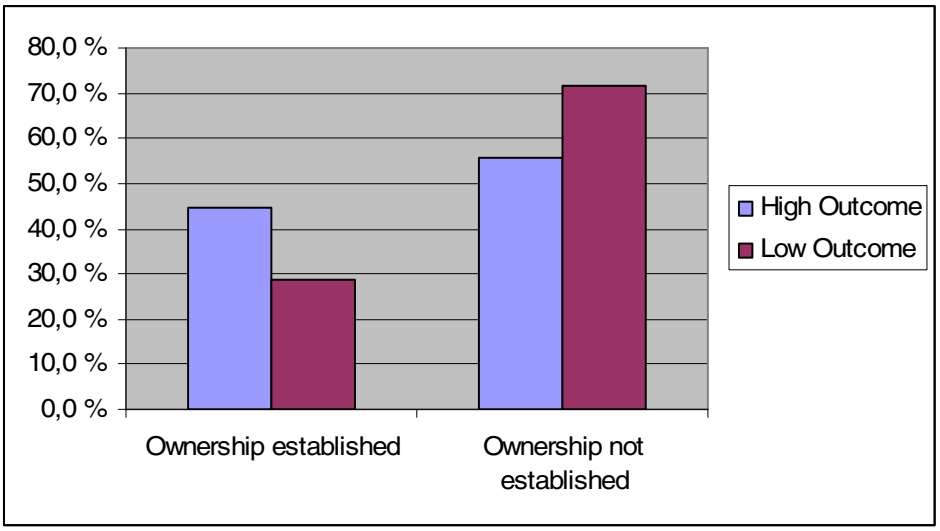

Figure 5. Process ownership. A comparison between the high and low outcome projects

Our research question for this factor is *Will projects that have initially appointed a process owner for the process exhibit a more extensive outcome than projects that did not establish such a role prior to the project?* Our data show that more projects in the high-outcome group had initially established process ownership compared to projects in the low-outcome group. However, the difference is not large.

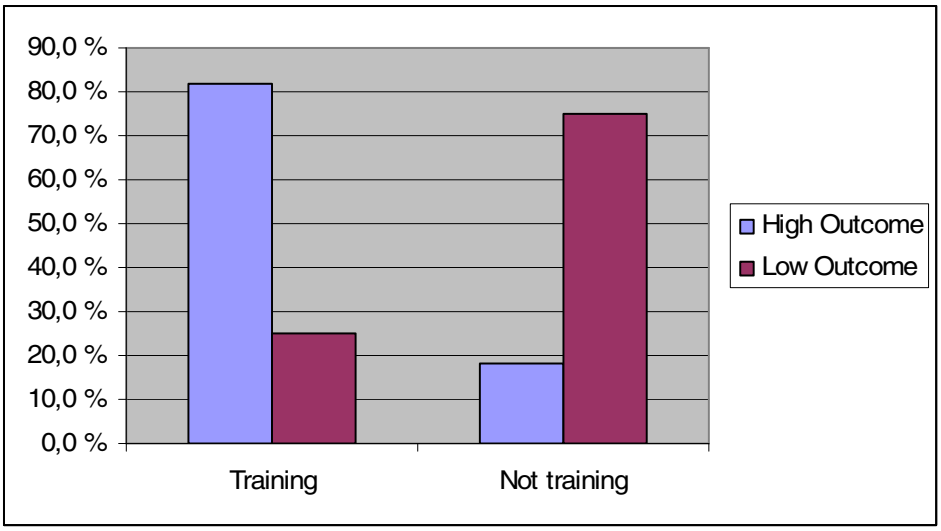

Figure 6. Training. A comparison between the high- and low-outcome projects

Training

We define training as actions taken to educate the participants in process thinking and process modelling before the process-modelling project.

Our research question for this factor is *Will projects that have organised training in process modelling exhibit a more extensive outcome than projects that have not organised such training?* Results from our analysis show clearly that more projects in the high-outcome group have provided training than those in the low-outcome group.

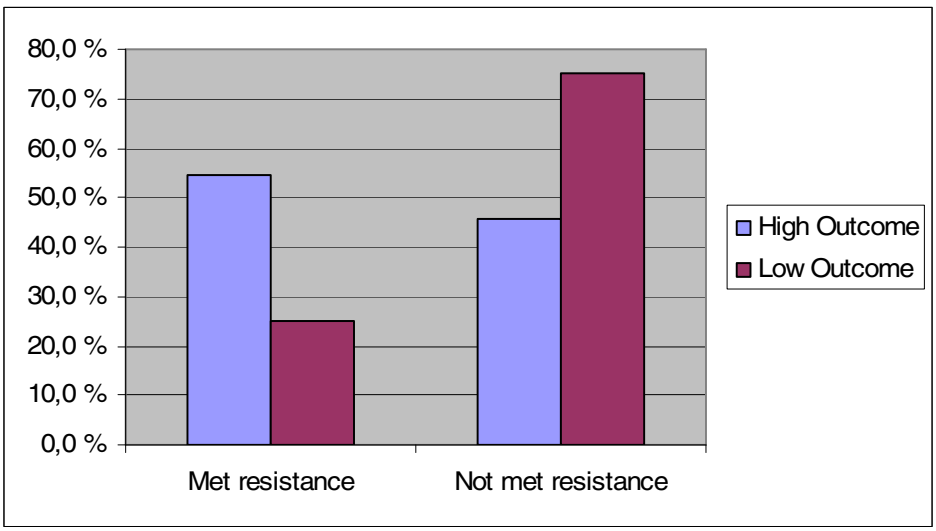

Figure 7. Resistance. A comparison between the high- and low-outcome projects

Resistance

We define resistance as explicitly voiced negative expressions, from either employees or line managers, about the process-modelling project.

