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Improving The Order Scope Management Process

Helsinki Metropolia University of Applied Sciences

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After all the hard effort, it's difficult to believe that I'm finally writing this very last part of the thesis. Last few months have been full of hard work, topped with uncertainty and anxiety. Luckily such a situation is normal for one working as a project manager. However this thesis project has been very unusual due its personal extent. For several years I've dreamed of doing a Master's Degree in Industrial Management. Time just hasn't been right until last spring, when I decided to take a year off from work.

Once I left from the entrance exam of Metropolia UAS last May, I was confident that I would get in. After some weeks I received the confirmation about the acceptance for a student. And only a month and a half later, I found myself sitting in a class room after a nine-year break, surrounded by new people and new things to explore ahead. Now looking back, the year has gone fast. Our IM class quickly created a wonderful spirit of its own. Encouragement and support from the peers has been one of the motivators in moments of struggle. Thank You.

Metropolia UAS staff and visiting lecturers were able to feed us information-hungry students just the right amount to keep up the appetite. Suiting well to the spirit of Industrial Management, the program is well productized. Practical and involving approach to teaching, combined with a tight bond to the working life kept the program interesting. Thank You, Kiitos and Спасибо.

I would also like to show my gratitude for my employer and all colleagues who contributed to this thesis. You made this possible. Looking forward to continue the cooperation!

I didn't take a long leave from work "just" to study. I also wanted to have more time with my two wonderful daughters. Being a stay-at-home dad is basically running a micro-scale management and leadership laboratory. I've been delighted to test the theories learned in practice and to see them actually working. The experience has been holistic. However you don't become a good father or spouse only by reading Kotter. Therefore, I want to apologize to my family for being distant and grumpy too often. Special Thanks to my parents-in-law for enabling my studies time-wise by babysitting whenever it was needed.

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This study explores Order Scope Management (OSM) of the case organization. The process is in place to handle changes in the scope of supply during the manufacturing of Engineered-to-order (ETO) products. Process is not working as designed, leading to delayed deliveries and unexpected costs.

The research design of the thesis is based on multiple case study. The case studies formed the Current State Analysis (CSA) of the OSM process. The CSA was done by interviewing employees related to two exemplary projects that had been through the OSM process. Main finding from the CSA was that basic process design of the OSM process is working well, but operational implementation of some parts of it are not done properly. Based on the findings the existing knowledge was selected. As the found weaknesses were partly managerial and partly process problems, the relevant fields to explore focused on Change Management and Business Process Management.

Best practices from existing knowledge were merged as Conceptual Framework of this thesis. This framework guided the building of the initial improvement proposals that were co-created together with a development team set up specifically to overcome challenges in the OSM process. The development team's initial proposal was validated by the case organization's management team with minor adjustments. Final outcome of the study was action and implementation plans for tackling five major weaknesses found in CSA.

Keywords	Process Improvement, Process Implementation, Change Management, Business Process Management

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Acronyms

ETO	Engineered-to-order
ERP	Enterprise resource planning
CO	Change order
CODP	Customer order-decoupling point
CR	Change request
CSA	Current State Analysis
KPI	Key performance indicator
LSU	Local sales unit
MTO	Manufactured-to-order
OEM	Original equipment manufacturer
OTD	On-time delivery
OPP	Order penetration point
PG	Product Group
PU	Production Unit
OFP	Order-fulfilment process
OSM	Order scope management

1 Introduction

This study explores the Order Scope Management (OSM) Process of the case organization operating in manufacturing industry. The OSM process is followed when changes to the scope of supply are made during the production. The study focuses on factors that are causing failures in this process. The outcome of this study is a list of proposals to improve the OSM Process in order to execute the changes as planned.

1.1 Key Concepts

The OSM is a sub-process of the Order-Fulfilment Process (OFP) and it is followed when the scope of supply is changed during the production. The CMP consists of two stages: the Change Request (CR) and Change Order (CO) Processes. Figure 1 illustrates how these PU's internal process are related to the over-all OSM Process from the customer's initial request to the implemented change. The intermediate step between the customer and the Production Unit (PU) is the Local Sales Unit (LSU).

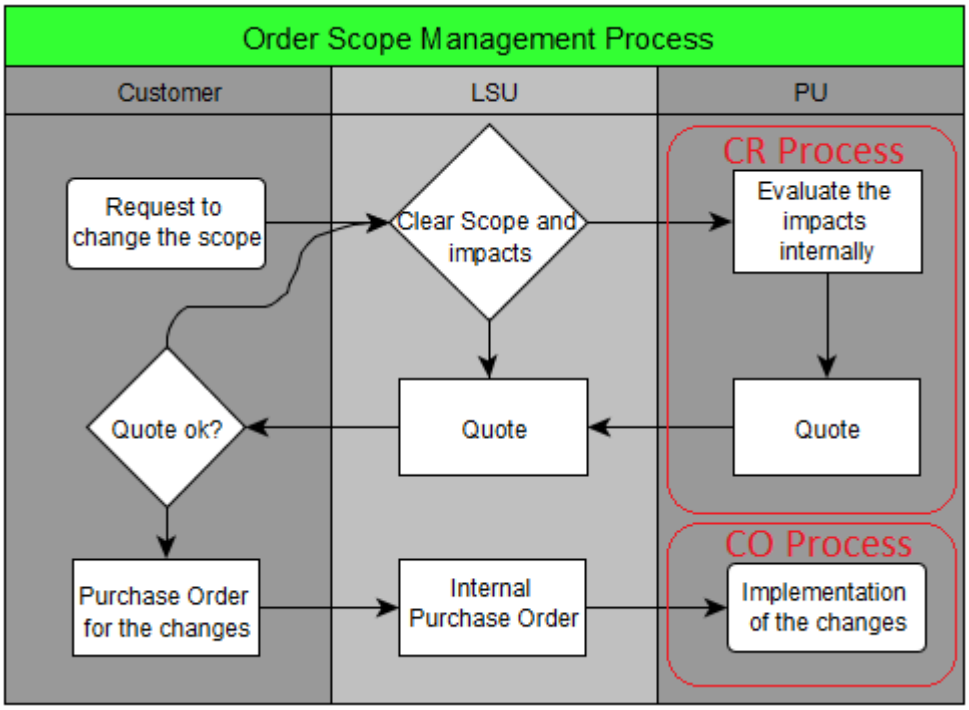

Figure 1. Location of the Production Unit's CR and CO processes (Authors illustration)

The purpose of the CR process is to prepare a quote for changes required by the customer. The outcome of the CR Process should be information of the price and delivery time impact of the requested change. This information is communicated to the LSU which submits the quote for the customer. Once the customer accepts the quoted change

it is implemented in PU using the CO Process. Engineering, purchasing and production activities should be done as planned in the CR stage.

1.2 Case Organization

The case organization is a Production Unit (PU) of an international industrial company. The products are manufactured on an engineered-to-order (ETO) basis. The case organization manufactures the main components by itself, but secondary components are purchased from sub-suppliers.

The products are usually highly customized according to customer needs and they are used in various industrial applications. The products are delivered all around the world and sold for the customers by a Local Sales Units (LSU). LSU's direct customer is rarely the end user of the products. Often there is an OEM, e.g. pump or compressor manufacturer, that delivers the products along their own equipment for the end user or for a contractor that is supplying an even larger entity.

1.3 Business Challenge, Objective and outcome of the Study

In the manufacturing industry, changes in the scope of supply during the production can easily be seen as a plain process failure. However, often the changes are made to provide additional value for the customer. Thus an agile and accurate OSM process can enhance the customer experience. In addition, a functional process provides quantifiable benefits also for the organization itself. Increased accuracy in scope change implementation improves forecastability which has a positive impact on On-Time Delivery (OTD) and capital efficiency.

Despite existing processes COs do not always end up matching with what was quoted based on the CRs. In practice this means that the delivery date, which has been adjusted due to changes, cannot be achieved or the organization needs to absorb some costs that were not taken into account in the change quotation.

The case organization has recently shortened the lead time models of all the product types dramatically. This means that customers get the products up to 40% faster than before. Accordingly, there is notably less time for the possible changes during the production. Still, many customers are indicating that the lead times should be reduced even more. That is an ultimate challenge for the current OSM process which has not been properly adjusted to support even the current lead time models.

Accordingly the objective of this thesis is:

to propose improvements to the OSM process.

A key element is the factors that should be taken into account in the CR process to successfully complete the CO process. Thus the research question is: Why do the COs not actualize as planned in CRs.

The objective is reached by first analyzing the current state of the OSM Process. The analysis is done by gathering qualitative data from two change cases by interviewing the employees involved. This data is elaborated further based on existing knowledge and validated with a specific development team of the case organization. Eventually the outcome of the study, a final proposal to enhance the CMP, is validated by the feedback from management team of the case organization. The results of the improvements can be seen from the organization's KPIs. For example, the OTD rate will increase and inventories reduce. However, within the time limitation of the thesis observing the improvements in KPIs is not possible.

1.4 Content of the Study

This thesis is written in seven sections. Each section is built on the previous one. Following the introduction, the research design of the thesis is explained. It anchors the data collection and the structure of the thesis to a well-known research theory, also providing means to ensure the validity and reliability of the study. Section three, the Current State Analysis targets to answer the research question by finding reasons behind the process failures.

The Current State Analysis reveals the nature of the problems, thus guiding the selection of relevant existing knowledge for section four. The exploration of existing knowledge aims to find means for building solutions for the problems found in the Current State Analysis. Section five combines the Current State Analysis findings to the theoretical background of the study as an initial proposal of the improvements. This proposal, co-created with relevant stakeholders, is validated by the case organization's management team in section six. The last section of the thesis discusses the findings and also evaluates the thesis.

2 Method and Material

This section discusses the means to reach the outcome of the study. First the research methodology and design are explained. Secondly this section describes how the validity and reliability of the study are ensured.

2.1 Research Approach

The research is made using a case study approach. Case study research is in-depth exploration of a phenomenon, a case, targeting to find an answer to the research question (Gillham, 2000). Yin (2003) emphasizes the importance of the research question in research approach selection. If it is a “how” or “why” question about contemporary phenomena that the researcher has no influence on, the case study is suitable approach.

A case study is a semi-iterative process. The logic of a case study research approach is shown in Figure 2.

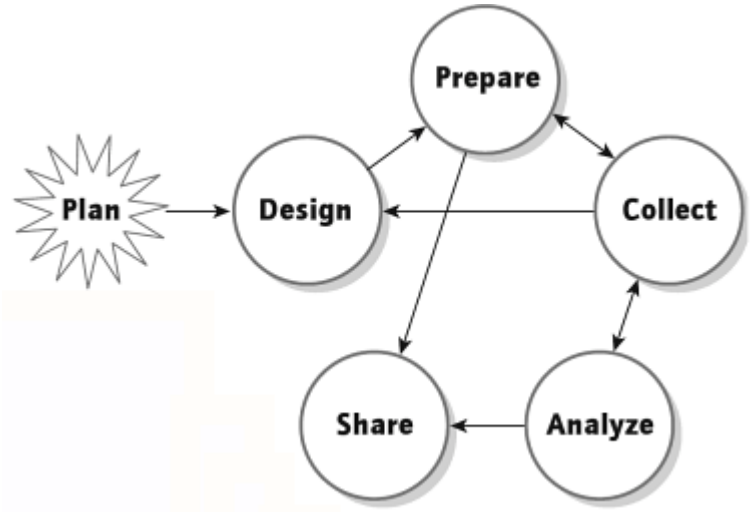

Figure 2. Logic of a Case Study Research. (Source: Yin, 2009:2)

The initial planning stage includes the formatting of the research question which still might guide to using some else research approach. If the research question is suitable for a case study the researcher needs to understand the pros and cons of the approach. The most significant advantage of case studies is their practicality and close connection to real life contexts. This helps to engage people to the research. However the benefit might turn into a disadvantage as the researcher’s experience of the case might set challenges to seeing what is relevant for the context of the study (Blaxter et al. 2006). This dilemma will be further assessed in paragraph 2.4.

The main activities of the design stage are the selection of the case or cases and planning a rigourous evidence trail of the research. The case selection forms the structure of the research. Basic types of research are shown in Figure 3.

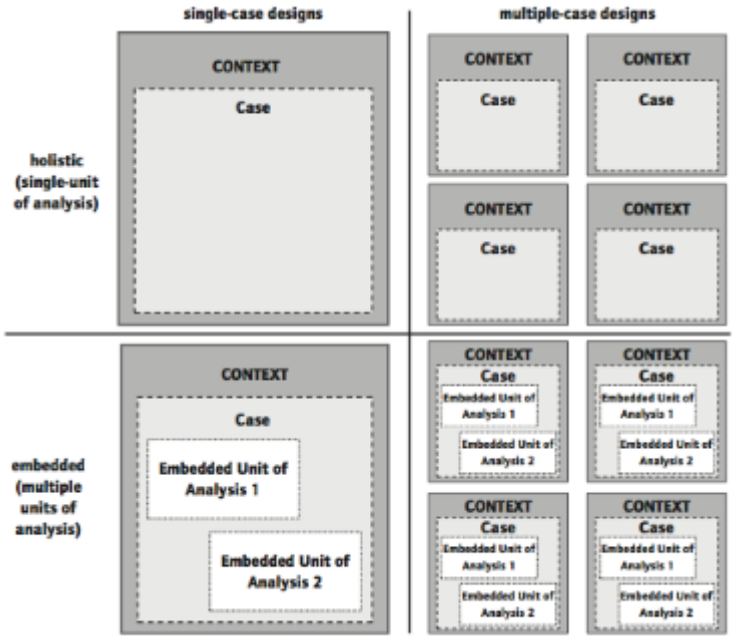

Figure 3. Basic Types of Designs for Case Studies (Source: Yin, 2009:46)

The division to single-case and multiple case designs is determined simply by the number of the cases in the research. Even a research with several units of analysis' can be a single case design if the case for these units is common. The division to holistic and embedded designs is done according to the number of units of analysis sharing the same context. The nature of the research project logically guides the selection of the design. A fixed terminology helps in explaining and evaluating the research approach.

The terms *preparation* and *collection stages* are self-explanatory. Nevertheless both of the steps are important considering the validity and reliability of the research. The case study protocol, disciplined data collection format followed throughout the research, needs to be developed and followed. It is notable that the case study protocol is not a survey questionnaire but a tool that helps to keep the focus on the topic and guide the research work (Yin, 2009). Hence, this tool should contain the questions in a fixed format.

