

The Practice of Business Process Modeling – A Story from the Field

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Abstract. This article aims to increase the body of knowledge on the practical use of business process modeling to support process redesign and organizational development. A qualitative case study inspired by Action Research has been performed in an SME. The data was deductively analyzed using an established project phase model aimed to support Enterprise Modeling activities. The main contribution is the detailed descriptions of the usage of business process modeling for process redesign, adding knowledge to the practice of business process modeling. In addition, this work also increases knowledge of aspects that support the Enterprise Modeling project phase model and provides suggestions for further development of the Enterprise Modeling project phase model. Other contributions highlight the critical issues of having a holistic perspective, including the three levels of inquiry, the need to include parts of later phases in the Enterprise Modeling project phase model in a pre-phase activity, and suggestions to extend the “what to avoid” list. The work also revealed that the list could be used for evaluation purposes. Furthermore, some advice to practitioners in the form of lessons learned has been formulated, e.g., the importance of establishing the problem owner and having the future state in focus instead of the current state.

Keywords: Business Process Modeling, Enterprise Modeling, EM, Action Research, AR, Practical Use, Lessons Learned, Critical Success Factors, CSF.

1 Introduction

In the dynamic landscape of current business environments, organizations are continually challenged to adapt and innovate in response to evolving market demands, technological advancements, and pressure from competitors. The ability to handle these complexities and achieve successful organizational change or adaptation is a critical determinant of long-term viability and success. Enterprise Modeling (EM) is a powerful tool for understanding and transforming organizational structures, processes, and strategies. It can create abstract

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representations that capture key aspects such as goals, functions, processes, and data [1]. Using EM for organizational change has been described in the literature for a long time, such as the work of Davenport [2] and Hammer [3], where the importance of process modeling in streamlining operations and fostering agility is a key requirement for successful organizational change initiatives. By employing various modeling techniques, organizations can gain a holistic view of their current state and design future states aligned with strategic objectives. This process allows for identifying inefficiencies, redundancies, and areas for improvement, forming the foundation for informed decision-making when working with organizational change. This article focuses on business process modeling, which is one part of EM.

Changing organizational business processes can be a complex and challenging endeavor involving many stakeholders with different perspectives and understanding. In the digital age, critical assets have been dematerialized, and the most valuable asset is knowledge [4]. Complexity arises when organizational, social, and technological factors interact [5], [6]. Industry 5.0 is concerned with this since it should bring us towards a sustainable, humancentric, and resilient European industry [7]. Therefore, theories from different fields are needed, as well as knowledge from EM practitioners [8]. Modeling can be used to analyze business processes to help improve work within the organization [9] and to identify issues that can be addressed and improved [10].

This article aims to increase the body of knowledge on *the practical use* of business process modeling to support business process redesign and organizational development. To achieve the aim, an action research approach was chosen to gain theoretical and practical knowledge about *how* business process modeling can be practically used. The study was performed in a Swedish manufacturing company (from here on called the Company) that designs and manufactures screening equipment for industries worldwide. The study focused on the Company's administrative process, which the Company has identified as a bottleneck, and how business process modeling was used in practice to improve this process. The main contribution of this article is the rich descriptions of how business process modeling was practically used in a manufacturing company, including practitioners' examples within each phase of the EM project phase model [10] used in the business modeling work. Furthermore, the work has also resulted in:

- Confirmations regarding the usefulness of suggested activities within the used EM project phase model.
- Contributions to the EM project phases model.
- Advice to practitioners in the form of lessons learned.

The article describes how business process modeling was practically used in a change process and compares this work to a theoretical project phase model of how EM can be used for this purpose. The theoretical model presents ten phases (Figure 2) that provide a structured modeling process that can facilitate organizational change. During our work with the case company, it was revealed that the company had used improvised variations of modeling with limited results. It also became clear that business process modeling was a new approach that the company did not have much experience using. Therefore, following an existing business process modeling approach was met with hesitation and skepticism, so the project researchers needed to deviate from the original plan to fully follow the approach presented by Sandkuhl et al. [10]. However, the work in the case company was much inspired by the modeling project phases offered by Sandkuhl et al. [10], and those phases provide a structured way to approach business process modeling. Therefore, the work with the case company can provide a valuable addition to knowledge on working with business process modeling within the field of small- and medium-sized manufacturing companies. These companies have very different experiences when it comes to working with business process modeling, so increasing the body of knowledge with examples from practitioners in the field is much needed [8]. Therefore, the deviations and differences identified are demonstrated and compared to the structured approach by Sandkuhl et al. [10] where applicable. The outcomes contribute to knowledge regarding using business process modeling to achieve organizational change and potentially to the EM project phase model provided by Sandkuhl et al. [10]. In addition, we provide a detailed description of the case and the work done to demonstrate an example of what

working with SMEs can look like. We consider the experience of working with the company a valuable input to researchers developing EM methods and practitioners using business process modeling as a tool to achieve process changes.

The article is outlined as follows. In Section 2, we give a short overview of relationships between various sub-models within EM, including an example of how different models can relate to each other. We also present the project phases presented by Sandkuhl et al. [10] to set the theoretical frame for the analysis. In Section 3, we present the case, the research method used when studying this case, and the data collection and analysis method. In Section 4 we present the work that was done in the case company. Section 5 presents the analysis and results and includes detailed descriptions of how business process modeling was practically used, which can be considered one of this article’s main contributions. Finally, in Section 6, we end up with some conclusions and theoretical and practical implications.

2 Overview of Relationships between Sub-models

This section gives a short overview of how different models can be used to capture different structures and dependencies within an enterprise. According to Allweyer [11], enterprise models can be presented in four ways: textual description, tabular representation, graphical without specific notation, and graphical models with a defined notation. An enterprise model generally consists of more than one model (sub-models) that describes an enterprise from different perspectives, such as business processes, rules, goals, actors, and concepts [12]. The various relationships between sub-models can be viewed in Figure 1 as described by Sandkuhl et al. [10]. This article focuses on the business process model.

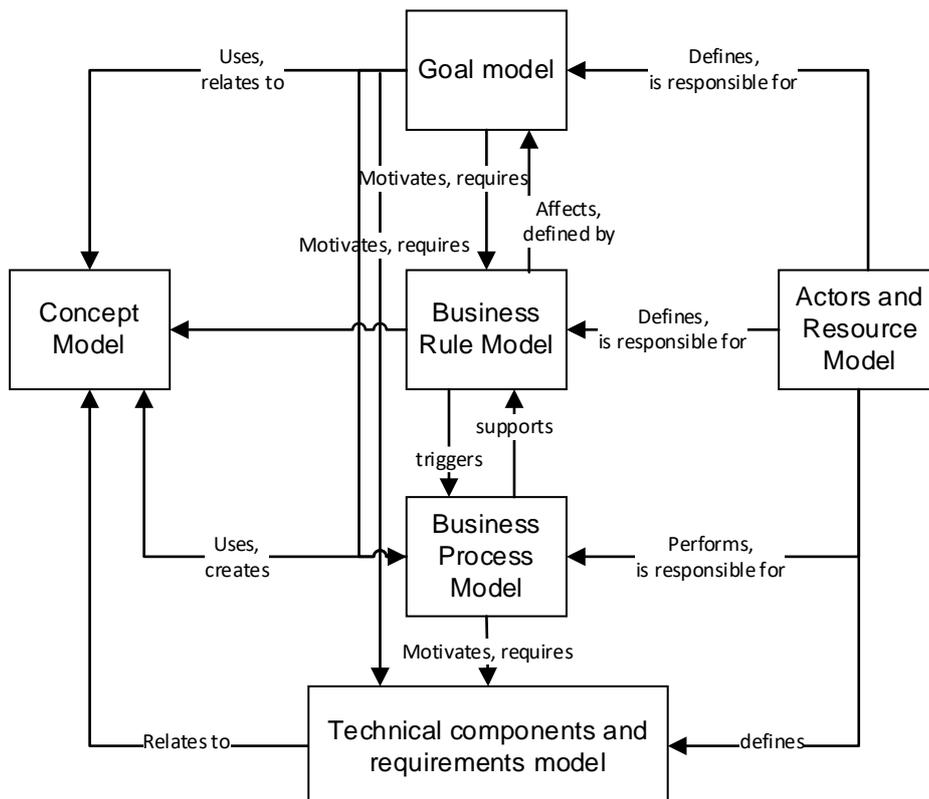


Figure 1. Relationship between sub-models [10]