Our research question for this factor is *Will projects that have not encountered resistance exhibit a more extensive outcome than projects that have met such resistance?* Results from our analysis show that more projects in the high-outcome group have experienced resistance than in the low-outcome group. Although the differences are not large, this is interesting because one could easily expect the opposite result. One reason might be that resistance forces controversies to the fore early in the project when they can still be resolved, instead of postponing conflicts to a later stage where they may limit outcome more severely. Further, those projects that have encountered resistance may have put more effort into change management, information and motivation and, thereby, managed to lead the project towards an extensive outcome. This result suggests that

resistance may not only be a problem for model-supported process change, but that it can perhaps increase project impact.

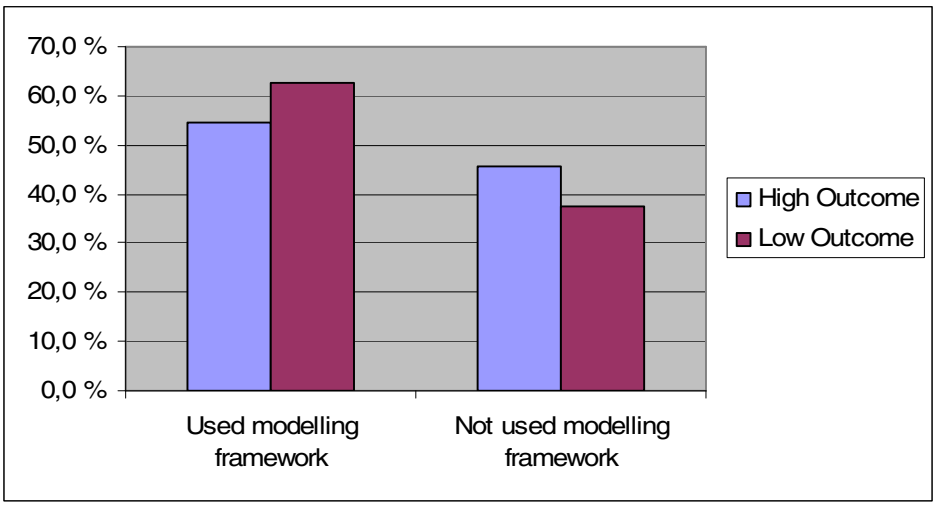

Figure 8. Modelling framework. A comparison between the high- and low-outcome projects

4.2 Modelling-related factors

Modelling framework

We define a modelling framework as a consistent set of modelling resources, such as a modelling method with suitable templates, a modelling language and a modelling tool, applied by a project as an integrated whole. A project that does not apply a modelling framework might use a stand-alone tool without any consistent methodological support.

Our research question for this factor is *Will projects that have applied an integrated modelling framework exhibit a more extensive outcome than projects that have not used such a framework?* There is no evidence in our study that projects that have used an integrated modelling framework have more extensive outcomes than projects that did not use such a framework. There is no clear difference between the high outcome and low outcome groups when it comes to use of a modelling framework.

Modelling language

We define a modelling language as a technique that is used to represent a process graphically. Our research question for this factor is *Is there a relation between the modelling language used and the extent of outcome?* Put in another way, will projects that have applied a certain modelling language score higher on outcome than projects that have used another one? Does modelling language matter?

We found that most of the projects in our study used a swimlane-based modelling notation. This counts for both the high-outcome and the low-outcome group. Our data show no clear differences between the two groups when it comes to modelling language.