Analysing the data targets to present the evidence free of interpretations. For structuring the data one of four research strategies should be used: theoretical proposition, developing case descriptions, using both quantitative and qualitative data and examining rival explanations. Structured data can be analysed using five techniques: pattern matching,

explanation building, time-series analysis, logic models and cross-case synthesis (Yin, 2009). Eventually the results are shared as a report.

The Case Study approach is selected for this thesis as it is supported by the research question and the nature of the research. Action research could have been an alternative approach. However, the timetable from both the case organization's and the author's side underpin the current selection as there is no time for several iteration rounds. Also the author's consultative role in the development team affected the selection of the approach.

This study is a holistic multiple-case study. Two cases are examined utilizing primary data. The cases are delivery projects that have gone through the CMP. The case selection is made by the author in cooperation with the CMP process owner, i.e. the project management team. The cases are selected to predict similar results or predict contrasting results but for anticipatable reasons (Yin, 2009). In this study the multiple-case design is primarily selected to have richer and compelling data for more robust results as proposed by Yin. (2009). Secondly the context of the study, the operating environment of the case organization, contains such variables as production capacity or engineering resources. This guides to evaluate each case in its own sub-context.

2.2 Research Design

The research design of this study is built on the case study approach. The business challenge of the case organization, the non-functional OSM process, is the starting point of the research. The step-by-step research process with input data and intermediate outcomes is shown in Figure 4.

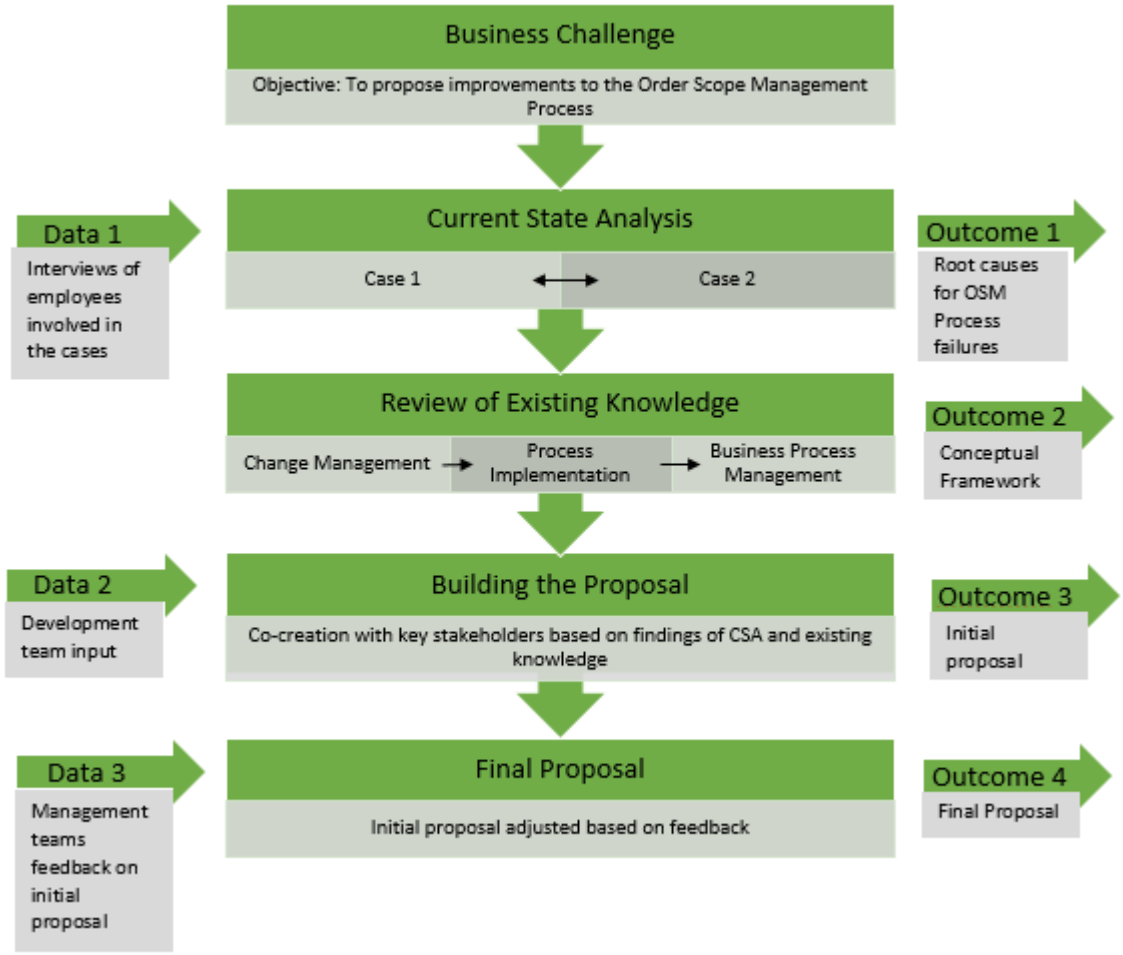

Figure 4. Research design of the thesis.

The business challenge defines the objective of this study, which is to propose improvements to the OSM Process. To analyse the status quo of the OSM process a Current State Analysis (CSA) is performed. It explores thoroughly two exemplary cases, projects that have been in the OSM Process. The findings from the cases form Data 1. The outcome of the CSA is achieved by analysing this qualitative data. The CSA reveals why the COs do not actualize as planned in CRs, i.e. what the root causes leading to the failure of the OSM Process are.

Partly in parallel with the CSA the author started to get familiar with the existing knowledge on themes raising from the CSA. In a case study research a detailed literature review cannot be done before the CSA as the nature of the phenomena is unclear (Gillham, 2000). In this study the purpose of the theoretical examination is to gain the knowledge for developing the Conceptual Framework, a model linking the findings of the research to the existing knowledge.

The business challenge of this study is a part of wider improvements in the case organization. The author acts as a member of a development team finding resolutions to the problems related to engineering and project management. The team's input in building the initial proposal for OSM improvements is an essential part of the study. The members are senior experts in engineering and project management functions - the ones suffering the most from inadequate OSM practises. This setup is fertile for enhancing the participant's engagement as the outcome is likely to have a remarkably positive impact on their daily work. The team's input forms Data 2.

The initial proposal is validated by the case organization's management team. The final proposal is formatted based on this feedback. This input is Data 3 of the research. Considering the schedule of the thesis, the implementation of the final proposal is not possible.

2.3 Data Collection and Analysis

Data for the study is collected from four sources: case interviews, development team meetings, meeting with other relevant stakeholders and management's feedback on initial proposal. Data is collected in three steps. The first step, Data 1 is collected by a case study method in the CSA stage. Table 1 summarizes the sub-data with the key features.

DATA REFERENCE	DATA TYPE	MAIN TOPICS	PARTICIPANT(S)	DATE	DURATION	DOCUMENT
Data 1a	Meeting with Project Management team	Selection of the cases	Project Management Team	29.1.2016	45 min	Meeting notes
Data 1b	Interview	Case 1	Project Manager 1	1.2.2016	47 min	Field Notes
Data 1c	Interview	Case 2	Project Manager 2	2.2.2016	25 min	Field Notes
Data 1d	Interview	Case 2	Engineering team leader	3.2.2016	35 min	Field notes
Data 1e	Interview	Case 1	Senior Electrical Engineer	4.2.2016	55 min	Field Notes
Data 1f	Interview	Case 2	Purchaser 1	8.2.2016	37 min	Field Notes
Data 1g	Interview	Case 1	Purchaser 2	10.2.2016	55 min	Field Notes
Data 1h	Interview	Case 1	Senior Purchaser	10.2.2016	28 min	Field Notes
Data 1i	Interview	Case 1	Production Manager	10.2.2016	55 min	Field Notes
Data 1j	Interview	Case 2	Head of Production Planning	10.2.2016	60 min	Field Notes

Table 1. Data 1 collection

The initial action in the data collection was the selection of the cases. This was done with the project management team as explained in chapter 2.1. The cases are from projects that customers have requested and then ordered wide changes in the scope of supply after production has started. The projects have thus been through the OSM process. The selected cases determined the interviewees in data 1 collection. The interviewees are the employees handling the CRs and COs of the cases. Thus all the stakeholders, having often very different viewpoints, are involved in the cases ensuring the representativeness of the data.

All the interviews are conducted using the same set of questions. The questions were selected to reflect (a) understanding and familiarity of the OSM process and related instruction, (b) the current state of the OSM processes and tools, and (c) ideal method and working practises. This setup creates a triangulated perspective within each interview and helps the interviewees to perceive the OSM process as an entity. The field note format of the interviews can be found in Appendix 1. The field notes are processed with a thematic analysis to reach the outcome of the CSA – root causes for the OSM Process failure. First the individual answers from each question are gathered into the same Table. Underlying themes are then derived from this material. Appendix 2 contains the analysis.

Data 2 is the development team's and other relevant stakeholders' input to the study. The collection of Data 2 was not as linear as for Data 1. It was also less formal than Data 1 collection as it aimed at solving specific issues rather than building a general picture. Details of Data 2 are listed in Table 2.

DATA REFERENCE	DATA TYPE	MAIN TOPICS	PARTICIPANT(S)	DATE	DURATION	DOCUMENT
Data 2a	Development team meeting	Introduction to the areas needing the improvements	Development team members	29.1.2016	60 min	Meeting notes
Data 2b	Development team's sub-group meeting	Working order of the team, Discussion about the development objectives and expected outcomes.	Sub-group members	5.2.2016	60 min	Meeting notes
Data 2c	Interview	Change handling tools	PG Global Engineering Tools Manager	15.2.2016	25 min	Field Notes
Data 2d	Interview	Change handling tools	After Sales IS and Quality Manager	22.2.2016	60 min	Field Notes
Data 2e	Unofficial discussion	Change handling tools	Project Manager 3	29.2.2016	15 min	Field Notes
Data 2f	Development team's sub-group meeting	Crafting of the initial proposal	Sub-group members	15.3.2016	120 min	Presentation

Table 2. Data 2 collection

The development team's agenda consists of several topics, the objective of this thesis being one of them. Therefore in the initial meeting the team was divided to sub-groups, each handling a specific problem in the case organization's operations. The OSM sub-group's first meeting was set up to discuss the objectives of the groups and means for achieving them. The Current State Analysis, which was work in progress at the time, was considered to be a solid basis for the sub-groups work. Receiving the authentic development needs from the field guided the group to enhance things that contribute the most to achieving the objective of this thesis.

However, based on the OSM related discussions of the sub-group and preliminary findings of the CSA, it was obvious that additional tool related data was needed. Therefore the PG Global Engineering Tools Manager was interviewed. The informant did not only

provide useful knowledge but guided the author to contact informants of Data 2d and Data 2e. Their involvement helped greatly in crafting the holistic vision regarding the future tool development possibilities. This vision as well as the initial proposal for the OSM improvements was created in the sub-group's workshop. The resolutions for each CSA finding were formatted in a co-creative manner by analysing the collected Data 1 and Data 2.

Data 2 was recorded through meeting notes, field notes and a presentation made in the workshop. An example document can be found in Appendix 3. To avoid data contamination by the author's personal bias and to make sure that the real tone of the meeting is reflected from these notes they were validated by the team. In practice this meant a recap of the topic based on the notes of the previous meeting.

Data 1 and Data 2 were used to build the initial OSM improvement proposal. Feedback to this proposal is Data 3 and its details are shown in Table 3.

DATA REFERENCE	DATA TYPE	MAIN TOPIC(S)	PARTICIPANTS	DATE	DURATION	DOCUMENT
Data 3a	Meeting	Initial Proposal	Head of Project Management, Engineering Manager	19.4.2016	90 min	Meeting notes

Table 3. Data 3 collection

The development team's outcomes were presented for the management team of the case organization. All the sub-group's proposals were present. Due to conflicting schedules the author was not able to participate in this meeting and therefore a specific feedback meeting was arranged with two of the management team members. This can be seen as an advantage for the proposal. In the earlier meeting with a full agenda some features of the proposal might have been ignored. Now the discussion about each proposed improvement was comprehensive and constructive. Based on the meeting a final proposal was formatted. Data 3 collection was recorded to meeting notes that can be found in Appendix 4.

2.4 Validity and Reliability Plan

This section explains how the trustworthiness and quality of this study and its results are ensured. Validity assesses whether the design approach and methods used are suiTable for investigating the phenomena (Blaxter et al. 2006). Yin (2003) divides validity in three categories – Construct validity, Internal validity and External validity. Each of the categories can be tested with certain case study tactics as shown in Table 4.

TEST	CASE STUDY TACTIC	PHASE OF RESEARCH IN WHICH TACTIC OCCURS (RELEVANT SECTION OF THE THESIS IN BRACKETS)
Construct validity	- Use multiple sources of evidence - Establish chain of evidence - Have key informants review draft case study report	Data Collection (3,5,6) Data Collection (3,5,6) Composition (5,6)
Internal validity	- Do pattern-matching - Do explanation-building - Address rival explanations - Use logic models	Data analysis (3,5,6) Data analysis (3,5,6) Data analysis (3,5,6) Data analysis (3,5,6)
External validity	- Use theory in single-case studies - Use replication logic in multiple-case studies	Research desing (NA) Research desing (2,3,5,6)
Reliability	- Use case study protocol - Develop case study database	Data Collection (3) Data Collection (3,5,6)

Table 4. Case Study Tactics for Four Design Tests (Modified from Yin, 2003, p.40)

Construct validity is built in data collection and composition stages. The research should be designed to clearly indicate the chain of evidence. Especially when qualitative methods are used research should have several evidence sources to underpin the findings. This is due to ambiguous nature of the data. Before releasing the report researches interpretations of this data should be reviewed by the key informants.

Validity of the data analysis is the internal validity. There are several tactics like pattern matching and explanation building that can be used to validate the findings. External validity in a multiple-case study can be tested by using a replication logic in research design i.e. can the findings from an individual case be used to explain another case.

Reliability refers to the quality of the study. If the research was repeated by another researcher the results should be the same (Blaxter et al. 2006). In case study research reliability is achieved by using a case study protocol and case study database as shown in Table 4 above. A case study protocol is a plan for the research and data collection. It guides the research work for example by creating uniformed structure to the interviews. The case study protocol of this thesis can be found in Appendix 5.