Having different sub-models and relationships between sub-models is an important tool to capture important aspects of an organization, and the overview of how these models relate to each other provides indications of different sub-model roles from a holistic perspective. Sandkuhl et al. [10] also provide a model of how the modeling process itself can be conducted through project

phases. For this particular case, only the business process model part of the sub-models was used. Although more models would provide a more holistic view of the organization, the case company was eager to focus on its business process. Therefore, the project phases described by Sandkuhl et al. [10] only apply to the business process modeling sessions.

In total, there are ten phases (Figure 2) that provide structure to the modeling process and clarity to the model representation and support organizational learning. In addition, the phases should make organizational changes easier [10]. According to Sandkuhl et al. [10], the approach of working with enterprise modeling to facilitate organizational changes is in constant development. Furthermore, each case is different and needs to be considered when working with companies. The project phases by Sandkuhl et al. [10] can be used as a theoretical framework to identify differences between the approach that was done in the case company and to evaluate the outcome of the modeling work. These differences can then contribute to further knowledge of working with the different sub-models and contribute to the project phases provided by Sandkuhl et al. [10]. In the Sandkuhl model, each phase is described as a process, and each phase is called a process. However, since this article concerns a *process* re-design, we use the word phases when describing each process/step in the process model for clarity. For the purpose of this article, the phases are central to understanding the workflow of developing the business process model. Sandkuhl’s model also includes information sets and external processes that are excluded in the model below as the main purpose of this article is to contribute to and compare the phases with the work done in the case company when modeling one of the sub-models, i.e. the business process model.

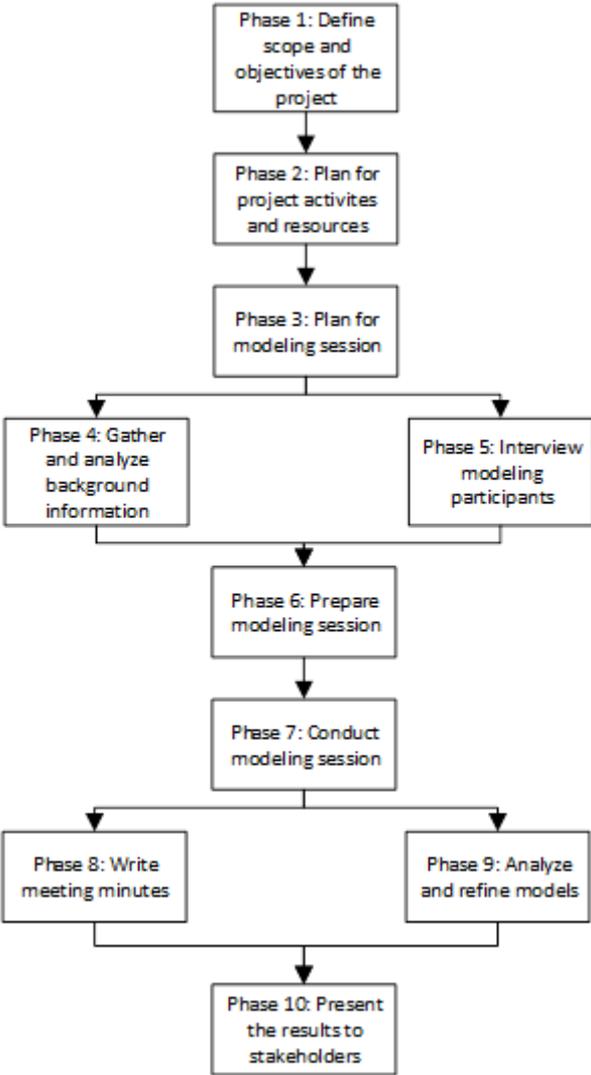


Figure 2. Project Phases (based on [10])

Table 1 provides an overview of each process of the project phases provided by Sandkuhl et al. [10] when working with enterprise modeling for organizational change. Although this project did not include additional sub-models, the phases should preferably support the work of creating individual sub-models that, together with their relations, contribute to a more holistic enterprise model.

Table 1. Description of phases (based on [10])

Phase	Overview
Phase 1: Define the scope and objectives of the project	The EM project leader and the problem owner must define the project, its boundaries, and expected outcomes. The project also needs to be accepted within the enterprise, and project goals agreed upon
Phase 2: Plan for project activities and resources	The EM project leader, problem owner, and modeling facilitator create a plan where modeling activities and sessions are agreed upon. Work packages can then group various modeling tasks and deadlines should be set for each work package. Activities and work packages are based on the project goals. Resources such as a modeling group, facilitator, steering committee, and reference group should be set based on the project needs.
Phase 3: Plan for a modeling session	The first modeling session is very important and needs to succeed. It is, therefore, important to plan the first session well. The session's objectives and questions to be addressed need to be clearly defined.
Phase 4 and 5: Gather and analyze background information and interview modeling participants	As preparation and to get a deeper understanding of the organization, domain experts who will take part in the modeling session can be interviewed beforehand. This can provide a much deeper understanding of the problem and what expectations are from the domain experts. The domain experts should also be informed of what could happen during the session if they are not used to working with enterprise modeling for this purpose.
Phase 6: Prepare modeling session	Based on the interviews and background material gathered in previous phases, the modeling session can be planned in more detail. Objectives and questions that will be addressed are more clearly defined based on organizational needs raised in participant interviews. Things that could cause conflicts or topics that might raise controversy need to be assessed by the modeling facilitator before the actual modeling session.
Phase 7 and 8: Conduct modeling session and writing meeting minutes	Based on the more detailed plan developed in the previous phase, the modeling session is conducted accordingly. The session's outcome is the models produced, but capturing meeting notes and action lists is important. These notes and actions can then be distributed among practitioners as a reminder of the work done and what actions they have agreed to be responsible for.
Phase 9: Analyze and refine models	The content, presentation, and layout usually need to be refined and scrutinized to see if the objectives of the modeling session and the project have been achieved. The results can be presented to the organization if the session is assessed to have reached the desired outcome. Otherwise, further work is planned and a list of issues is documented.
Phase 10: Present the results to the stakeholders	Presenting the results to stakeholders and the project owner marks the end of the modeling project. The outcomes should be actionable or an input for another development project. Another outcome could be that the modeling sessions highlight issues that require further development.

3 Research Design

A qualitative case study inspired by Action Research (AR) was chosen for this case. AR is often chosen when the research aims to solve specific problems and achieve practical benefits for stakeholders [13], [14]. A single case can be justified if it is purposeful and provides much information [13].