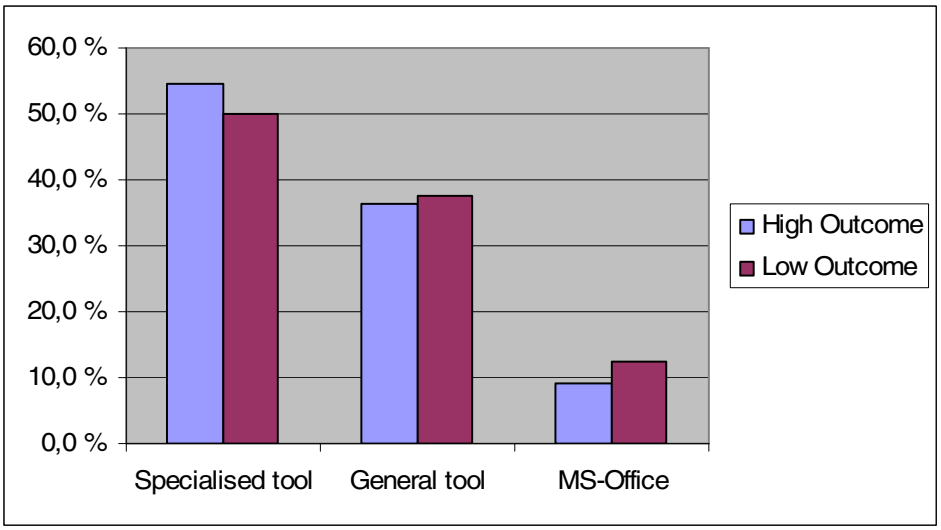

Figure 9. Modelling tool. A comparison between the high- and low-outcome projects

Modelling tool

We define a modelling tool as a computer program used by the project to facilitate drawing, maintenance and distribution of process models. In our project, we have divided modelling tools into three different groups: *specialised tools* designed to support one or more specific modelling languages (like ARIS) and that thus offer syntactical support, *general drawing tools* used for all types of models without providing syntactical support (like MS-Visio) and, finally, *MS-Office*.

Our research question for this factor is *Is there a relation between the modelling tool applied and the extent of outcome?* Will projects that have applied a certain type of modelling tool exhibit a more extensive outcome than projects that have used another type of modelling tool? From our data we find no differences between the high- and low-outcome groups when it comes to the type of modelling tool used, as shown in Figure 8.

5 Summary and discussion

We have studied Norwegian model-based process-change practice with focus on the relative importance of project-specific and modelling-related factors. The purpose was to determine which type of factors that influence project effectiveness more. We compared the practices of the high-outcome and low-outcome groups with respect to project outcome and found that the project-specific factors *management support*, *participation*

and involvement, *process owner*, *training* and *use of a consultant* were important. On the other hand, we did not find clear differences between the two groups when it came to modelling-related factors. This leads us to conclude that project-specific factors are more important for effective process modelling than modelling-related factors.

Our research does not answer the question of why project-specific factors are more important than modelling-related ones, but our findings are consistent with results from other areas. For example, Weir et al. [WHL02] report from a case study of a data warehouse implementation that management and end-user buy-in appears to be among the most important factors for successful implementation.

Yet it remains surprising that modelling-related factors do not seem to play a role at all for determining process-modelling effectiveness. One possible reason is that the present study has not addressed the right model-related factors. For example, it is possible that the analysis should have been carried out at the level of individual modelling constructs or notational details, although we have found no indications of this in the data we have collected. It is also possible that there are interactions among modelling-related factors that should have been taken into account. For example, sophisticated modelling techniques may only be worthwhile when used in combination with dedicated tool sets and as part of certain comprehensive methods.

Another reason might be that modelling-related factors interact with other factors such as process-modelling *purpose* or *maturity*. For example, simple modelling approaches may be appropriate for simple process improvement studies, whereas more complex approaches may be better for IT-enabled process change. Or simple modelling approaches may be appropriate for organisations with little priori process-modelling experience, whereas organisations with higher maturity could benefit from sophisticated approaches. Although we have tried to mine our data for such patterns, we have not been able to find any. The reason for this may be that relatively few of the projects we studied could be called highly sophisticated. Hence, when our data indicate that modelling-related factors do not seem to play a role at all for determining process-modelling effectiveness, this result mainly generalises to organisations with little process-modelling experience. For more mature organisations, modelling issues may come more strongly into play.

6 Conclusion and further research

There is an extensive literature and much reported research on process-modelling techniques, tools and frameworks. But little empirical research exists on how process modelling is carried out in organisations and on which factors make process modelling effective. Sedera et al. [SGRM04] have proposed a *Process Modeling Success Model*. In their model, critical success factors are divided into *project-specific* and *modelling-related factors*. Analysing data from Norwegian organisations in relation to the Process Modeling Success Model, we found that project-specific factors matter more for a high level of project outcome than modelling-related factors, supporting Sedera et al's early

findings. Specifically, we found that *management support*, *participation and involvement*, *process ownership*, *training*, *resistance* and the *use of a consultant* are factors that seem to influence effectiveness.

Our data do not, however, give us insight into the details of how these factors actually impact on model-based process change projects. A closer study and examination of these practices is a natural path for further research. In particular, modelling-related factors need to be re-examined. Perhaps additional factors of this type need to be examined and perhaps interactions among modelling-related factors need to be addressed. The impact of modelling-related factors should also be investigated in light of different process-modelling *purposes* and *maturity levels*.

The scope of investigation also needs to be broadened. This paper analyses data from a small sample of 34 projects in 30 different organisations, and the research is limited to Norway. Extending this research to include more projects in more countries is an obvious path for further work. As suggested by the authors in [IEOO06], national cultural differences may explain why Norwegian practice deviates from the recommendations found in the predominantly Anglo-American literature. More intensive research is also needed, e.g., interviewing multiple informants and using other information sources from each project and following each project over a longer time.

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