Data for this study was gathered from multiple sources and several organizational levels. This brings richness to data and creates a triangulation perspective – evidence is supported by several sources. The semi-structured interviews were carried out individually by phone or face-to-face. The questions were presented as written in field notes templates. Especially in Data 1 collection, the questions were presented in a neutral manner. This was to avoid leading the answer to one direction or another. When analyzing the

data pattern-matching and explanation building were used. A logical evidence trail is built starting from the CSA (Section three). The author's interpretation of the data is explained in Appendix 3 and supported by the quotes of the interviewees. Finally the validity and reliability of this study are evaluated in section seven.

3 Current State Analysis

This section discusses the status of the OSM process in the case organization. The aim of the chapter is to find out why the change orders do not actualize as planned in the change request stage. As understanding the organizational structure is inevitable for understanding the logic of the OSM it is explained first. Secondly this section presents the processes and tools used for handling the order scope changes. Thirdly Case 1 and Case 2 are presented by placing the change events on a timeline to gain understanding what factors have led to failure of the CMP. Finally, based on the cases, this section summarizes the strengths and weaknesses of the OSM in the current state. This enables moving to chapter 4 – Review of Existing Knowledge

3.1 Research approach for the Current State Analysis

The CSA was started by interviewing the employees related to two exemplary cases. This interview material forms Data 1 shown in Table 1 on page 8. The interviews were carried out in February 2016. All the interviewees were asked the same questions grouped under six themes. Some of the questions were case specific and some were approaching the cases from a general perspective. The case specific questions were set to reflect the interviewee's perceptions about the project in question. These answers contributed the most for this study. However, the general questions about the process supported the information gained from the cases thus increasing the reliability of the study.

Data 1 was analyzed using a thematic method. The interviewee's answers were in most of the cases describing the daily problems relevant to their part of the process. Single answer were combined in the analysis of the data for pointing out the patterns. The field note example of the interviews and related analysis sheet can be found in Appendices 1 and 2.

3.2 Description of Organizational Setup

The case organization has a project-based matrix organization. The project managers have a commercial and technical responsibility for the nominated projects. Project management is supported by other internal departments. As the case organization is a part of a large multinational Group, there are important external (yet intra-Group) stakeholders whose role is essential in the business model. Figure 5 illustrates the order-fulfilment process, showing the order flow between the parties and departments in the supply chain.

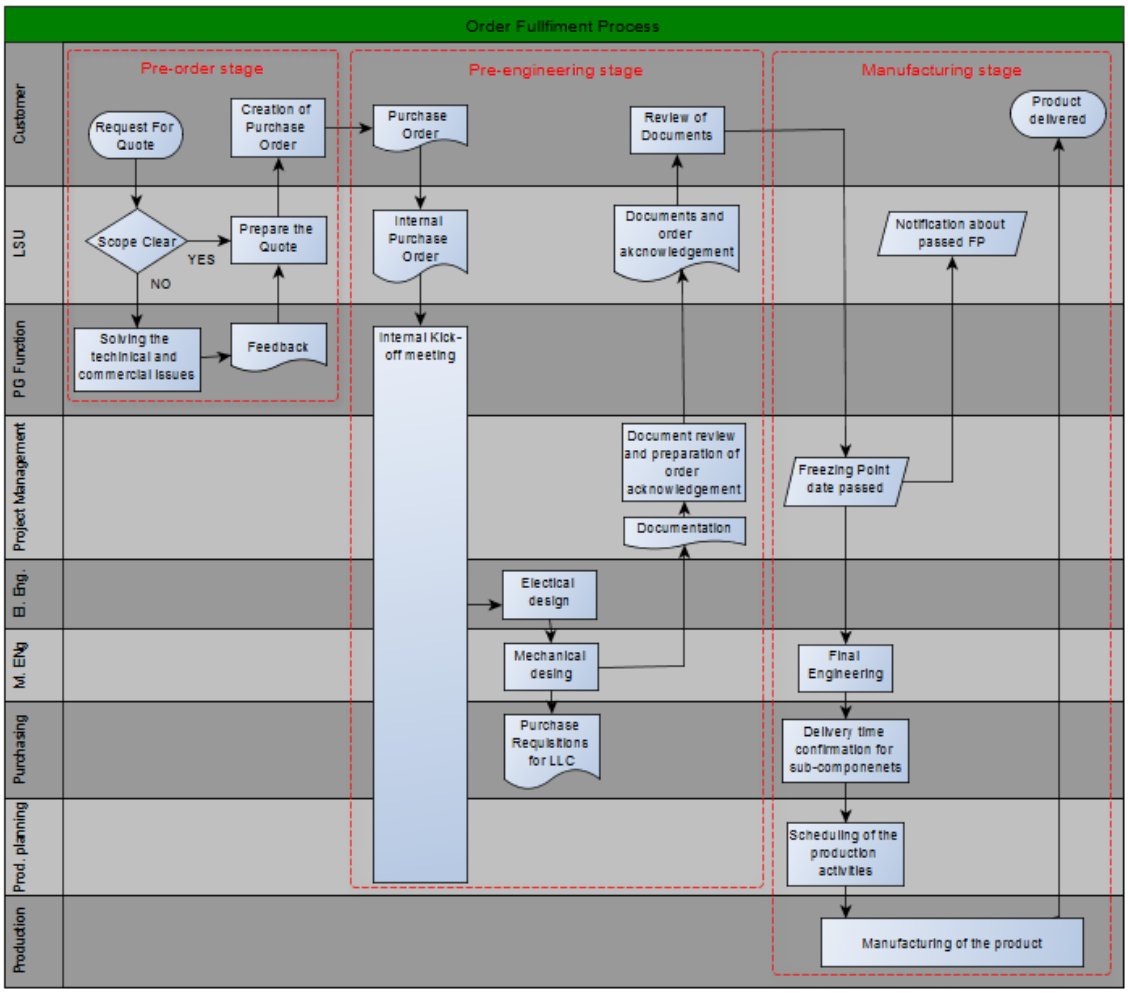

Figure 5. The case organization's order-fulfilment process (Author's illustration based on case organization's internal material)

The customer is not buying the products directly from the case organization but from the LSU. LSUs are selling the whole product portfolio of the Group and then ordering the goods from different factories (PUs). LSUs enable the Group to serve the customers in their own language and their own time zone. In the pre-order stage LSUs are supported by the Product Group Level (PG Level). This is an international team responsible for sales, marketing, technical support and product development. When the order is received this function thus has a good understanding of the project as they have been involved in the bidding stage. They utilize this knowledge when transferring the order to the PU. Before the order is booked for manufacturing an internal kick-off meeting takes place. This meeting is a hand-out from PG sales for PU. The participants from all departments have their say on manufacturability and the expected delivery schedule. The outcome of the meeting is the technical file of the product that can be used as a basis for the design of the product.

Once the order is clear and booked, engineering can be started. Engineering is done in two steps. Step one is preliminary design which is further divided to electrical and mechanical engineering. The prior finalizes the performance design and the latter creates the customer documentation, ensures the manufacturability of all the mechanical details and orders possible long lead time components. The first set of customer documents is submitted to the LSU and further to the customer. Also the order acknowledgement is sent at this stage. It contains two important dates. The delivery time of the products and the freezing point date. The freezing point is the latest date when the changes in the scope of supply should occur so that the products can be delivered in a timely fashion with the shortest possible lead-time. Figure 6 illustrates this concept.

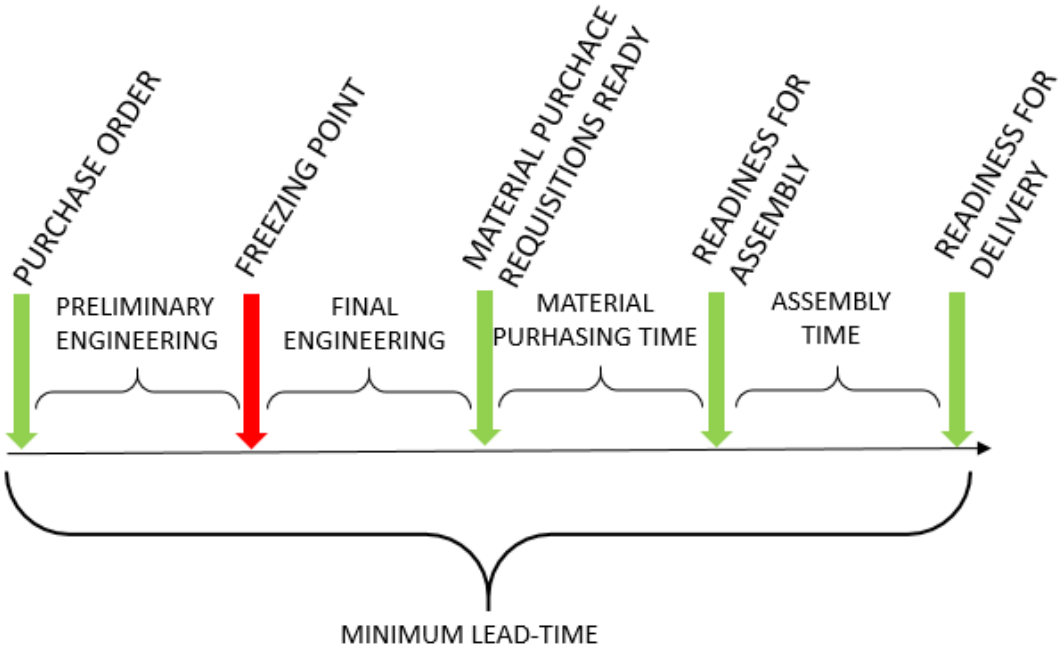

Figure 6. Minimum lead-time model and freezing point

The freezing point date is defined by counting back from the delivery time reducing the time needed for final engineering, purchasing and assembly. In the final engineering step the costs start to cumulate rapidly as it aims to release the materials for purchasing. Thus the price and complexity of the changes initiated after the freezing point is higher.

The work division in the Purchasing department is based on material categories. For example mechanical subcontracting is one entity. The purchasers group similar components from different projects balancing between the required delivery times, pricing and loading between suppliers. Once the delivery times for the subcomponents are confirmed production planning ensures the manufacturing schedule. Adjustments or clarifications

are sometimes needed. The manufacturing schedule is the basis for work queues of the manufacturing cells on the assembly line. The most critical time for changes is the production phase. If the goods are already on the production line, a hold-up in the projects causes a disruption to the material flow.

3.3 Description of the Order Scope Management Processes

The purpose of this chapter is to describe the case organization's tools and processes used in the OSM. The descriptions are based on the current instructions of the case organization.

3.3.1 Tools Used in the Process

Respecting the scope of the thesis this section describes only the tools needed in the technical scope management. Other, mostly SAP based tools are needed when pricing or delivery time is changed but they are not relevant for the scope management itself. Table 5 presents the tools in question.

TOOL	PLATFORM	PURPOSE
Change Order Tool	SAP	Creation and management of the Change Order
Change Request Tool	Lotus Notes	Creation and management of the Change Request
Product Configurator	PGs own sofware	Main location for managing the technical details of the product
Technical Details	Case company former ERP	Secondary location for managing the technical details after order booking
Document Portal	SharePoint	Collaboration platform for sharing project related documents

Table 5. Tools used in the order scope management.

The CR is made by project management. The tool is built on Lotus Notes. This tool is designed for collecting the necessary data for making a quotation about a change requested by a customer. The project details and task description are manually filled in. The author of the CR tool has also a possibility to define the urgency using one of three levels. The desired resolution date is created based on the urgency selection. The CR has only one processor at a time and the work flow is adjusted manually. For example the electrical engineer must manually type in the mechanical engineer's name after ensuring the right person from another system.

Current Enterprise Resource Planning (ERP) software SAP is including the majority of the tools (transactions, sub-programs of the SAP) used in project management. Also the

CO tool is there. Formerly this functionality was also built on Lotus Notes. The matter clarified in a CR was possible to turn into an actual CO just by clicking a button. Now the data from the CR is manually copied to SAP. There is no direct link between the systems but the request and order can be matched with each other based on the project number. The workflow in the tool is pre-determined and the tasks are automatically assigned to the project specific designers. The system sends notifications to the task owners about the new and pending tasks. The target date for the task resolution can be set by the author of the CO. One of the important features of the CO tool is communication of on-hold situations, i.e. situations where all activities of a certain project are frozen due to upcoming changes. According to the current instructions the on-hold situations are communicated by using a Change Order tool. This is done also for projects in the CR stage if the upcoming changes are massive. The tool has a specific tick box for this purpose. All the functions see the on-hold notification on their work queues, when the selection is on.

The technical specification of a project is an extract from the Group's product configurator. The file is initially made by LSU but it goes through a detailed inspection before it is transferred to the PU's manufacturing database. The engineering of the products is made based on this file. If changes occur updates are done to this local file. Engineering tools, unlike the ones used in project management, are mostly based on the former ERP system. The software was developed by the case organization in the early 1990's. Technical data from the product configurator is loaded to this system and some technical details still need to be maintained there.

The PU transfers the project related documentation for the LSU using a web-based application. The LSU can utilize the system in their communication with the customer as well. The application sends a notification when new files or updates are available.

3.3.2 Change Request Process

The CR process is started inside the PU by the project management. The process targets on determining the feasibility, price and delivery impact of the required changes in the scope of the supply. The CR tool in Lotus Notes is used. The request received from the LSU is manually typed in or copied to the description field. Mostly the data received requires some clarification before it can be processed at the factory. Once the process is started it flows through the relevant departments as shown in Figure 7.