In this case, the company wanted to develop its customer process and make it more efficient. Hence, AR, as a research method, aimed at obtaining the dual outcomes of

- action (change) and
- research (understanding).

Before describing the practical use of business process modeling (Section 4), in this section, we briefly describe the case study (Section 3.1) and data collection and analysis methods (Section 3.2).

3.1 A Case Study Inspired by Action Research

The case was performed in a Swedish SME designing and manufacturing screening equipment for industries worldwide. Since 1995, the Company has been part of a large international enterprise group that is internationally active in the screening and processing technology markets, but the Company has a high degree of independence. The Company makes-to-order, which in this case means that each piece of equipment they produce is bespoke and unique to a specific customer and that it is produced only when there is a customer order. Their mission is to consistently deliver a complete solution based on their customers' specific screening needs. The company has around 25 employees organized at three organizational levels, and employee turnover is low. The company entered the research project to improve its administrative process. "If we do the paperwork right, the order goes faster through production.", as they put it. This included their information systems (IS) and business processes, mainly focusing on their so-called administrative process. The case used enterprise modeling to achieve organizational change and was one of four cases included in a research project.

In AR, the researchers and practitioners work together but in different roles. The practitioners possessed the knowledge of the Company and were responsible for the anchoring and implementation work within the Company. The researchers had the scientific and methodological knowledge and were responsible for the data collection, the analysis work, and knowledge generating, where reflecting and asking questions to practitioners were important activities. Furthermore, in AR solutions, insights and knowledge are generated in an explorative and iterative manner, and there must be a sensitivity for this throughout the project [15], which was the researchers' responsibility. The researchers were also responsible for project progress, including planning the work.

In action research, four typical phases can be discerned [16]:

- *Diagnosing* refers to the joint (researchers and practitioners) identification of situated problems and their underlying causes.
- *Action planning* is the process of specifying the actions that can improve the problem situation.
- *Action-taking* refers to implementing the intervention specified in the action-planning phase.
- *Evaluating* refers to jointly and iteratively reflecting, assessing, and learning. Evaluating entails the joint assessment of the intervention by practitioners and researchers while specifying learning, which denotes the ongoing process of documenting and summing up the learning outcomes of the action research cycle. This contributes knowledge to both theory and practice.

The business modeling sessions were mainly performed in the phase of Action-taking. Before the Action-taking phase, some preparation and planning sessions were performed. Activities after the Action-taking phase included analysis and formulation of learning. This is in accordance with

the EM project phase model (Figure 2). Table 2 gives an overview of the company’s main activities for each phase of the AR method and relates them to the EM project phase model. As demonstrated in the table, some phases were done in parallel. For instance, the evaluating phase was running more or less throughout the whole project.

Table 2. Project activities related to AR phases and phases in the EM project model

Phase	Activities in the company	Phases in the EM project model
Diagnosing (8 months)	Jointly understand situated problems and underlying causes and what the company meant when discussing their “administrative process”. Jointly deciding what process to redesign, resulting in the Customer Process (CuPr) being the business process in focus. Building relationships and understanding the culture.	Phase 1
Action planning (8 months)	In collaboration, designing a way of working, timeline, etc., to redesign the business process called CuPr by the company.	Phases 2-6
Action taking (10 months)	Jointly developing and re-defining CuPr Implementing the redesigned CuPr (the company’s responsibility)	Phase 7
Evaluating (more or less throughout the whole project)	Jointly iteratively, reflections, assessments, and learning	Phases 8-10

3.2 Data Collection and Data Analysis Method

A common distinction in literature is between the following two types of knowledge (see, e.g., [17], [18], [19]):

- tacit knowledge and
- explicit knowledge.

Compared to gathering explicit knowledge, tacit knowledge is more difficult to identify and express since it is highly personal and concerns insights and intuition [18], [20]. Different data collection techniques were used to capture explicit and tacit knowledge since both types of knowledge were relevant to the project.

Except for several telephone contacts with the company and a project workshop, all data collection was performed at the company’s location. Throughout the work, the researchers took extensive notes. Interviews were taped and transcribed. Formal documents, such as organization charts and steering documents, were also part of the collected data. All collected data was shared between the researchers. This was an important part since researchers had different areas of expertise and accordingly observed and sometimes noticed different things.

The data was collected for two and a half years. Based on the five typical AR phases, Table 3 summarizes the performed data collection activities, their aim, and types of collected data (explicit knowledge or tacit knowledge). Notably, the AR phases were iterated during the work, and data collection and analysis in different phases influenced each other and how the work was performed.

The collected data was deductively analyzed using the general EM project phase model (Figure 2) as an analyzing tool. By analyzing discrepancies between the models and the case, we gained knowledge about the practical use of the phases when modeling a business process and how it contributed to change as well as what challenges there were. We also learned about aspects that either confirmed or provided examples that could contribute to the overall EM project phase model when focusing on one sub-model.

Before presenting the analysis and results, a more detailed description of the business process modeling work is given in Section 4.

Table 3. Overview of data collection activities

Aim	Data collection activities and how the data were collected	Type of data (explicit and/or tacit knowledge)
-----	----- <i>DIAGNOSING</i> -----	-----
Understand the company's needs and underlying causes	Meeting with the management group. The attending researchers took notes. Formal documents such as organization charts and steering documents were also shared by the company, both during the meeting and by e-mail. Walk around the company. Observing behavior, things that happened, and asking questions. The researchers took notes.	Explicit Tacit
Understand what the company means when talking about its "administrative process".	Researchers joined a "morning meeting", an important part of the process. Observing and taking notes. The customer process is modeled with the management group (see Figure 3).	Tacit Tacit, explicit
Develop relationships and understand the company and the CuPr from a holistic view	Nine in-depth interviews (recorded and transcribed) with employees from different organizational levels. The semi-structured interviews allowed for in-depth supplementary questions based on the answers. The interview guide was structured into five question areas (1) Introduction; (2) Their work regarding Continuous Improvement (CI); (3) Measuring and management of CI: Communication of goals and measurements; (4) The use of information technology within different areas of the company; (5) Ending, focused on the importance of Knowledge Management (KM) in CI	Explicit
-----	----- <i>ACTION PLANNING</i> -----	-----
Share the interview results and decide on future focus and plan activities based on this collaborative plan.	Dialogue about the results so far with the management group. The attending researchers took notes. To manage Critical Success Factors (CSFs) in the upcoming work, we used CSFs as described in Aggestam and van Laere [24] and van Laere and Aggestam [22] and as an analyzing tool	Explicit
Commitment to future focus from a holistic perspective of the CuPr.	Telephone meeting between the project leader, the CIO and the production manager. The project leader took notes. This also includes commitment concerning what was going to be developed.	Explicit
Knowledge sharing concerning the work so far and the next step	A workshop at the University where all the companies and researchers who were included in the larger project were attending. Café dialogues where each group documents the discussion.	Explicit
Specify actions for future work and update each other	Meeting with the management group of the Company. The two attending researchers took notes.	Explicit
-----	----- <i>ACTION TAKING</i> -----	-----
Develop and define the redesigned CuPr.	Eight workshops in different settings, of which one was specifically devoted to creating models using process modeling. How the work was carried out, i.e., the description of the practical use of process modeling, is a part of the results and, therefore, in more detail described in Sections 4 and 5.	Tacit, explicit
A decision about the redesigned CuPr.	The decision was taken by the company's management group and communicated to the researchers.	Explicit
Implementing the redesigned CuPr.	This was done by the company with support from the researchers. Notes were taken concerning how it proceeded.	Explicit
Monitoring and supporting the implementation work	Five meetings with the management group. Notes were taken concerning how it proceeded.	Explicit

4 Business Process Modelling Example From the Field

In this section, we describe extensively the case study chronologically, roughly following the first three phases of the AR method: Diagnosing (Subsection 4.1), Action planning (Subsection 4.2), Action taking (Subsection 4.3), and Evaluating (Subsection 4.4). The practical example of the business process modeling sessions is the main part of the action-taking and is accordingly described in Subsection 4.3.