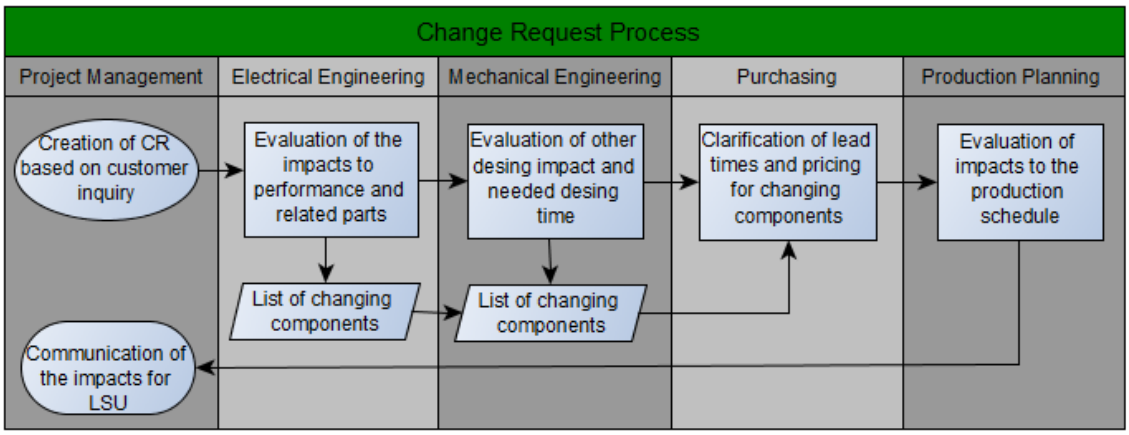

Figure 7. Change Request Process (Authors simplified illustration based on the case organization's material)

The first party handling the request is electrical engineering. This function is responsible for the performance design of the products. Electrical engineering is logically the first step in the process as the performance determines e.g. the physical size of the products. When the performance of the products is subject to change electrical engineering is thus in important role. They need to determine what changes in the main components. The next party in the process, Mechanical Engineering, is responsible for communicating the changed parts forward. Parts related to performance are highly standardized and then have their own item number in the case organization's engineering system. Thus the traceability to previous orders and their prices and lead times is easy. In these cases the purchaser can usually contribute to the Change Request resolution accurately enough even without contacting the supplier.

However all the cases passing through mechanical engineering to purchasing are not straightforward. The requests usually contain not only performance related issues, but also changes in accessories, subcontracted mechanical parts or other details. As explained there are different purchasing categories and thus several purchasers might be needed to solve a single CR. The coordination between the purchasers is done in a disciplined manner. The leader of the team determines the individuals involved and the clarifications can be done in parallel. The previous handlers of the request can remarkably ease the purchaser's work by listing down each item that is going to be changed.

Once the price and delivery time impact of the sub-components is clear, the production planning evaluates if the original delivery time of the product can be achieved. If the original production schedule changes, the best possible new delivery time is offered. The length of the postponement is also depend on the PU's manufacturing work load. Once the production planner changes the request status to finished, the project manager gets

a notification about it being ready. The request should now have all the details for making the quotation for the customer.

3.3.3 Change Order Process

The CO process is supposed to be the execution of the plan created in the Change Request stage. Once the production unit receives an updated purchase order for the scope changes offered, the implementation is done using the CO process. The work cycle of the process is following the logic of the CR process as illustrated in Figure 8.

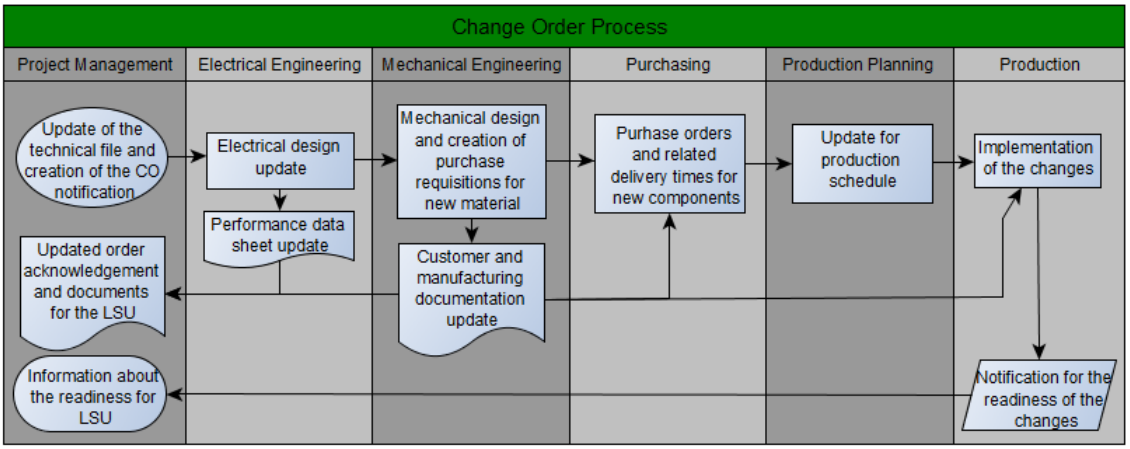

Figure 8. Change Order Process (Authors simplified illustration based on the case organization's material)

First the project manager updates the scope changes to the product configurator and depending on the change also to old ERP system. The CO notification is then done in SAP. The author of the CO can define if the required change is only a document update or actual physical modification. In the documentation cases the system creates tasks only for the engineering departments. For physical changes, i.e. the concern of this study, the purchasing, production planning and production have their own tasks.

The engineering functions update the design and documentation. The revised documents are sent to the LSU along with the updated order acknowledgement. The updated manufacturing documentation is used not only in the production of the case organization, but purchasing also shares relevant documents with sub-suppliers. The implementation of the changes is done according to the adjustments in the schedule made by production planning. The schedule is naturally respecting the delivery time agreed with the customer.

3.4 Description of Case 1

The project for Case 1 was selected because it represents well a typical change coming from a customer that fully understands the scope of order, but who later by own rationale

finds out a need for a change. For the resolution of the customer's problem and cooperation this setup is fertile as the possible price increases and delivery postponements are most often well understood.

The case organization had an existing business relationship with this customer and the products in question were spare units for a project already delivered. The products have a terminals for electrical supply connections on the left or right side. An earlier batch delivered had contained both left and right handed products. However, the customer wanted to have two spare units that could replace any of the existing ones. Therefore they requested the case organization to design a special solution with terminals on both sides. This solution required changes in the products' internal electrical connections that had a small impact on performance values. Also the product would be wider than the existing ones. Despite the impacts the customer wanted to order the goods with the new design.

Nevertheless after receiving the first set of documents the customer realized that due to the increased width the products would not fit to the mounting location. Also the original performance values were now considered more important than in the pre-order stage. Thus the customer contacted LSU to return to the original design 6 weeks after the freezing point. Once the project manager at the factory received the information about the change in the scope, he immediately sent an email to the purchasers for cancelling the relevant parts. Due to his electrical background the project manager was able to communicate the parts in subject without assistance from the engineering. However, the material subject to change was already manufactured by the supplier, and a hold or cancellation was not possible. The purchaser notified the project manager about the prices for the new parts and a quotation was sent for LSU.

Once the price and the delivery postponement were confirmed by the customer, a change order was made for the change itself. However the project on-hold status was not indicated. Therefore the production did not realized that the changes were coming until the parts needed for the first production steps were found to be delayed. The change was still processed in engineering and up-to-date drawings or bills of material were not available. Due to a holiday of the original designer of the products the change order had been pending for some days. Once the electrical engineering was finally done the design was copied from the original products. However, the electrical connection in the new design resulted in a minor mechanical change and therefore purchase requisitions for excess components were automatically created. However, a purchaser questioned the

necessity of the material and extra costs were avoided. Looking back, the complete purchasing history of this project, some unnecessary parts were ordered as the on-hold status was not clearly communicated.

Eventually the products were delivered for the customer one week late. Considering the magnitude of the change and late reception of the change request this delay was considered decent by the customer.

3.5 Description of Case 2

Compared to Case 1 the driver for the change is totally different. There had been a loss of information when the order was sent from the Sales Unit to the PG sales. The factory received the order with standard configuration without any reference to an existing product. Still, after the submission of the first documents the customer commented that the new product did not correspond to the existing one on site.

The project manager put the project on hold as there were five units in total and he wanted to avoid cost accumulation. He returned the project back to the sales support team of PG sales. The Change Request tool was used. The sales support rejected the Change Request as the order was already booked. The project manager then assigned the CR for Factory Engineering team. This team however, was under a heavy work load by that time and there was no full-time designer to assign for the job. The project Manager discussed the situation with the head of the engineering, but the drawing preparation could not be advanced. An updated layout drawing was sent for approval two weeks after the indication of a wrong design. A manufacturing approval for an enhanced design was received one week later. The on-hold status of the project was removed and a Change Order was created. After the engineering part of the Change Order was completed, the project manager called in a meeting with purchasing and production planning for clarifying uncertainty regarding the updated manufacturing schedule and earliest possible delivery time. The date agreed in this meeting was not achieved as the capacity in the manufacturing was not sufficient for making the changes.

The products were finally delivered for the customer three weeks later than expected. Even though from the engineering and manufacturing perspective this case can be seen as a change in the scope of supply, for the customer this is a pure mistake of the supplier.

3.6 Key Findings from the Cases

This chapter presents the strengths and weaknesses found from the current OSM Process based on the cases. Key findings are first introduced in the form of cross-case analysis and then discussed in detail. The findings are processed from Data 1 interviews

by combining all the answers of each question and then deriving the underlying themes utilizing cross case analysis. A detailed analysis of the findings can be found in Appendix 2.

3.6.1 Cross-case Analysis

This chapter combines the findings from the two cases. The structure of the Data 1 interview template is used to arrange the activities. The results are shown in Table 6.

	ACTIVITY	CASE 1	CASE 2	FINDINGS	
CHANGE REQUEST	Change originated from the customer	YES	NO	-Changes can be caused by intra-group communication shortages	
	CR tool was used	NO	YES	-CR tool not used (or even regocnized) in all functions leads to various problems	1.
	CR Process was followed	NO	YES	- Natural workflow supports the process -Needs of the next process steps not fully understood	+ 4.
	Requested impacts were evaluated with relevant	NO	YES	-Tight timetables and ridig CR tool engourages to take shortcuts	1.
	Input data sufficient for processing the change request	N/A	YES	-Lots of variation in the amount of data, too little/ too much -Capturing the essence is crucial for smooth handeling	4.
	Reason for the change clear	YES	YES	-Understanding the contexts helps the organization in providing the optimal solution	1.
	Urgency of the change clear	YES	YES	-Usually "ASAP" -How to prioritize the cases without centralized handling?	1.
	CR process timely finished	YES	NO	-Expected troughput times are not respected as instructions are not clear	
CHANGE ORDER	CO tool was used	YES	YES	-CO tool is concidered to be purposeful	+
	CO Process was followed	YES	YES	- As in the CR process, the natural working order is followed (mainly) -Needs of the next process steps not fully understood	4.
	Input data sufficient for processing the change order	YES	YES/NO	-Dependent on the CR stage and transferred information -Hold and Cancellations are not clearly handled	3.
	Reason for the change clear	YES	YES	-Dependent on the CR stage and transferred information	4.
	Urgency of the change clear	NO	YES	-Location of CO's targeted resolution date is generally not known -Task flow does not support the purchasing activities	2.
	CO process timely finished	NO	YES	-Highly dependent on engineering resources. Engineering is the bottle neck of the process.	1.
	Freesing point was respected	NO	NO	-Is the current order-to-delivery process purposeful for all projects?	5.
	On-Time-Delivery	YES	NO	-Dependent on the success of the CR process	1.

Table 6. Cross-case analysis with the related findings.

The Activity column shows the questions of the interviews in a nutshell. The Case columns reflect whether this statement holds true in each case or not. The Finding column shows the central ideas observed in the interviews. It also shows numbers from one to five and plusses. The numbers relate to five weaknesses found and the plusses are the identified strengths. These findings will be discussed in the following chapters.

3.6.2 Strengths

In total, three strengths were identified. Two of them are shown by a plus sign in Table 6. The third strength, relating to the co-cooperativeness of the employees, is a general finding based on the atmosphere of the interviews.

Firstly, even though the case organization is manufacturing engineered products, the white collar and manufacturing processes are linear. One phase is executed after another. This logical continuity has provided a good gripping surface for the current OSM Process. Both the CR and CO Process are designed to support the natural working order in the case organization. This is reflected from the good understanding of the processes. Even the employees who did not recognize or use the CR tool had internalized the logic of this process. Same employees also understood the weaknesses of neglecting the CR process. Informant of Data 1f stated the following:

> "I don't really know what I should fill in to each field there (CR tool) and so on, therefore my messages there have rarely reached the correct receiver. If I communicate unofficially, I know immediately who to contact… CR side then is just a place to keep a log, not a guiding tool as it should be."

From the development perspective this provides a fertile ground for creating more structured working practices for example by improving the tools. This finding will be used as a basis for building the proposal.

Secondly, all the respondents considered the current CO tool to be at least satisfactory for its purposes. Some Interviewees even praised the tool to be very good and purposeful. This might be surprising, but it tells that the case organization has managed to develop a system that is sufficient for every stakeholder's needs. Not only the CO tool, but also other SAP related tools have been developed remarkably in recent years. This is well reflected by informant Data 1g:

> "CO tools is used as it's so handy! I'm able to do all the things I need in SAP. It highlight the discrepancies of the CR tool."

Devotion for building an environment linking the key functionalities together is paying off as satisfied users.

The third strength found was the people in the case organization. This strength is not shown in Table 6 as it is emerged more from the general atmosphere of the interviews. All the interviewees obviously had a will to improve the current change management practises. Everyone was able to find the time for the interview. The fact that the interviews took up to one hour of the employee's day is a sign of commitment and need for improvements. Thus the development of the OSM should be taken seriously. All the interviewees presented their opinions and perceptions in a relaxed manner. None of them

hesitated to show any personal bias. These honest answers are a good basis for the next steps. As all the OSM Process stakeholders were interviewed the key issues from each perspective are now captured and indicated in the following chapter.

3.6.3 Weaknesses

The biggest problems of the current OSM process do not originate from the process itself, but from various external sources. Figure 9 below illustrates the issue.

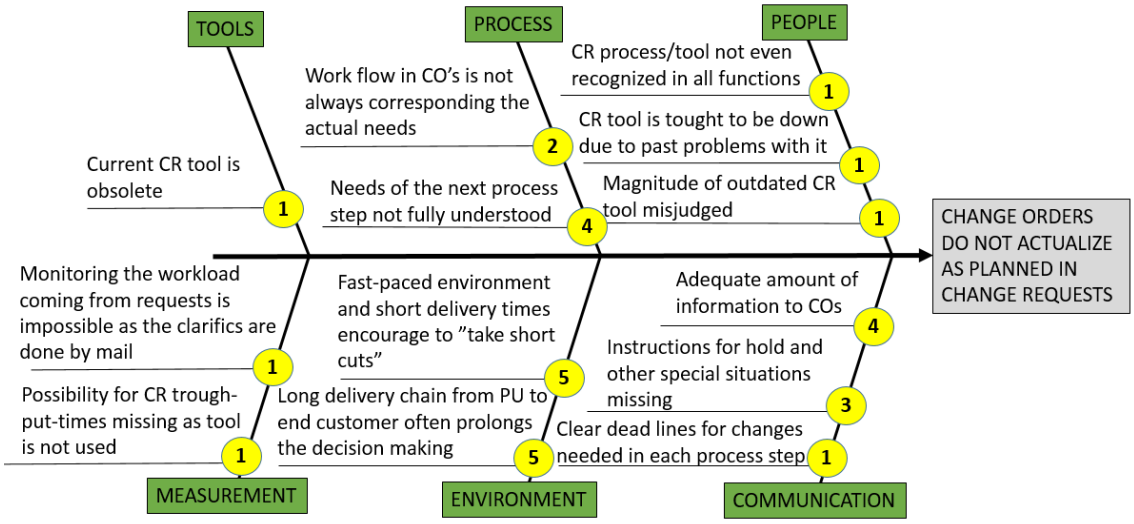

Figure 9. Weaknesses of the OSM Process presented with root causes and related sources.

A total of five weaknesses were identified. The location of weaknesses is marked on yellow balloon. To begin with, the most severe discrepancies of the OSM process are related to the CR tool. The current tool is practically not used due to several reasons. Most of the functions consider the tool to be slow, unreliable and rigid. This quote from an informant of the Data 1c summarises the common thinking:

> "Without footwork nothing happens as fast as should. If you need to go to talk to each handler of the request anyway, the database turns into meeting notes losing part of its practicality".

The perception of unreliability is partly a reflection from the past problems with the tool, even though the software is now fully operational. Engineering is the most active user of the CR tool. Still, in the following process steps the tool was not always even recognized. In addition the newest employees do not have the Lotus Notes installed on their computers. As the CR tool is a part of this software, there is no basis for a successful CR Process. When a CR is assigned for an employee without access to the tool, the communication chain is broken and the quotation for the customer delayed.

Neglecting the usage of the tool leads to lack of traceability, transparency and commitment to CRs. The customers are usually expecting the feedback to the requests of scope

changes within some days. Therefore alternative communication methods are used to provide timely responses. Clarifying the impacts of the changes by phone, emails or face-to-face discussion are the most common ways to gather the details needed for making the quotation. Most of the interviewees considered this to be the most efficient way for go through the CR Process. Nevertheless the efficiency comes with a price. Traceability and transparency of the communication is lost when all the information is in emails. Informal communication reduces also the engagement of the employees. Sloppy handling of the CR stage leads to slippages in the CO stage, especially when the resources for actually making the change are not ensured. Also the context for the change can be lost when the request handled by emails is turned into CO in SAP. Necessary information is copied manually from a system to another and the handler of the CO might not be the same as for CR. Thus the handler of the CO just ends up doing predetermined manual work instead of solving a specific problem of the customer. Also a wider understanding could often help to provide an even better technical solution for the customer.

In addition the CRs are creating a significant work load especially for engineering. However, at the moment the exact quantity of the change requests is unknown, as the CRs are not handled with the tool. The work load is invisible and totally uncontrolled, thus not taken into account in resourcing of the engineering department. This is leading to prolonged handling times for the rare changes going through the tool. Also prioritizing between the individual CRs is impossible. This leads to a situation where an urgent CR for a project in an advanced state might be postponed as a project with more flexible schedule is in the progress. The CR for Case 2 is a good example of such a situation.

From the CO Process and the related tool can be found only minor weaknesses based on the interviews. However the second weakness is raising from purchasing and production planning criticizing the task flow in the CO tool. An informant of Data 1g formatted the viewpoint as follows:

> “The current method is definitely the best (for handling the COs). Even its rigid system in some sense, it works. In-built task flow system is important. It could be improved to inform the purchasing earlier about the oncoming changes. That would often bring savings in material costs”.

Now the purchasing is notified just when the engineering tasks are finished. The engineering being the bottleneck function, information of the changes might be received too late for cancelling or modifying the order of a sub-supplier. This causes slippage in the planned costs of the change. If the CR from the customer had been received some weeks earlier for Case 1 this would have been a probable scenario. The second aspect hinder-

ing the CO process is the expected handling times of the tasks. The majority of the interviewees did not know where this information can be found. Despite of this being such a small detail, this information is crucial for the prompt execution of the CO process.

The third weakness is a common difficulty in both CR and CO processes. Communicating the on-hold statuses of projects, situations where all activities are frozen due to upcoming changes, is not done in a centralized manner. Like in both Case1 and 2 on-hold statuses are often communicated by email. Despite it being a fast method, the message usually has a limited audience and the information cannot be found from the SAP. An Informant of Data 1b stated the following:

> "The hold should have been extended to the production functions as well, not only to purchasing. Now some parts were manufactured from the stock materials even though they were about to change. This would have required an additional notification in SAP CO tool."

The quote reflects how the unclear practises mislead even experienced employees. The SAP being the tool for production planning and follow-up makes it the right place for this information. As the on-hold information from different sources might vary, confusion is natural. Especially in Case 2 there was uncertainty on how to proceed after the on-hold status was removed, even though the COs for on-hold removal and proceeding with the changes were already made.

As a fourth weakness can be considered the lack of understanding the next process steps needs. All the interviewees mentioned at some point the importance of communication and hence the lack of understanding the needs of the next process step is a major problem. An Informant of data 1h gives a practical example of what that means:

> "The part-level technical details are often missing. Purchasing needs to know exactly what has been changed in the project so that we can effectively communicate the changes for the suppliers".

Transferring the correct information for the next handler is necessary, otherwise the process needs to take a step back for clarifications. In many interviews the correct amount of information was discussed. As some stakeholders considered the information flow to be overwhelming and some others needed more details, it is fair to say that professionalism is needed in communicating the essence. Also timeliness of the communication was mentioned several times. It was considered better to receive the information of changes as soon as possible, even unofficially first.

As the OSM process is only a sub-process of the OFP, also the interfaces to the main process need to be reviewed critically. Hence the final finding of the CSA is related to the case organization's lead-time model used in the OFP. Even though it is the last finding, it is not the least one. As shown in Figure 6 (Chapter 3.2) the case organization

commits to a certain lead time upon an order. In addition, the Figure shows that only a certain period of the total lead time, the preliminary engineering, is reserved for making the changes to the scope of supply. In the complexed, minimum lead-time deliveries there simply is not enough time to elaborate the documentation and thus the scope to correspond the customer needs. An Informant of data 1b described the problem as follows:

> "…the most severe pitfall in the process is the current project execution model. Our minimum lead-time model simply does not have as much time as would be needed for the scope modifications in the complexed projects".

Even though a preliminary dimensional drawing is usually provided for the customer along the quote, the tailored final product might have significant differences in terms of size and details. Despite the robust sales configurator used, communication with the final documentation seems to be in some cases the best way of co-creating the solution the customer needs. It then comes questionable whether the current lead-time model is suitable for all projects.

3.7 Summary of the CSA

The purpose of the CSA was to find out why the COs do not actualize as planned in the CR stage. The problem was analysed by investigating two exemplary cases. All the relevant stakeholders of the OSM process were interviewed. Table 7 lists the main observations.

FINDINGS FROM THE CSA	KEY ISSUES	DERIVED THEME(S)
1. Change Request tool not used as instructed	-Engaging the employees to use the tool -Action plan for taking the tool back in use in all functions needed -Action plan for long term evolvement of the Change Request tool needed	Change Management
2. Task flow in the Change Order tool is not adequate	-Modifying the process in the tool	Business Process Management
3. Practices for communicating the project holds and other special situations are not clear	-Lack of process instruction and communication -Operational implementation plan needed	Business Process Management, Change management
4. General lack of understanding the next process steps needs	-Re-training of the employees -Reinforcing the good working practises	Change management
5. Current lead-time model not suitable for complexed projects	-Alterations to Lead-time model needed -Implementation plan needed	Business Process Management, Change management

Table 7. Summary of the CSA findings

The most important finding is that the problem is not in the basic design of the OSM Process. However, the operational implementation of some process parts is not done properly. The main concern is the CR tool usage. As the CRs are not handled in a centralized way the process cannot be controlled or measured. A successful change is highly dependent on the initial clarifications made in the CR stage. The impacts indicated are a commitment for the customer and slippages in the deliveries reduce the case organization's attractiveness as a business partner. As the changes are a great opportunity to co-create additional value for the customer, the importance of the OSM should be internalized in all organizational levels. The case organization has so far misjudged the magnitude of lacking a proper platform for the CR process. However it is probable that prevalent neglecting of the CR tool usage has not been known by the management.

The second finding regarding the inadequate task flow of the CO tool and the third finding about the current unclear practises concerning the project on-hold situations lead to the same problems. Additional costs and work are caused as the purchasing or manufacturing functions are not informed about the oncoming changes in the proper way. Based on

the interviews these shortages are remarkably hindering the operation of the case organization.

Fourthly, the CSA revealed the lack of understanding the next process steps needs. If the right information does not flow within the OSM process, steps backward are needed to capture the needed information. This is naturally increasing the handling times of the CRs and COs, but also creating resistance within against the current tools as a communication platform.

The fifth and final finding of the CSA is the case organization's lead-time model. Even though this finding is not respecting the objective of this thesis, the issue's magnitude is so remarkable that the author wanted to include it in the thesis. The current lead-time model does not support the industry-wide common practise of making the final scope adjustments with the product's documentation. The complexity of the projects and related documentation cannot be communicated clearly enough in verbal form at the sales stage. The case organization commits to a certain delivery date upon order, even knowing that changes can be expected. An alternative lead-time model needs to be established to avoid the resource-intense changes in the production stage.

The current state of the OSM Process is thus clear. It is obvious that the problems in the OSM process are partly change management problems, partly process problems. Thus, a review of the existing knowledge can be done based on the findings. The applicable areas to explore are Change Management and Business Process Management.

4 Review of Existing Knowledge

This section discusses the theoretical foundation of the thesis. The review is conducted from a practical perspective and thus it aims rather at capturing the essence of the knowledge e.g. in the form of best practices, than deep-diving into detailed debates between scholars. First, Change Management and Business Process Management are reviewed separately. In the final section these themes are merged to a Conceptual Framework of this thesis respecting the findings of the CSA.

4.1 Change Management

In today's international working environment the pace of change is greater than ever and it is not slowing down (eg. Burnes, 2009 and Porras & Silvers, 1991). Therefore, change management has become a vital business skill. This chapter first drills into the core of Change Management by defining what it actually means. Secondly, the main schools of the field are introduced. This chapter also gives an overview to the history of Change Management science and describes the psychological basis of it.

4.1.1 Roots and Definition of Change Management

The roots of Change Management lead to development of organizational theories in the early days of industrialization in the 19th century. Organizational theories started to shape up by a need-based process when the demand to control and describe organizational relationships emerged. The classic organizational theory was a reflection of the time, seeing the company and its employees as a Newtonian mechanism. When organizations started to get more complex this simplistic model was criticised for not corresponding the real business environment. In early 20th century raised new approaches seeing the company and organizations as a cooperative systems. In 1940's Kurt Lewin recognized that change is constantly present in the organizational life. A foundation for change management as a science was laid, even though it evolved under organizational theories and development until the 1980's. (Burnes, 2009)

Change management has been proven to be one of the necessities in a modern manager's tool box. Despite the self-explanatory name, the nature and objective of change management is defined in several ways in the literature. Partly this is due to change management being an inter-disciplined science. In this paragraph change management is approached from the perspective of an individual then extending the view point to wider context. Tsoukas and Chia (2002:567) state that change itself:

> "is the reweaving of the actors' webs of beliefs and habits of action to accommodate new experiences obtained through interactions".

This statement highlights the role of single employee in the overall change process. After all, organizations are made of a group of individuals. Especially when the individual is working as a change agent, spear head of changes, the impact on the whole organization can be significant.

Burnes (2009:321), defines the change management to be:

> "planning and implementing the changes required to achieve, or shape, strategic objectives".

As all the operations of the company should be strategy-driven, this statement holds true in most of the situations (Porter, 1988:35). However this statement also has a weakness – it does not take into account the scale of the change. If the change concerns the most fundamental guiding feature of the company, i.e. the strategy, the Burnes' statement needs to be expanded. Moranbaird and Brightman (2000) generalise the change management to be an all-encompassing activity not limited by the company boundaries:

> "Change management is the process of continually renewing an organization's direction, structure, and capabilities to serve the ever-changing needs of external and internal customers."

This quote shows the complexity of Change Management. It has, to some extent, an impact on all the activities within the company and its surroundings. Moranbaird and Brightman (2000:66) further conclude that:

> "change management is not about managing change… (but)… about managing people".

Managing people is thus the essence of change management. Change management targets to align the people to the company strategy in transactional stage of an organization. Bringing the change to an organization in an efficient way while minimizing the disruptions in the company's key process is the key challenge. Utilizing the elements from organizational sciences, psychology and management science Change Management aims to level the organization for better performance.

4.1.2 Planned Approach

This chapter explains the nature of the planned change approach and gives rationale for the psychology behind Change Management. Practical models for conducting the change initiatives as well as criticism for the approach are presented.

4.1.2.1 Definition of Planned Approach

As identified in the previous chapter Change Management aims at realigning the company to reach the strategic objectives. In a planned approach a company identifies an area needing improvement i.e. finds a process or working practice that is hindering the

strategy execution. Corrective actions are then planned and implemented to steer the organization to the desired direction. (Burnes, 2009) Kurt Lewin's three-step model characterizes the planned change well even nowadays though this pioneering work dates back 70 years. A central part of his thinking was the opposing forces driving and restraining the changes. A balance between the forces maintains a status quo. The concept of the three-step model shown in Figure 10 illustrates this logic.