4.1 Diagnosing

Following the diagnosing phase, the initial work aimed to identify situated problems and underlying causes and to define and attain a joint understanding concerning what the Company meant when discussing its “administrative process”. From a holistic point of view, defining the process’s main customer and, hence, what the output should be to satisfy the customer’s need was a critical part.

During that phase, there was a meeting with the management group aimed to understand what the Company meant when they talked about “focus on the office part” and their “administrative process” as well as developing a common and shared view of that process. Accordingly, it was an important part of the diagnosing phase and was important in how the action-taking phase was performed. The participants were the management group, i.e., CEO, Production Manager, Sales Manager, and Quality and IT Manager, as well as two researchers. The purpose of the meeting was explained at the start of the meeting, and then the work started. One of the researchers took notes, and the other one used the whiteboard and, together with the management group, defined relevant process elements and relations (See Figure 3). Here, we used a SIPOC-inspired way of working. SIPOC is a tool from the Six Sigma[†] methodology where S stands for Supplier, I for Input, P for Process, O for Output, and C for Customer [21]. The participatory work proceeded to develop an initial draft of the administrative process.

A researcher guided the work by asking questions related to the process, and it didn’t take long until one of the participants felt the urge to stand up and start drawing on the whiteboard. The researchers welcomed this as this raised the level of participation by all members of the management group and the researchers could focus on asking questions about the process. After about two hours of high activity, the first model (Figure 3) representing the administrative process had reached a good enough quality, and the participants expressed their surprise at how good the workshop had been. To use their own words, “We have tried this before, but we always got stuck and never finished the process”. This successful modeling workshop was a pilot that became a “proof-of-concept” for the company when it came to using modeling as a tool. This meant that the management group accepted that this way of working forward would be very beneficial when further developing the administrative process. A common understanding emerged between the company and the researchers that the production department was the process’s customer. This was a new way of thinking for the company. This highlighted the importance of having all the needed information to produce the screening equipment earlier in the customer process when initiating production orders.

To highlight the importance of the administration process, the production manager said: “A mismatch in administration can involve several hours of work in production” (the production manager). Therefore, the process they had called the “administrative process” changed the name and became the customer process (CuPr) after the realization that production was the customer of the sales process. This business process, therefore, needed to be re-designed to capture all needed information and define how different types of external customer inquiries should be handled within the process.

[†] <https://www.investopedia.com/terms/s/six-sigma.asp>

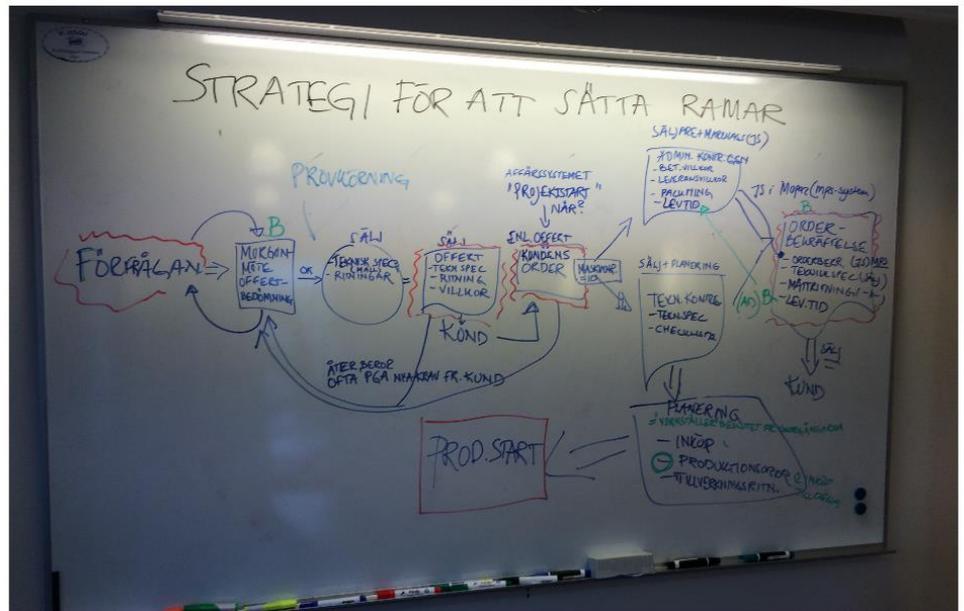


Figure 3. The first joint version of the administration process

Depending on the complexity of the inquiries, the order could take different paths in the process, requiring different quality checks and gates. Figure 4 shows how this was visualized and communicated from a holistic perspective to the company. In parallel, the researchers did work to understand the company’s culture and establish trusting relationships. For instance, nine in-depth interviews with employees from all three organizational levels (operational, tactical, strategic) were performed, as well as different types of observations, e.g., participating in meetings and walk-around in the company (see Table 3). The work in this phase aimed to establish trust, identify situated problems and underlying causes, and define and attain a joint understanding concerning what the company meant when talking about its “administrative process.” From a holistic point of view, defining the process’s main customer and, hence, what the output should be to satisfy the customer’s need was a critical part.

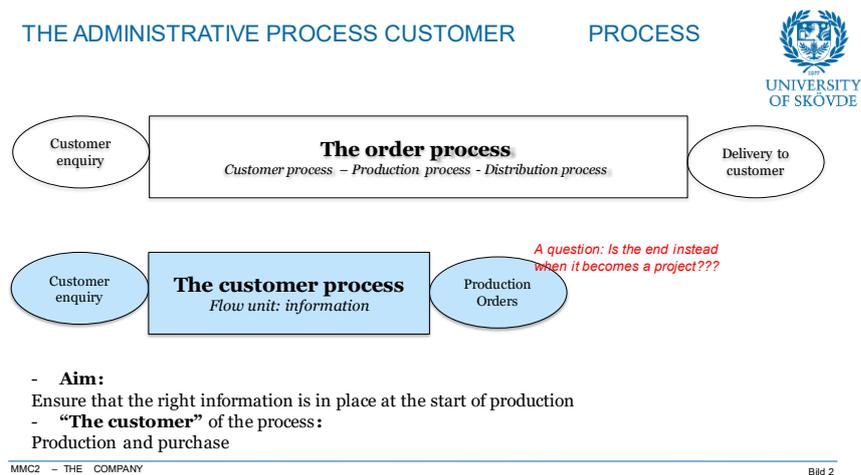


Figure 4. Committed focus (translated)

4.2 Action Planning

Based on the diagnosing phase, the action-planning phase commenced. Since the diagnosing work had revealed that the CuPR was the core issue, we focused on actions aiming to improve and redesign this process. The diagnosing phase also revealed that the sales personnel were a critical

group for a successful result. Hence, in the process development work, work design and actions were needed that would make it possible to involve the sales personnel as well as include their knowledge and insights. The researchers also continued the work of developing good relationships with the company and its employees and, at the same time, taking part in their knowledge and insights. Since the personnel's knowledge and experience were considered critical to the following work, the researchers suggested business process modeling as a useful method to support the coming work and gain a common understanding in the next phase.