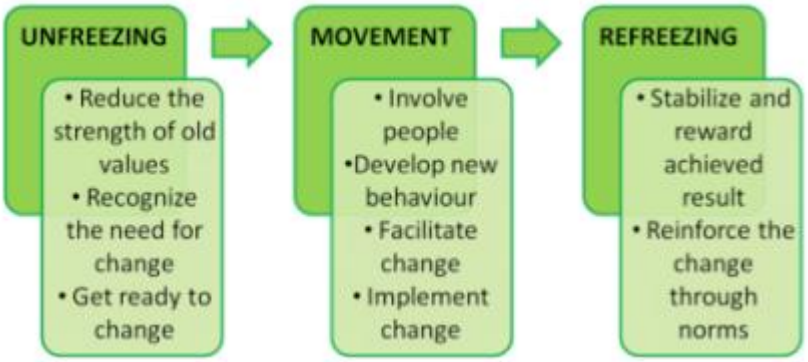

Figure 10. Kurt Lewin's Three-step model to planned change (Illustration based on Burnes, 2009:338-339)

The Unfreezing step targets to reduce conservative forces and prepares the organization for the change. Once the relative amount of the driving forces increase, the organization moves on. Before the actual changes are made an organization should prepare by involving people and facilitating the circumstances for the change. Once the changes are implemented the new behavior is strengthened by rewarding and creating norms. Organizational learning thus comes in steps, as incremental change, as shown in Figure 11.

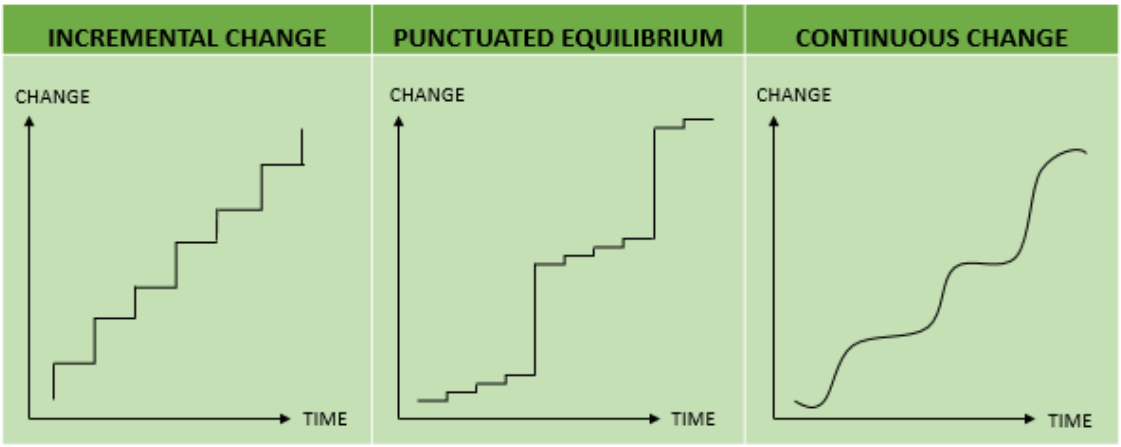

Figure 11. Models of organizational transformation (Burnes, 2009:351-353)

Consecutive change initiatives improve the organization step-by-step. This approach does not expect major leaps in the processes or know-how of the employees. Punctuated equilibrium model is based on an assumption that the organization goes through radical

changes after relatively calm periods. However punctuated equilibrium model is criticized to consider the calm periods to be the normal status for organizations. As the organizations environment is on constant change, company should renew itself accordingly. Continuous change model shows that organization is developing all the time. However the pace of change varies.

4.1.2.2 Practical Models for Managing Planned Change

Later scholars have developed Lewin's model further, as it was criticized to be too simplistic for managing the complexity companies are facing in the real-life change initiatives. Bullock and Batten (1985) are not only proposing a new four-step model, but also proving evaluation criteria and analysis for the 30 different models created until then. Their model is consisting of exploration, planning, action and integration. Kanter et al (1992) propose ten commandments for executing change initiatives and Kotter (1996) introduces an eight-step model. Table 8 shows how these models compare to each other.

Lewin	Bullock and Batten	Kanter *et al*	Kotter
1. Unfreeze	1. Exploration 2. Planning	1. Analyse the organization and it's need for change 2. Create a shared vision and common direction 3. Separate from the past 4. Create a sense of urgency 5. Support a strong leader role 6. Line up a political sponsor	1. Create a sense of urgency 2.Build guiding coalition 3. Form strategic vision 4. Enlist volutary army
2. Moving	3. Action	7. Craft an implementation plan 8. Develop enabling structures 9. Communicate, involve people and be honest	5. Enable action by removing barriers 6. Generate short term wins 7. Sustain accelaration
3. Refreezing	4. Implementation	10. Reinforce and institutionalise change	8. Institute change

Table 8. Comparison of four planned change management models (Authors illustration)

In the Table the similar steps are highlighted in the same color throughout the three columns. The logic of Lewin's model can be recognized in the later models. Lewin's unfreezing stage targets to prepare the organization for the change as does exploration and planning in Bullock's and Batten's model. Later approaches emphasize the creation of urgency to gain momentum for the change initiative. Thus in all models the first steps are preparing the organization for a change. Whereas Lewin and Bullock and Batten models call for "moving" and "Action", Kanter et al breaks the step down three individual actions that are aiming to move the organization forward. Following the same logic but

with another wording Kotter's model has enabling, rewarding and strengthening elements. Finally all the four models target to stabilize the situation, making it the new normal.

Similar reflections from the models show that the planned change models are targeting to solve one-off problem. They are not in place for facilitating long-term evolvement of organization, but to help in overcoming a transactional situation. This emphasises the practicality of the planned change models. Practicality is the reason for popularity of these models. Differences in the models reflect the variety of change initiatives that the organizations are facing. Bigger the change, bigger the resistance. Thus, in the dramatic changes, models stressing the importance of initial step of the change initiative become favourable ones. Underlying reasons for this are discussed in the following chapter.

4.1.2.3 Managing Planned Change Is Anticipating Human Behavior

A clear pattern between the planned change models reveals the objective of change management – how to effectively response on expected normal human behavior. Supporting this Carnall (2003) draws a coping cycle consisting of five stages to reflect how people react to changes. According to him denial, defense, discarding, adaptation and internalization are normal responses to change occurring in consecutive order. In addition, the study of Elrod and Tippett (2002) shows that employee performance decreases in a disruptive change situation. They also bundle up the coping cycle and Lewin's three-step model to their own work. As the change in the planned approach is considered to be circular one-time event the graphical illustration according to Figure 13 can be drawn.

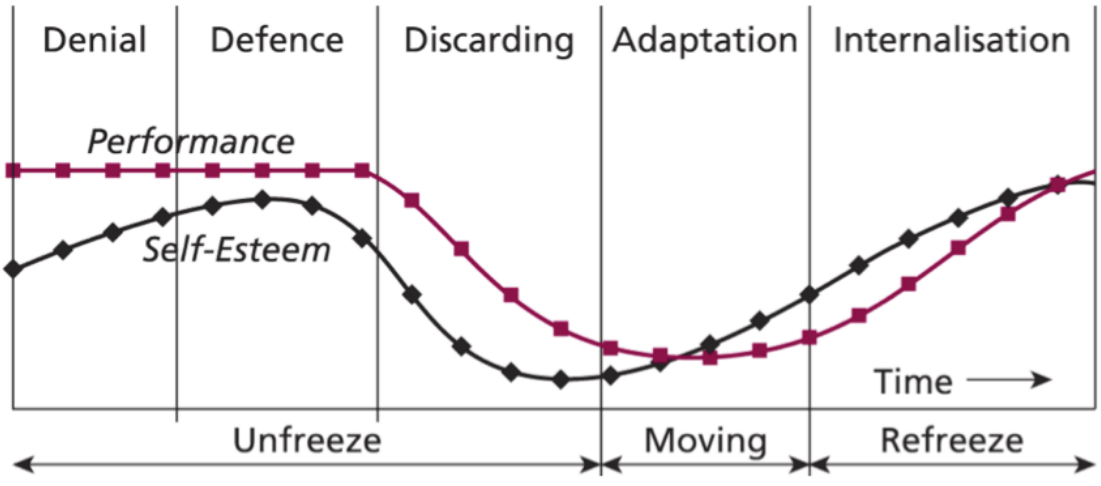

Figure 12. Employee performance and self-esteem fitted to three-step model and the coping cycle (adopted from Burnes, 2009:341)

Figure 13 shows how Lewin's unfreezing-stage targets to handle the feelings of denial, defense and discarding. When the change is inevitable and it will happen anyway, the

employee productivity and self-esteem decline rapidly as a natural response to unfamiliar situation. Denial turns into defense, making it the impossible to see the advantages of the change. However, human nature has a tendency to start accepting the oncoming new situation. Lewin stresses this stage to be the time for learning away from the old habits in order to adopt new habits that the change brings. Thus, this is the place for rationale and open information throughout the organization. In the moving-stage organization is in transitional situation and changes are implemented. Employees start to adapt to the new situation meanwhile the productivity and self-esteem recover. As the time goes on the new situation becomes the “new normal” and the organization has moved on to a new level of performance.

4.1.2.4 Criticism on Planned Change

Despite development in the change models and popularity in the practical change initiatives the planned approach is also criticized. Firstly, there are theoretical concerns raising from the planned approach’s roots in the organizational development. This has led to unbalance between the group behavior change and the organizational transformation. As the practitioners of the field understand the former significantly better, the latter has not evolved as far. (Burnes, 2009)

Secondly the planned approach has been criticized for not being suitable for all change initiatives. For example Dunphy and Stace (1993:905) argue that large scale radical changes cannot be handled with models of planned approach due to its incremental nature. However they acknowledge the planned approach to fit in “fine tuning” or “incremental adjustments” of an organization i.e. small scale changes.

4.1.3 Emergent Approach

This section explains the nature of the emergent approach by first defining it and then investigating the factors that influence on success of the emergent change initiatives. Also models for practical solutions are given.

4.1.3.1 Definition of Emergent Approach

Whereas supporters of the planned approach can be seen to some extent being a homogenous group, proponents of the emergent approach are more dispersed. The Emergent approach sees change as ”continuous, dynamic and contested process that emerges in an unpredictable and unplanned fashion” (Burnes, 2009:366). Change management models based on the planned approach rely on company internal and external stability. Environment and the practises are taken as unchangeable, which leads to the

assumption that a change is an abnormal situation for organizations (Tsoukas & Chia, 2002). However real-life studies have proven change to be always present in organizations. Criticising this discrepancy unifies the proponents of the emergent approach.

Secondly, the emergent approach is based on an assumption that changes can be initiated (emerged) from any level of the company, contrary to the planned approach where the change initiatives are manager-driven and schedule oriented. This changes the change process from top-down to bottom-up. In a dynamic and fast-paced environment the need for the changes occurs rapidly and senior managers can not react on them timely. Thus empowered employees on lower organizational levels perform the change operations and the managerial level acts as a facilitator for the changes. (Bamford & Forrester, 2003)

Thirdly, finding the change model that “fits” best the organization in question is common for the emergent approach promoters. As the approach considers the organization’s environment to be in the constant change there can not be universal model that fits all organizations and situations. As a result it emergent approach is lacking coherence and a diversity of techniques (Bamford and Forrester, 2003) Also emergent approach being a relatively young movement compared to planned change has impact on this.

4.1.3.2 Success Factors of the Emergent Approach

This chapter’s purpose is to explain which elements are included in a successful emergent change initiatives, and simultaneously show, why proponents of the emergent approach stress the complexity of the organizational changes. Crafting a universal formula for managing emergent change collides with one of its main principles. As the approach highlights the change initiative’s suitability for the organization’s current situation, a detailed universal model becomes ineligible, being too general in nature. To structure the determinants for a successful change, Burnes (2009) groups the influencers promoted in various sources. The determinants are Organizational structure, organizational culture, organizational learning, managerial behaviour and power and politics as shown in Figure 14.

Figure 13. The determinants of successful change (adopted from Burnes, 2009:376)

Organizational structure. Organizations come in a variety of sizes and forms. From the change management perspective organizational arrangements can be seen as a success factor because it determines the responsiveness to the change. Length of the communication chain within the organization has impact on how well the change initiatives spread throughout the organization. As Kotter (1996) notes flat organizations tend to be agile in the changes.

Organizational culture refers to "a system of shared meanings held by members that distinguishes the organization from other organizations" (Robbins, 2005:230). Organizational culture has been studied heavily and even claimed to be the most important success factor for the organizational changes. Several attempts to structure the phenomena exists. For example Cummings and Huse (1989) define the culture to consist of four layers, basic assumptions, values, norms and artefacts. Deepest layer, basic assumptions, contains the unconscious believes of how the things in the organization should be. Second layer, values, tells how the things *should* be. Values set the importance for any organizational choice and thus act as guiding element. Next layer, the norms, se the rules for behaviour. Finally, the artefacts are the highest level of cultural awareness. It includes for example observable behaviour of members, rules and structures. Cummings' and Huse's model reveals the essence of culture from the change management perspective – changing the superficial artefacts layer, may it be e.g. new rule or organizational form, does not necessarily change the underlying cultural layers.

Organizational Learning. For organizational learning can be found a myriad of definitions. Garvin (1994:80) says a learning organization to be “an organization skilled at creating, acquiring and transferring knowledge, and at modifying its behaviour to reflect new knowledge and insights”. Gavin (1994) also presents a building blocks for organizational learning. The characteristics common for a learning organisation are: systematic problem solving, experimentation with new approaches, learning form their own experience and past history, and transferring knowledge quickly and efficiently throughout the organization. These characteristics are based on his study that is among many others in this field. Many of the statements in them are opposite to each other (Burnes, 2009). To conclude, organization is a framework for people who are the ones that actually learn. Gavin’s approach shows the importance of utilizing this learning and new knowledge to evolve the organization.

Managerial Behaviour. Traditionally managers are expected to be the ones who tell how the things will be done. Due to top-down approach of the emergent change, coaching and encouraging managerial behaviour is preferred and guiding and restricting style is depreciated. Managers are turned into leaders. Kotter (1990:85) defines the leader’s main objective as follows:

> “They don't make plans; they don't solve problems; they don't even organize people. What leaders really do is prepare organizations for change and help them cope as they struggle through it”.

This sharpened quote captures the essence of the managerial role – to be the facilitator for the change. Leader-Manager is expected to overcome the obstacles and search the sources of inertia for the changes (Burnes, 2009). However, despite of stressing the leadership side, the managerial role has its distinctive purpose that has been clearly recognized also by the proponents of the emergent approach. Taken to extremes, this means that the manager’s task is to choose whether the changes are following the planned or emergent approach (Stace & Dunphy, 2001).