The last activity in the action-planning phase was a meeting between the two researchers and the management group, intending to design and specify the action-taking. The researchers suggested using business process modeling to develop and define the CuPr. Earlier in the project, it was met with some skepticism as this had been tried before by the company, but following the advice of Sandkuhl et al. [10], the purpose of the activity was clearly stated, and an emphasis on the importance of having affected stakeholders taking part was highlighted. Furthermore, the researchers reminded the management group about the successful outcome of the simplified pilot modeling session in the diagnosing phase (see Section 4.1) The strategy to use business process modeling was then agreed upon, and a date for the first workshop was set, and all members of the management group agreed to attend.

4.3 Action Taking Including the Business Modeling Sessions

Action planning was then followed by action-taking. During action-taking two main parts are identified:

- Jointly developing and redesigning the CuPr.
- Implementation of the redesigned CuPr by the company.

The business process modeling work was the first part of the action-taking phase, and eight workshops were held in different settings aiming to develop and redesign CuPr. Throughout the work of developing and redesigning the CuPr, additional work of aiming, anchoring, and obtaining a commitment for the coming proposed way of working with the CuPr was performed by the company management group and the researchers. Even here, the business process modeling sessions played a critical role.

Following the AR approach, evaluation and learning influenced the work. When the action-taking phase occurred, the first model of the redesigned CuPr was picked up as a starting point (Figure 3). As a first step, the management group and the researchers reviewed it, and updates were identified. The management group and the researchers also agreed that the researchers should transform this revised model to digital form to facilitate updates and the possibility of sharing the model. The researchers suggested a digital tool called Visuera Modeler,[‡] which the management group accepted. Many digital tools can be used for modeling, but this specific tool has been used many times before by researchers, and, based on their experience, the tool facilitates business process modeling understanding. It is swimlane-based and captures, e.g., roles, decision points, information, and process flow, which have been identified as critical aspects in the administrative work (Figure 3) in the diagnosing phase. The simplified whiteboard model was then converted to a digital model using the tool. The business process model was reviewed based on the digital version during the next meeting with the management group. The work demonstrated that the process was mostly about getting correct information from the customers before receiving the actual order at the production level. The researchers then used the input from that meeting to make changes to the process before sending the model back to the company. At the next iteration, it became clear that the process needed to be divided into two processes, “the offer process” and “production order preparation and planning process”. In addition, the importance of the ongoing regular morning meetings in the company became increasingly a gate for quality control of the

[‡] <https://visuera.com/>

information from sellers that had contacts with the customers. At this point, the models describing the current design of the CuPr were said by the Company to be “good enough,” so the next step was to focus on how the future version of the processes should look.

As mentioned previously, when modeling the current state of CuPr, some crucial aspects arose that became important for the new version and re-design of the process. At the next workshop with the management group, the re-designed CuPr (future state) was modeled to secure the flow of vital information from the customer to the production team. When the CuPr had been updated, a larger workshop was held where all sellers at the company took part, along with representatives from design, planning, procurement, production, and top-level management. Small additions were made at that meeting, such as the sellers using a predefined checklist (gate) before presenting possible orders at the morning meeting. A small example of the TO-BE request process is provided in Figure 5, where, for instance, a “traffic lights” control point is implemented at two locations as gates. The first location of the traffic lights is where the seller needs to classify the request from a customer as either a standard order (green, although not entirely standard, but similar to what has been done before) or a special order (red) that needs, for instance, more design work or some information is missing. The second traffic light was implemented at the morning meeting, where representatives from all company parts (design, production, sales, management) got updated on incoming potential customer orders from sales personnel.

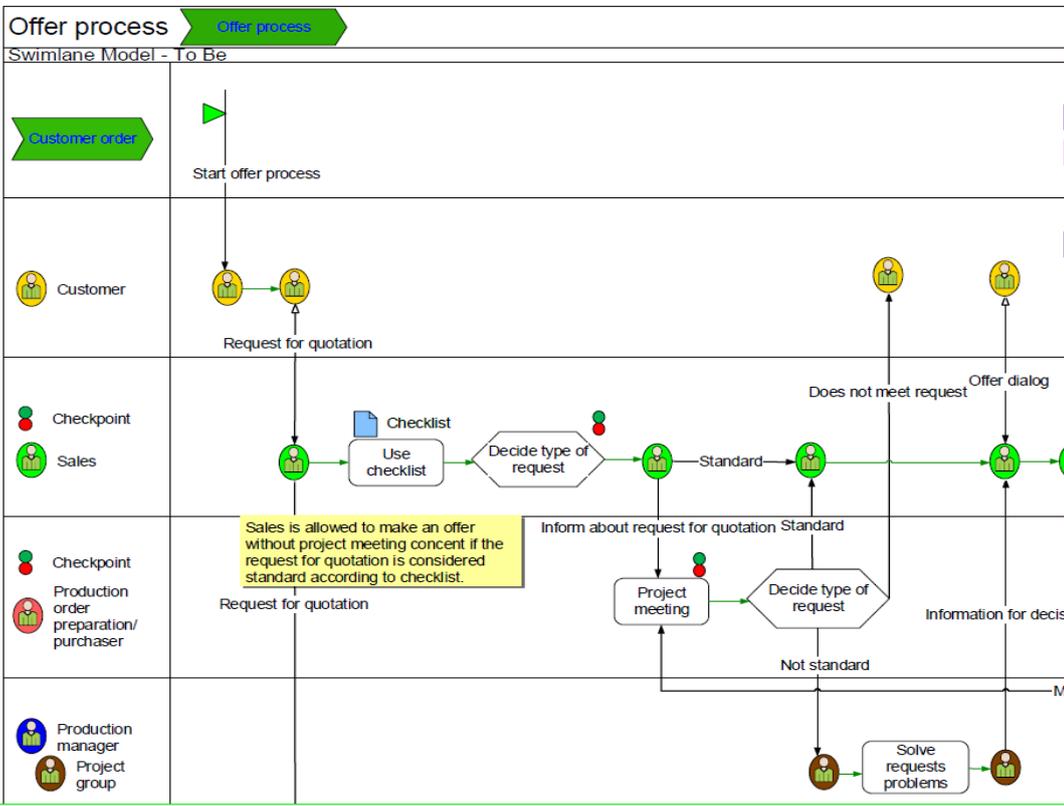


Figure 5. A part of the redesigned request process

Finally, the jointly developed and redesigned CuPr and its including gates, i.e., points that must be fulfilled if the process is to proceed, and their measurements are visualized in Figure 6. One critical gate was what the company called their “morning meeting”. At this point, when the process was getting more structured and the “traffic lights/ gates” were implemented, the suggestion came to change the name of that meeting to “Project meeting”. That would make the purpose of the meeting clearer for employees. This project meeting would be held daily. Thus, much effort was made to develop instruments to keep the Project meeting sustainable over time. This means making sure that the meeting keeps on fulfilling its role from the perspective of CuPr and, at the same time, continuously improving it. In addition, the meeting was moved from the sales manager’s

office to a more “neutral” office space as the meeting should focus on customers’ request for quotations (the projects) and not just “sales.” In addition, the process model was put on the wall for everyone to see along with a standardized meeting agenda.

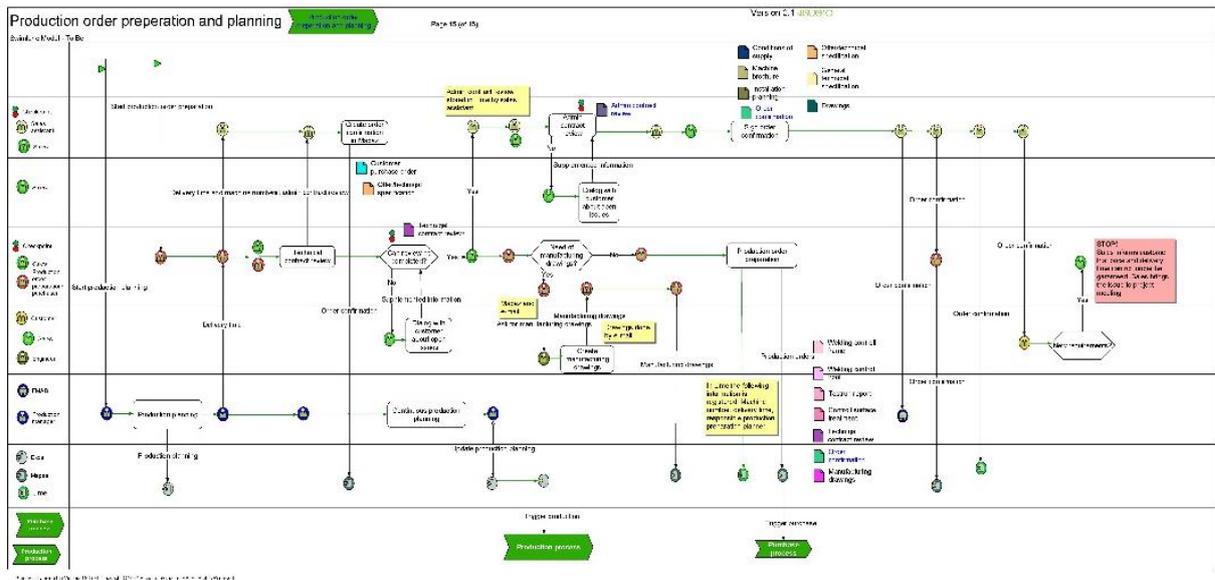


Figure 6. The outlook of the redesigned Customer Process (CuPr)

The newly defined and developed CuPr was approved by the Company’s management team and preparation work for the implementation started in the autumn with the goal of following the new process from January 1st the next year. The Project meetings were run as planned. A measurement was set in place to see the effects of this process. Before implementing it, the production team had counted how many times information was missing, and how many times customers’ requests for quotation needed to be sent back and forth between the production team and the sales personnel. By the end of the project, after implementing the new process, the measurements showed a significant decrease in missing information. Hence, we regard the work to be successful. Process modeling played a critical role in developing the CuPr and contributed to the results accordingly.

4.4 The Evaluating Phase

This phase is about joint assessment and learning between researchers and the company. It was iteratively performed and was integrated with the other three phases and, therefore, affected the upcoming work. Evaluation and learning are parts of the analysis that influenced how the work proceeded (see Table 1). Joint learning can also be observed in different agreements due to joint assessments. For instance, our joint assessment concerning production being the customer resulted in an agreement of the CuPr as the focus of the intervention, and the choice of business process modeling resulted from our analysis and learning work in the diagnosing phase. Regularly throughout the work, we also went back to the overall aim in order to evaluate and learn whether the work was on the right track. Furthermore, between the data collection occasions, the researchers also had internal working and analyzing meetings, which played an important role in the evaluation phase for specifying learning outcomes and their potential influences on the work.

5 Analysis and Results

This article aims to increase the body of knowledge on the practical use of business process modeling. The goal is to understand further how business process modeling can be practically used in a change process and the challenges of using business process modeling in that type of work. The data has been analyzed using the general EM project phases (Figure 2). The complete analysis

is presented in Table 4. It provides an example of how this case required some deviations from the project phases, which is to be expected, as Sandkuhl et al. [10] mentioned, since every case is unique. The analysis revealed aspects that both confirm the project phases in the model and aspects that differ from them. The differences can, therefore, potentially contribute to further development of the EM project phase model. *These contributions are written in italic* in Table 4. We conclude each phase with the main takeaways.

Table 4. Analysis of the phases and the work

Phase in the theoretical model (Table 1)	Practical work in the company
<p><i>Pre-phase: Preparing for the EM work</i></p>	<p>Although extensively described in the work of Sandkuhl et al. [10], we identified a need to add a “pre-phase” section to the EM project phase model. The success of EM depends on how it is introduced [10], and the same should apply to each sub-model. Modeling was done on the whiteboard with the management group, facilitated by one “champion” from the company, as described in Van Laere and Aggestam [22]. Participation of the champion from the company established ownership of the problem and contributed to a learning activity for both researchers and the company. The researchers could see how the problem was described by the champion, and support the champion with basic modeling of the problem. The focus was on company needs (no method focus; see below), which, in turn, helped steer the choice of method (business process modeling). In addition, it helped introduce the method properly through demonstration and action.</p> <p>The company’s needs: <i>The use of CSFs</i> as described in Aggestam Laere and Svensson [23] revealed, for instance, the following:</p> <ul style="list-style-type: none"> • Low maturity in enterprise modeling, • The importance of clearly motivating why the customer administration process was important and how it contributes to the critical group of sellers within the company, • No experience of measuring and steering an administrative process, • Earlier experience within the company using modeling to understand the process's current state (AS-IS) was unsuccessful, resulting in initial negative attitudes towards the process modeling method, • A holistic perspective of the business process was important in understanding why it was critical to “hold on” to the planned work process and not give up. <p><i>Main takeaways:</i></p> <ul style="list-style-type: none"> • <i>Getting a buy-in for the method by doing a pilot session where the method is used but the focus is on the company’s needs (not a method focus)</i> • <i>Identifying champion/s within the management group</i>
<p>Phase 1: Define scope and objectives of the project</p>	<p>Based on using CSFs in the diagnosing and action panning phases as described in Aggestam and Laere [24], we used <i>system thinking</i> and focused on developing a <i>holistic view</i>, including <i>the three levels of inquiry</i> [25] as well as establishing a common and shared view on why we were doing this and who the customer was. Here, it was important to relate to the strategic level of the enterprise and its focus on continuous improvements in production, as well as communicate on both the operative and strategic levels of the organization.</p> <p>The business process was defined jointly, based on a holistic view, and with a customer focus. Defining the customer of the process (scope) and which customers’ needs the project should fulfill. Another aspect was to specify when a project (orders from customers) starts and when it ends. Here, SIPOC was a valuable tool, as demonstrated in section 4.1.</p> <p>We started with defining WHY and the aim (business, quality, money, reducing non-value-added activities), and the scope, followed by the internal customer perspective (production and procurement) and external customer’s needs. This supports defining</p>