Power and politics refers to how people try to influence each other achieve their desired goals. Robbins (2005:178) defines the power to be “a capacity that A has to influence the behaviour of B so that the B does something he or she would not otherwise do”: He further determines politics as “activities that are not required as part of one’s formal role in the organization, but that influences, or attempt to influence, the distribution of advantages and disadvantages within the organization” (2005:184). These definitions cover anything from formal authority of manager-subordinate relationship to “back-stabbing” of the colleague at coffee break. Thus part of the power is inbuilt to organization and can

be adjusted by means of change management. From the change management perspective controlling these separating or unifying forces is crucial. A practical approach on managing these dynamics has been given by Senior (2002): Ensure or develop the support of key power groups, use leader behaviour to generate support for the proposed change, Use symbols and language to encourage and show support for the change, build in stability by using power to ensure that some things remain the same.

4.1.4 Combing the Approaches And Beyond

Even though organizations face changes all the time, the frequency and magnitude of these change initiatives vary. In this thesis the planned and emergent approach are introduces as alternatives rather than competitors. Among scholars the division is often seen in black and white. However Dunphy and Stace (1993:905) argue that:

> "A more comprehensive approach to organizational change management and consultancy is needed which finds a place for transformation as well as incrementalism and which accommodates the use of directive/coercive as well as participative means of achieving change."

Both of the approaches thus have their place in the tool box of a manager driving the change. Which one to use is dependent on magnitude of the change. In small, one-off change initiatives planned change is more suitable due to its incremental nature. As the magnitude of the change increases, emergent approach becomes more favourable. Well planned change initiative that fits the organization and its environment is in place to manage the complexity.

Secondly, Kanter et al (1993) have a very similar approach to changes as Dunphy and Stace. She divides the change initiatives to "Bold Strokes" and "Long Marches". Bold stroke refers to a manager-driven, forcing change initiative targeting to quickly implement the change. This type of change does not support the growth of organizational culture. To cover that shortage series of small incremental changes, a long march, should occur.

Thirdly, as noted by Leana and Barry (2000) companies pursue change to adapt to the competitive environment, but simultaneously stability is favoured to reduce uncertainty. The same logic applies to employees. This contradictory setup is propitious for combined approach. As shown in paragraph 4.1.2 Change Management models fundamentally aim to anticipate the human reactions on change. In an environment where several small and large scale change initiatives are implemented simultaneously timing of the changes becomes an essence. Too many radical changes paralyze the organization and in the turbulent times employees receive performance-increasing comfort from familiar processes

4.2 Business Processes Management

In the previous section Change Management was found to be a method for aligning the people with the company strategy in a transactional stage of an organization. This section targets to find best practises for doing the same for the business processes.

4.2.1 Terminology and History

The field of process management is filled with unstable terminology (e.g. Lee & Dale, 1998). Same expression can be used to describe different phenomena. Therefore defining the terminology becomes an essence. To start form the objective itself Zairi (1997: 64) defines a process to be:

> "an approach for converting inputs into outputs. It is the way in which all the resources of an organization are used in a reliable, repeatable and consistent way to achieve its goals".

Emerging IT in late 1980's was the seed for Business Process Re-engineering (BPR). Key concept of the BPR is the adaptation of the company's process to the IT systems. Processes are namely re-engineered to suit the thoroughly exploited capabilities of the IT system. The target is to achieve improvements in organizations performance. (Biazzo, 1998) Patching (1994:10) praises the BPR as follows:

> "true process re-engineering or re-design, goes beyond the level of the simplification exercises, and is most likely to give rise to dramatic successes and significant organisational change".

Despite its popularity among companies and consultants BPR is also widely criticized. Mainly because the change initiatives rarely have had the planned impact. Simply by re-engineering a process the organizational culture does not change. Thus the advantages do not actualize in full scale as all the employees are not committed to the new practises and accordingly their work is not efficient. (Biazzo, 1998). Analogy to the change management theories is obvious. As the planned change approach, discussed in paragraph 4.1.2, the BPR ignores the complexity of the organization.

A more recent approach to process management started to emerge due to criticism of BPR in late 1990's. Business Process Management (BPM) offered a softer way to drive incremental changes to organization's operations without totally destroying the old structures. It can be argued whether the BPM really was something new as development activities have always been a natural part company life. (Lee & Dale, 1998) However this time the theories started group under the title of BPM. Zairi (1997: 64) defines the BPM to be:

> "a structured approach to analyse and continually improve fundamental activities such as manufacturing, marketing, communications and other major elements of a company's operation".

This thesis is written utilizing Zairi's approach. However due to the complexity of the field the concept of Total Quality Management (TQM) needs to be introduced. According to Mele and Colurcio (2006:464) TQM is:

> "systemic and global approach to firm management based on management by process and continuous improvement of business performances by all human resources in order to satisfy explicit or implicit expectations of customers and other stakeholders".

In the context of this thesis it can be considered as one sub-approach of the BPM emphasizing the importance of quality systems.

4.2.2 Success Factors

Before going to practical applications of the BPM it is purposeful to review the underlying features of the company. Zairi (1997:65-68) emphasizes four factors shown in Figure 15 as important for a successful BPM initiative.

Success factor		Explanation
Accredited Quality Systems	->	Utilization of e.g. EN ISO 9000
Quality Structure	->	Framework for the Quality Processes
Strategy	->	Aligning the Employees to the Company Goals
Process Management	->	Re-thinking Processes and Organizations

Figure 14. Success factors of the BPM (Zairi, 1997)

Accredited Quality system. As noted by Winston *et all* (2006) utilizing disciplined quality system such as EN ISO 9001 truly help the companies to organize their operations. Typically processes become clearer and the quality of the internal and external documentation improves. In addition duties and responsibilities are shared clearly within the organization. These advantages are gained as the auditing systems of the notified bodies "forces" the companies to improvements.

Quality structure refers to the system or framework that organization has established for executing the improvement and development initiatives. It may come in form of IT system, instructions, or working practises. Quality culture can be seen as an outcome of the quality structure as it is employee's perception of the quality systems. Within the process management field there are opposing approaches to the nature of the quality structures. Proponents of BPR consider the well-designed quality process to be self-driven entity. In the other extreme, complexity in the relation of structure, strategy, people and other variables is emphasized.

Strategy needs to be the basis for the BPM. Success of the initiatives is highly determined by how well the strategic goals are built in to the business processes. Taken to

the operational level this means communicating the organizational objectives for employees through the formal procedures. Kaplan and Norton (2006) have another approach to the relation of the business processes and strategy. According to them over-optimization of the organization is not necessary for the successful strategy execution. Contrarily Kaplan and Norton argue that strategy can be, to some extent, be adjusted to fit the company structure.

Process Management is a contradiction to the traditional functionally driven approach, where different departments focus just on their specific duty. This creates barriers between different stakeholders and organization becomes siloed. As a result, internal value and communication chains are disrupted. Eventually the value experienced by the customer decreases. Lee and Dale (1998) observe that by managing the processes, companies can truly improve their operations. The beneficiary from the improvements is the customer.

4.2.3 Order-Fulfilment Process Models

The Order-fulfilment process (OFP) is the company's way to convert the customer order to the actual product. All other business processes are subordinated for OFP. As noted by Sackett *et al* (1997) aligning it to the company strategy is crucial for the success of the business. To explain the differences between the process models, concept of customer order decoupling point (CODP) is used. Some sources, e.g. Olhager (2003), refer this as an order penetration point (OPP). According to Olhager (2003:319) this point "defines the stage in the manufacturing value chain, where a particular product is linked to a specific customer order". Figure 16 illustrates the phenomena and shows the most common CODP models.

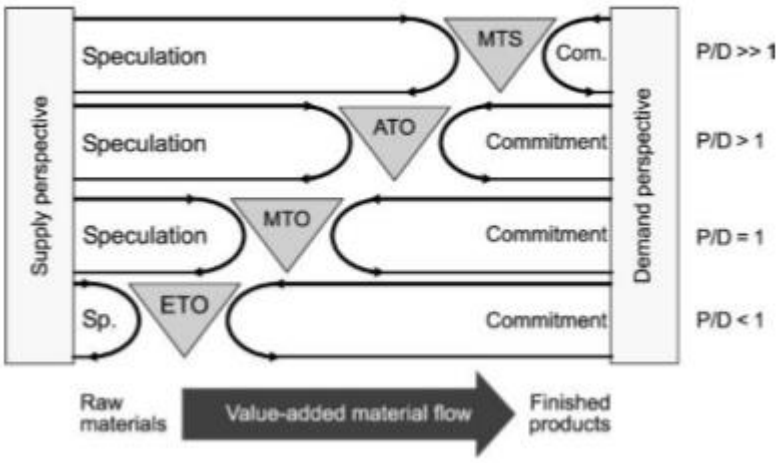

Figure 15. Typical Customer Order Decoupling Points (Rudberg, 2005:626)

The models are characterized by P:D-ratio, where P refers production lead time and D to total delivery lead time starting from the order. Greater the ratio, more planning and production needs to be done based on speculations. When goods are manufactured-to-stock (MTS) the speculation time is the longest. However the delivery can take place rapidly as the goods are manufactured in advance. Accordingly this model provides the lowest customizability. Assembled-to-order (ATO) and manufactured-to-order (MTO) models represent the mid-cast in the P:D-ratio. Main difference between the models is the principle of stocking the material in ATO. Engineered-to-order model (ETO) means that the products are designed according to customer needs. However the customizability comes with the longer production lead-times. Nature of the products naturally guides the selection of the most suitable CODP.

4.2.4 Best Practises for Implementing BPM Initiatives

As noted by Zairi (1997) BPM literature provides a vast array of methodological approaches for executing change and improvement initiatives. This paragraph presents two of them. Both models can be used for managing incremental improvements as well as major changes. Firstly, Figure 16 shows Six Sigma Process Improvement Model also known as DMAIC.

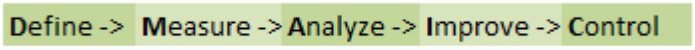

Figure 16. Six Sigma Process Improvement Model (Krajewski et al 2006:84)

It consists of five steps. The Define-step aims to find the boundaries of the process and to define the inputs and outputs of the process. This initial step is crucial for the success of the whole improvement in question as a well-defined scope provides guidance in the following phases. In order to evaluate the process, metrics need to be established. Analysing this data tells where the improvements are needed. Once the improvements are made, the enhanced process needs to be controlled to maintain the performance level.

A more detailed approach is presented by Harrington (1995). His model consists of five phases divided to 27 key activities as shown in Table 9.

PHASE	KEY ACTIVITIES
Organizing for quality	Defining critical business processes Selecting process owners Defining preliminary boundaries Forming and training process improvement teams Boxing in the process Establishing measurements Developing project and change management plans
Understanding the process	Flowcharting the process Preparing the simulation model Conduct a process walk-through Performing process cost and cycle-time analysis Implementing quick fixes Aligning the process and the procedures
Streamlining the process	Process redesign (focused improvement) New process design Benchmarking the process Improvement, cost, and risk analysis Preferred process selection Preliminary implementation plan
Implementation, measurements and control	Finalized implementation plan New process implementation In-process measurements Feedback system Poor-quality cost
Continuous improvement	Major breakthrough in performance Process improvement must continue Natural work teams or department Improvement teams take over

Table 9. The process breakthrough methodology (Adopted from Zairi, 1997:71)

Even though this model takes the activities on a more detailed level a similar pattern to DMAIC can be recognized: problem recognition – quantification - taking action – measuring - keeping control. Still, differences can be found as well. Process breakthrough methodology emphasizes the importance of each process having an owner. This viewpoint is supported by Mele and Colurcio (2006). Without centralized coordination the processes become fragmented.

4.3 Conceptual Framework of the Thesis

This chapter targets to illustrate how the existing knowledge can be utilized in finding the resolution for the problems identified in the CSA. The Conceptual Framework of this thesis consists of two elements. The elements are change management related actions and process related actions as shown in Figure 18.

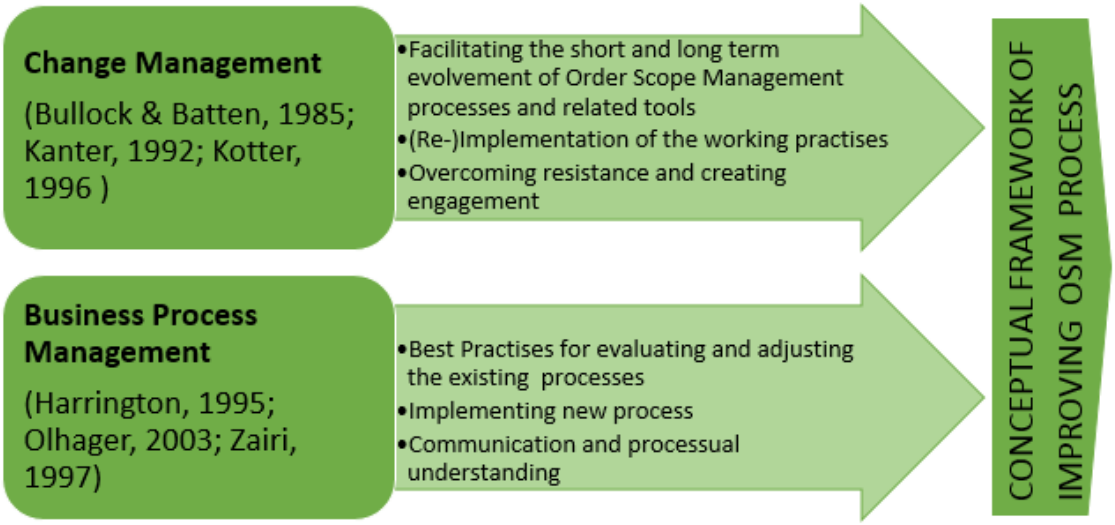

Figure 17. Conceptual Framework of the thesis

For facilitating the changes in the Order Scope Management process and the related tools, managerial actions are required. The actions need to be in two steps as a holistic and robust solution is not feasible within the timeframe that such a solution would be needed. The short-term managerial actions are needed to solve the problems at hand immediately. As indicated in the CSA, the need for the improvements is instant. Hence the short-term target is identifying the actions needed and implementing them. Long-term actions are needed in mapping the future tool and process options, and crafting the implementation plan accordingly. As the working environment of the case organization will be disrupted by these changes it is crucial to plan the activities well to avoid a dramatic drop in performance and secondly to engage employees.