	<p>WHAT the scope/process must produce to be successful and fulfill customer needs. This helped define the process's start and stop from a holistic perspective.</p> <p>Developed models visualized the scope. These models were revised and further developed in meetings until the Company was satisfied and a common and <i>shared</i> view was established. This work needed to include the whole management group and representatives (managers) from both production, sales, and quality development.</p> <p>The work in the action planning phase revealed the need to establish a <i>common, accepted, and shared view on how to work</i>, which is critical for success [24]. The strategy to use business process modeling was agreed upon between the researchers and the management after the initial sessions. By using CSFs as a “diagnosing tool,” we identified the Company's important factors, which strongly contributed to our suggestion and choice of business process modeling. For instance, we found the following critical factors for the Company:</p> <ul style="list-style-type: none"> • The sales department and the specific sellers were critical to have on board for both understanding the current process and laying the foundations for the future state. • Establish an understanding from a holistic point of view by understanding smaller parts of the process and how they interact. • Understanding the importance of management support including real involvement from management in various sessions. • Agreeing on staying persistent throughout the project. • Continuously going back to the purpose and aim of the project to stay on course during the session. • Developing understanding and raising awareness of the importance of follow-up on both why and what levels for the desired future state, i.e., why developing and re-designing this process (doing the right things), and what is important (doing things right). • We also found it critical to start each meeting where the former meeting had stopped to allow participants to “come back” to where we were in our last meeting. <p>One part of the project phases model is the importance of establishing trust. The use of CSF concerning the objective [24] revealed that a critical step was the defining and agreement concerning <i>the internal customer</i> and the needs that the project should fulfil. This perspective was an important motivation in the overall work and contributed to establishing trust and understanding of why conducting the work. In addition, it also helped prioritize and keep the focus on the project.</p> <p><i>Main takeaways:</i></p> <ul style="list-style-type: none"> • <i>The critical importance of having a holistic approach, a customer focus, as well as a focus on the future state.</i> • <i>Define WHY-WHAT-HOW as part of the scope and objectives definition.</i> • <i>Using CSF as a diagnosing tool to identify company critical factors.</i>
<p>Phase 2: Plan for project activities and resources</p>	<p>The planning was done with the management group which supports to establish their ownership. Due to the importance of having the sellers on board, a decision was made that all sellers should participate together with the management group in the main modeling session.</p> <p>The aim of the sessions, together with the scope, was decided together with the management group. The setup for the modeling session, slides for the presentation, and the parts the management group was responsible for were clearly communicated and negotiated. <i>This anchoring work is time-consuming</i> but a critical part of the preparation work.</p> <p>We decided not to work with the deadlines described in the theoretical model (Table 1, Phase 2). Instead, we agreed on the need to have a commitment from everyone to reach agreement on a “good-enough” level. When we had that, we agreed that we had reached “the deadline”.</p>

	<p>The project organization and domain knowledge are important parts of the EM project phase model. In the work at the company, the CEO and managers for sales, production, construction, and IT could be viewed as the steering committee in the Sandkuhl et al. [10] model. This group was also a part of the larger modeling group. Since they had different roles, decisions could be made during modeling sessions that otherwise might have to be raised in different groups involved in the project. This also demonstrated the importance of using a technique that visualizes both different roles and flows. For this case, using swim lanes in the Visuera tool helped to achieve that. The production manager had a clear mandate from the CEO to own the re-design process. This was clear in both words and action and essential for success. The practitioners knew the Company and were responsible for the anchoring and implementation work. The researchers were responsible for the scientific and methodological knowledge, including data collection analysis work and knowledge generation (extracting knowledge from practitioners and combining it with the researchers' knowledge).</p> <p><i>Main takeaways:</i></p> <ul style="list-style-type: none"> • <i>Anchoring work is time-consuming but critical for success.</i> • <i>The company must be the owner of the work, not the researchers.</i>
<p>Phase 3: Plan for a modeling session</p>	<p>The first modeling session was carefully planned together with the management group. During planning, there was a clear agreement between the researchers and the company that the focus was on the wanted future state of the CuPr. The work performed in the earlier phases helped us to set goals for the session (desired output) and select the right members for the modeling group.</p> <p>Wanted output from the planning:</p> <ul style="list-style-type: none"> • Setting a common and shared process to fulfill the customer's need (see above). • Emphasizing goals related to the motivation of the persons involved in the process that was going to be developed <ul style="list-style-type: none"> – not only the modeling participation. • Setting the goal for the session (see above) but even more important was the goal of creating a positive attitude and getting involvement and commitment from practitioners, especially the sellers. <p>Furthermore, the two researchers who were going to run the modeling session planned it in more detail, including what different roles they were going to have. Analyzes from the Pre-phase and Phase 1, as described above, were the basis for how to arrange the session. During that planning, three important aspects of the project phase model were found to be needing further clarification:</p> <ul style="list-style-type: none"> • <i>Using a holistic perspective.</i> • <i>Making sure the managers are the problem owners – and presenting the problem to the participants.</i> • <i>Using tools they understand, not making it more difficult with too complicated modeling techniques.</i> <p>As mentioned before, the sellers were identified as a critical group. Therefore, all sellers were invited to the main modeling session. However, the session did not include all sellers as some were on business trips, but just receiving an invite was deemed important within the group. This meant the sales manager was responsible for updating and discussing decisions made with the sellers who could not participate in the session.</p> <p><i>Main takeaways:</i></p> <ul style="list-style-type: none"> • <i>Plan the modeling session together with the company.</i> • <i>Have a clear and committed agreement concerning the wanted output of the modeling session.</i> • <i>Use tools that are familiar to the company.</i>
<p>Phase 4 and 5: Gather and analyze background information and</p>	<p>Following the AR approach, our work in the diagnosing phase, including the analyzing work based on the CSFs as described above, was the base for the action planning and taking. Hence, the diagnosing phase included Phases 4 and 5 and was the base for how to plan the project activities. In our case, we found it necessary to interview participants</p>

<p>interviewing modeling participants</p>	<p>at an earlier stage as part of <i>gaining trust and common understanding</i>. The information from those interviews and the dialogues during the interviews helped the researchers to get a better understanding of the organization, which was helpful when working towards identifying the real problems and who actually was the customer of the process that was being analyzed. <i>Therefore, in this case, understanding the context and gaining trust must be done in an earlier phase (pre-phase).</i></p> <p><i>Main takeaway:</i></p> <ul style="list-style-type: none"> • <i>Understanding the context should be a part of the pre-phase.</i>
<p>Phase 6: Prepare modeling session</p>	<p>We agree with Sandkuhl et al. [10] that the interviews were an important part of preparing for the modeling session. However, in our case, the preparation started at an <i>earlier phase (pre-phase) as part of gaining trust and buy-in of using enterprise modeling as a tool for the work</i>. Although many of the suggestions raised by Sandkuhl et al. [10] were not addressed during the interviews (such as what could have happened during the session), <i>those discussions became more of a side-note during the dialogues with the management group</i> after gaining the trust for the method. We want to highlight some issues that we identified despite carefully planning the modeling session:</p> <ul style="list-style-type: none"> • <i>The room we chose was too small even though we had “plenty of chairs” for all participants. Having more than one whiteboard is something to recommend.</i> • <i>We felt we got a genuine buy-in from the participants because the problem owners were the managers and not the researchers. The managers presented what was going to be done and why.</i> • <i>Having discussed who was responsible for what part – and agreeing on it (researchers and managers) added to the credibility of the workshop since there was no dialogue on who should do what, or who should handle which situation during the session.</i> <p><i>Main takeaways:</i></p> <ul style="list-style-type: none"> • <i>We needed to prepare the session earlier and throughout the work.</i> • <i>It was very important to do the preparation together with the company.</i> • <i>Dividing responsibilities between the researchers and managers added credibility. This included who was responsible for what tasks or parts during the session – and to emphasize that the Company was the problem owner.</i> • <i>We found it helpful to have only one facilitator (researcher) and one researcher taking notes during the session.</i>
<p>Phase 7 and 8: Conduct modeling session and writing meeting minutes</p>	<p>Sandkuhl et al. [10] present a list of activities during the modeling session. The list provided the foundation for the start of the session, and things to avoid. Based on our case, we found it <i>important that the introduction to the session was done by the Company and not by the researchers.</i></p> <p>As described above, The CEO started the meeting and introduced the aim and goal, both for the whole work and for the modeling session. In addition, the Production and Selling managers were responsible for parts of the introduction before one of the researchers took over to facilitate and lead the modeling session. The other researcher took meeting notes. That the Company showed ownership of the work was a critical perspective in the preparation work and a strong argument for why the CEO should conduct the introduction of the session.</p> <p>In the project phase model, there is some advice on what to avoid during modeling sessions [10, pp.170-171]. In the following, we demonstrate how we followed that advice during our sessions:</p> <ul style="list-style-type: none"> • No long explanations of abstract concepts. • We began the seminar with well-known goals, processes, and concepts to let the participants feel comfortable and safe. • When there were different opinions concerning what was meant in the model, it was often because of different understandings of concepts. Therefore, we worked with describing sentences to facilitate common understanding and to avoid increasing complexity. Sometimes we did not come to an agreement concerning some of the questions raised, e.g., the time needed for a seller to

	<p>check an order. In those cases, we wrote the question down for the Company to return to later. This was an important output from the sessions.</p> <ul style="list-style-type: none"> • Following the system theory technique of reinterpretation, we regularly returned to the customer’s needs. That helped avoid goals and activities that did not contribute to the overall goal and reach a more generic system level. • No loose ends. If we could not reach a conclusion about something in the model at the session, the responsibility and future handling of the issue were explicitly stated. • The results from the sessions were converted to a digital model and accordingly revised together with the company. • We tried to avoid complex relationships in the process. Even if there was still work to do, this helped the Company to identify things that were done in a complex manner. Sometimes an easier way was found already in the modeling session. • The facilitator worked hard to force the participants to break down statements into concrete points and to avoid detailing attributes before the conceptual structure was established. • The three last points in the theoretical model are in line with the experience of the researcher who was taking notes. <p>Using the list of what to avoid from Sandkuhl et al. [10] to analyze the modeling session indicates how well the session went. The results can be used to <i>learn from and improve before the next sessions</i>. Therefore, we recommend using this list of advice as a diagnostic checklist to <i>evaluate the session</i>.</p> <p><i>Main takeaways:</i></p> <ul style="list-style-type: none"> • <i>The “what to Avoid” list is important in preparing and evaluating the session.</i> • <i>Let the CEO introduce the seminar and involve other relevant managers.</i> • <i>Keep it simple.</i> • <i>Document the outcome during the session so there is a consensus when the session is over.</i>
<p>Phase 9: Analyze and refine models</p>	<p>In this phase, the results of the modeling sessions are scrutinized and refined. This was done iteratively in cooperation with the management group. Based on how we did this in the Company, some important working approaches can be identified:</p> <ul style="list-style-type: none"> • The importance of refining and scrutinizing the models together with the management group. • To have a common view of what the first version of a model is and what the last version is when reviewing the digital versions of the model. After each refining, the latest version of the model was sent to the Company for them to walk through in their own settings. This also prepared us for our next model refinement meeting. • The importance of identifying gates on both why (doing the right things) and what levels (doing things right) in the process that is being modeled. These gates are decision points and affect the flow within the process and, accordingly, important to follow up. What to follow up and measure needs to align with the objectives of the process. This includes discussions regarding why certain activities are performed, how, and by whom. A clear and explicit connection between goals and measurements in the process is critical. In addition, measurements were important to measure the effects of working according to the new process. A baseline needs to be identified before changing the process. • To support the implementation of the new process and integrate it into daily work, it was important to find relatable existing structures and processes where it could be included and integrated. <p><i>Main takeaways:</i></p> <ul style="list-style-type: none"> • <i>Refining and changing work in close collaboration with the company.</i> • <i>Use existing structures and tools, as far as possible, to integrate with daily work.</i> • <i>Clear connection between goals and what to follow up and measure.</i>

<p>Phase 10: Present the results to the stakeholders</p>	<p>In the final phase, the results are presented to stakeholders, and the project owner marks the end of the modeling project. However, in our case, since the digitalized versions of the model were iterated and refined continuously in close collaboration with the management group, the <i>group knew the results, and no specific presentation of a “final” version was needed.</i> The management group continuously presented the results to other stakeholders in the Company, receiving feedback that could be used for further refinements if necessary.</p> <p>The work focused on the future state and developed a shared and common view of the future state. The redesigned process was established and accepted. This is critical for success (e.g., Aggestam et al, 2023 [23]) and was an important goal to achieve. We also defined and established a common and shared view of the current state, but only good enough, i.e., what was critical to understand concerning the bigger picture concerning the desired future state.</p> <p><i>Main takeaways:</i></p> <ul style="list-style-type: none"> • <i>Keep the company so involved that no final presentation of the result is needed; they are already on board.</i> • <i>Have a clear focus on the future state, and only analyze the current state if absolutely required for the future state.</i>
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6 Conclusions

This article aims to increase the body of knowledge on *the practical use* of business process modeling. The main contribution of this article is the detailed descriptions of how business process modeling was practically used in an SME. Two important conclusions are:

- The analysis confirms the usefulness of suggested activities within EM project phases model as well as the need to adapt the work to the specific company.
- The analysis also reveals aspects that can contribute to further developing the practical use of business process modeling (see *italics* in Table 4) and have the potential to be included in the EM project phases model. The following are excerpts of potential improvements:
 - The need to include Phases 4 and 5 in a preparatory pre-phase in order to understand the context and gain trust in an earlier phase.
 - The usefulness of using Critical Success Factors (CSFs) as an analyzing tool.
 - The critical importance of throughout the work having a holistic approach, a customer focus, and a focus on the future state.
 - Close collaboration with the company is important so that no final presentation of the result should be needed; the company and management are already on board.
 - The need to define scope and objectives together with the company on the three levels of inquiry as well as having them both common and shared.
 - Already from the beginning, develop understanding and raise awareness of the importance of follow-up and measure on both why and what levels, i.e., why developing this process (doing the right things) and what is important (doing things right).
 - The usefulness of the “what to avoid list” also from an evaluating perspective.
 - Keeping it simple and using tools that the company understands.
 - The importance of identifying and using champion/s.

Furthermore, based on our experiences, some lessons learned for practitioners based on this particular case can be identified:

- Prioritize the anchoring work; even if it is time-consuming, it is critical for success.
- Be involved in all stages of the work and take ownership of the work.
 - No final results should need to be explicitly presented because company participants should have been a part of developing them and already on board.
 - Let the CEO be responsible for introducing the work and related sessions; and involve other relevant managers.

- Have a clear focus on the future state, and only analyze the current state if absolutely required for the future state.
- Pay effort to develop a shared and common view on all three levels of inquiry (why, what, how).
- Arrange a pilot session where the method is used, but the focus is on the company's needs as one step in the work to get an understanding and commitment to the method.
- Keep it simple and use tools that are familiar to the company.
- Use existing structures and tools, as far as possible, to integrate the developed work into daily work.
- Follow up and develop measurements on both why (doing the right things) and what levels (doing things right).
- Choose a modeling technique that is simple to follow. In our case, the participants highlighted how easy it was to follow the swim lane-based Visuera tool.

Future research studies should focus more on whether the aspects discussed in this article apply to other companies and, hence, have the potential to be included in the EM project phase model, specifically when working with only one of the potential sub-models. In our case, the sellers were a critical group. After the main modeling session with the larger group, all the sellers did not participate in further refinement of the process, and the sales manager was responsible for keeping this group on board. However, even if this worked in our case, we would like to emphasize the importance of including all critical participants at the later stages as well to support acceptance during implementation. Thus, a motivated question to examine in future research is whether it is better to include critical groups in all sessions.

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