Like the above description of the change management side of the Conceptual Framework shows, the business process management side is an inseparable part of the proposal. The process-related actions are the practical, operative, part of the Conceptual Framework. The CSA revealed OSM Process and its sub-processes to suit the case organization's purposes with minor remarks. However, the CSA also showed suitable lead-time models to be a prerequisite for the success of the OSM process. Thus the processual approach is needed in crafting the recommendations on how to improve the flexibility of the lead-time model.

5 Building the Initial Proposal

This section merges the results of the Current State Analysis and the Conceptual Framework towards the building of the proposal.

5.1 Steps of Building the Proposal

The objective of this thesis was to propose improvements to the case company's Order Scope Management Process. The process consists of two sub-processes, change request and change order processes. The first one targets to clarify the impacts of the customer's request to change the scope and the latter to execute the changes as planned. Currently the case organization's process is not working efficiently leading to additional expenses and delayed deliveries. As a basis for the proposal a Current State Analysis was carried out. The analysis was a reality check for current practices, tools and instructions. It was performed as a multiple case study containing two cases. The cases selected were projects where the scope of the supply has been changed during the production thus interrupting the planned workflow. The data for the analysis was gathered by interviewing ten persons, in total, who had been involved in the cases.

The Current State Analysis revealed five weaknesses altogether. The first one is the widely spread neglecting of the change request tool. The current tool is not used as it should be due to various reasons. One of the reasons is the outdated Lotus Notes platform of the tool. Now emails are used instead of the tool. Hence the process is lacking traceability and transparency. The commitment to the unofficial requests is weak and leads to problems in the change order stage. In addition, the workload caused from the requests is now uncontrolled. As the workload does not appear in metrics, under-capacity in the workforce is a constant. This can be seen, in particular, in the Engineering department that is the bottleneck of the process.

The second finding of the CSA was a flaw in the change order task flow in the tool. In the current flow purchasing gets a notification about the changes after the engineering activities are completed. This leads to additional expenses as the material could have been cancelled once the change was initiated.

The third and fourth finding emerge from unclear (or unknown) instructions. Firstly, current practices in handling the project's on-hold status are unclear. Secondly, a related theme is the inability to recognize the needs of the next process step. The case organization's tools and process are capable, to some extent, of steering the change initiatives

to the right direction. However, detailed understanding of the influence of each role to the overall success of the change processes should be internalized in all functions.

Finally, as a fifth finding the order scope management process was found to suffer from discrepancies derived from the lead-time model of the case organization. The current ETO model lead-times are too short for complexed projects. Still, in the market the demand for even shorter lead-times exists. This dilemma needs to be solved not only for improving the case organization's operations, but also to facilitate the value co-creation experience with the customer.

The CSA findings guided the selection of the literature that is used to anchor the thesis to the existing knowledge. Two relevant fields were selected for exploration. Firstly the best practices from Change Management literature were reviewed. This area was selected as all the observations of the CSA turned out to be related to implementing new practices and bringing change to the organization. Secondly business process management literature was reviewed. This field forms the other corner stone of the proposal as the CSA showed some process flaws.

For building the proposal, findings from the CSA and existing knowledge are supported by substantial knowledge from the case organization. In this thesis, the input is called Data 2 (refer to Figure 4. Research design of the thesis). The main contribution to this data comes from the development team that was set up by the management team of the case organization. The development team consists of six sub-groups that are each targeting to solve a problem hindering the case organization operations. The proposal was crafted in one of these sub-groups, but supported by the other relevant stakeholders. Details of building the proposal will be discussed in the next chapter. Throughout this and the following chapters, the order of the proposal reflects the five weaknesses found in the CSA.

5.2 Building the Proposal

The proposal building stage consisting of meetings and interviews as described below. The logic of the CSA findings will be followed, going through the resolution creations point-by-point.

5.2.1 Change Request Tool

The CSA showed that the Change Request tool is fully operational but not used due to various reasons. However, the importance of the request-stage was understood by the interviewees, even though they did not use the tool. One of the reasons is the obsolete

platform, Lotus Notes, on which the tool is built. Motivated by the future prospects of the tooling and a need to get a helicopter view to the topic the Global Engineering Tools Manager (data 2c) was interviewed. The Informant provided a valuable global and long-term aspect to the issue:

> "In crafting the proposal for the thesis take into account the group's IT strategy. It target's to reduce unnecessary bonds between the actual production organizations and resources like engineering, purchasing or sales. This highlights the need for a tool that is not local".

Even though the objective of the study is to propose improvements to the case organization's practises, the software and platforms usually come from Group level. In addition the informant provided contacts (data 2d and 2e) that could enlighten the options for the future tools. Based on these interviews initial mapping for the future options was made. It can be found in Appendix 4, data 2f. A more detailed discussion of the tools is not relevant in the context of this study.

Instead, the interest is on the managerial aspect to the problem. The development team discussed this topic widely when the proposal was built. All group members agreed that neglecting the use of the change request tool is the root cause for many unsuccessful change initiatives. Also the poor usability of the current tool was mutually recognized. The discussion can be condensed into two facts. Firstly the current tool is not the optimal one, but it works. Secondly, the alternative platforms for the tools are not ready for the implementation. As a result the development team ended up with a two-step proposal. In the initial step the current tool is taken back to use. Simultaneously the activities for selecting or developing a new tool needs to be started. In both steps the bottom line is the efficient implementation of the new practises by engaging the employees.

5.2.2 Task Flow of The Change Orders

A minor discrepancy in the task flow of the change order process was first considered as insignificant item by the development team. As the CSA showed instead of the tool informing the purchasing it can be also done by more flexible ways, e.g. by email. However the Development Engineer in the group started to quantify what the miscommunication means in monetary terms (data 2f):

> "We have roughly 4000 changes per year. Let's assume that in half of the cases the improved work flow would bring some saving. Even if the savings were some hundreds of Euros the total sum is remarkable".

A six-digit saving potential, even if a rough estimate, assured the development team members that this adjustment is worth making. Especially considering the fact that it is also the easiest finding to fix. The case organization has a Continuous Improvement (CI) process that is in place to overcome operational issues such as this. A key element of

the CI activities is that the initial impulse can be raised from anywhere in the organization and it is then guided for a resolution in the right function. The development group unanimously considered the change order task flow to be most effectively corrected by utilizing the CI activities.

5.2.3 *Project On-Hold Status and OFP Understanding In the Case Organization*

Even though findings three and four are listed as separate findings in the Current State Analysis, they can be solved together as communication is the underlying theme in both findings. In addition, efficient handling of the project on-hold statuses requires a deep understanding of the OTD process. In the CSA interviews various interviewees mentioned the information coming from upstream to be insufficient for doing their part of the process. In the workshop the Mechanical Engineer of the development team pointed out the equal importance of understanding the upstream side of the processes:

> "It's just not my part of the process and the following steps that I need to understand. Also the earlier steps contribution to the whole change process needs to be internalized so that I can pass on the relevant information".

Other development team members agreed that a holistic understanding of the process leads to the best result. The development engineer noted this is the approach utilized also in the instruction which is under preparation. According to the development engineer new "*Guideline for project hold, postponement and cancellation*" should be launched within May 2016. The document is not only internal instruction of the case organization, but it sets the rules for cooperation with LSUs in the situations mentioned in its title. While writing this, the documents are still in the approval process by the stakeholders.

Nevertheless the development team finally decided to propose combining the introduction to the new guideline and a process recap. The topics nicely merge into one training set that covers the key issues found in the CSA. Training can be combined for example to weekly team meetings.

5.2.4 *Lead Time Model*

When the author introduced inflexible lead-time models as one of the CSA findings for the development team, conflicting reactions emerged. The Electrical engineer of the team resisted by making this point about the proposal:

> "We are supposed to propose improvements to the order scope management practises. Now we are stepping one level above it. If we go on that road, we will soon end up taking a stand to pretty much anything that happens in our company".

However after intense discussion followed by the comment, the development team members agreed that many failed scope change initiatives are derived from the lead-time models working on ETO basis. Even though the customization level of the products is

very high, the case organization commits to the certain delivery date in order booking. LSU can use the product configurator to calculate the delivery date. However the preliminary engineering stage, the ideal time for scope changes, is relatively short in the complexed minimum lead time orders. In demanding projects including e.g. strict customer specification it is typical that the documents are revised several times, before they are accepted by all the parties in the supply chain. Therefore the changes often occur after the final engineering is finished or even when the production has started. Changes in the late stage of a project result in a delivery postponement and invoicing is postponed accordingly. The development engineer noted that:

> "It's not only our processes that are not working properly but sales configurator and LSU personnel's skills that should be improved too".

The statement holds true to some extent. Nevertheless, even if the sales configurator and its users were even more professional, in delivery time postponement cases the capital remains bonded longer than expected. To tackle the challenge of making the scope changes in the production stage and to improve capital efficiency the development team decided to propose a two-step lead-time model, where engineering and production steps would be separated.

5.3 Proposal Draft

This chapter describes in detail the proposed improvements to the order scope management practices. The solutions proposed are anchored by the evidence from the CSA and on the other hand by best practices from the existing knowledge. The previous chapter described the steps of building the proposal and gave rationale for the decision made. This chapter aims also at underpinning the rationale given.

5.3.1 Change Request Tool

The recommendation to overcome the issues with the current Change Request Tool and its usage comes in two steps. Firstly, the current change request tool should be taken back to use as soon as practical. Even though the platform is not ideal it would effectively solve the discrepancies discovered in the CSA. The usage of the tool would (a) increase the traceability and transparency of the change request process, (b) increase the accuracy of the change requests as sloppy handling of the request could be traced afterwards and (c) bring the related work load visible, as the Lotus Notes Change Request Tool has a functionality to follow that. None of the competing platforms can solve currently all the three shortages caused by neglecting the change request tool usage.

The re-implementation of the Change Request Tool will face resistance for sure. The employees are used to working in more flexible ways, using mostly emails to communicate the request. In the change implementation points a, b and c above are the main arguments in creating a sense of urgency for the employees. Each of the arguments is supported by a related benefit for employees. Improved traceability and transparency will decrease the workload in the organization as it will make the change process detached and independent of certain individuals. The change request, the clarification stage is often done by another person than the change order, implementation stage. Hence the handler of the change order is often forced to additional clarifications to follow the logic and details planned in the change request. Once the change request tool usage becomes expect accuracy of the clarification will improve. In the current informal working methodology haste is overriding the quality. In the CSA several interviewees mentioned inadequate resources for handling the change requests properly. The main advantage for the employees is that once the workload can be proved to be existing, it can be also taken into account in the resourcing of the case organization. Thus the relative workload per employee will decrease over time.

Communicating the advantages is crucial for engaging the employees in the change. A probable counter-argument is the fear of the increased handling times of the change request. To overcome this challenge the handling times for the change request need to be determined. The current tool has a possibility to monitor the handling times of the requests. The Line manager's responsibility in each department is to follow up the throughput times closely and take corrective action if required. Metrics showing short handling times are an efficient way of showing employees that the re-implementation has been successful and worth doing.

Even though the Lotus Notes change request tool can bring a quick solution to the problem, it is an obsolete platform and will disappear from the case organization's tool selection within some years. Accordingly, the second recommendation is about facilitating the long term evolvement of the change handling tools. This thesis maps the current options for a new tool (Appendix 2). However each of the options require deeper clarifications that are not in the scope of this thesis. It is recommendable to establish a guiding team consisting of one or more employees from each function to primarily finalize the clarifications and secondarily to select and implement the new tool.

5.3.2 Task Flow of The Change Orders

The task flow of the Change Orders should be adjusted to notify the purchasing immediately once the Change Order is created. Currently the system notifies first the electrical

engineering and then mechanical engineering. The purchasing is not notified about the change until the engineering part is finished. As the engineering step might take anything from hours to several weeks depending on the scope of the change, the purchases of the project might proceed significantly in meanwhile. If the purchasing were notified timely when the change order is made, the material purchases subject to change could be put on hold or cancelled. Therefore an additional step needs to be added to the workflow of the change orders. First a notification should be sent for purchasing to indicate that changes are expected.

Currently the purchasing is notified by email. This is a fast method but email has a limited audience. Especially in special situations like in a holiday season email information gets easily lost. Email can be used as a supporting tool in case the changes are urgent and massive in nature. Another supportive element that should be used by the project management is the Special Purchasing Requirement-functionality in the SAP. This feature has been designed for communicating important issues for purchasing. If changes are expected purchasing should be put on hold by utilizing this functionality.

Despite other means to prevent unnecessary purchases and related capital expenditure workflow adjustment is worth doing as it is a relatively small task. The case organization's Continuous Improvement activities will be utilized to implement the change. Once the impulse is done it will be evaluated by the relevant stakeholders, in this case the purchasing department. Once the impulse is unambiguously formatted, it will be forwarded for the party responsible for the development of the tools. The new workflow will be operational upon the next release of the ERP system, within some months. Before the release, the purchasing team needs to be informed about the improved practice.

5.3.3 Project On-Hold Status and OFP Understanding In the Case Organization

The new instruction, "*Guideline for project hold, postponement and cancellation"* is about to be ready. It should be released shortly after this thesis is completed. The CSA clearly showed that there is a need for such a document. The CSA also revealed that all employees do not recognize their role in the overall order scope management process. Hence it is useful to implement an OFP recap to the training sessions of the new guideline. As this document is all about how the case organization's different departments should work in unusual circumstances, e.g. remarkable postponement of the order, merging the topics is a perfect match.

All the operative functions should be familiarized to the new guideline. It is practical to combine the training session for example to a weekly team meeting. To highlight the importance of the processual understanding the training session should be planned for

each department separately. Expected inputs and outputs should be understood. Also bonding the individual employee's significance to the success of such special situations should be highlighted.

5.3.4 Lead-Time Model

The CSA revealed that the case organization's lead-time model is not working from the order scope management perspective when the projects are complexed. The main issue is the case organization committing to a certain delivery date, even though the value-adding co-creation by changing the documents (and accordingly the structure) cannot be done within the time period reserved for it. Projects with a risk for remarkable changes can be usually recognized in the sales stage. Demanding customer specification and high level of customization are typical warning signs. Hence in this type of projects it is recommendable to commit rather to certain lead-time after the customer releases the design for manufacturing, than to a fixed delivery date. Figure 19 illustrates the proposed model.

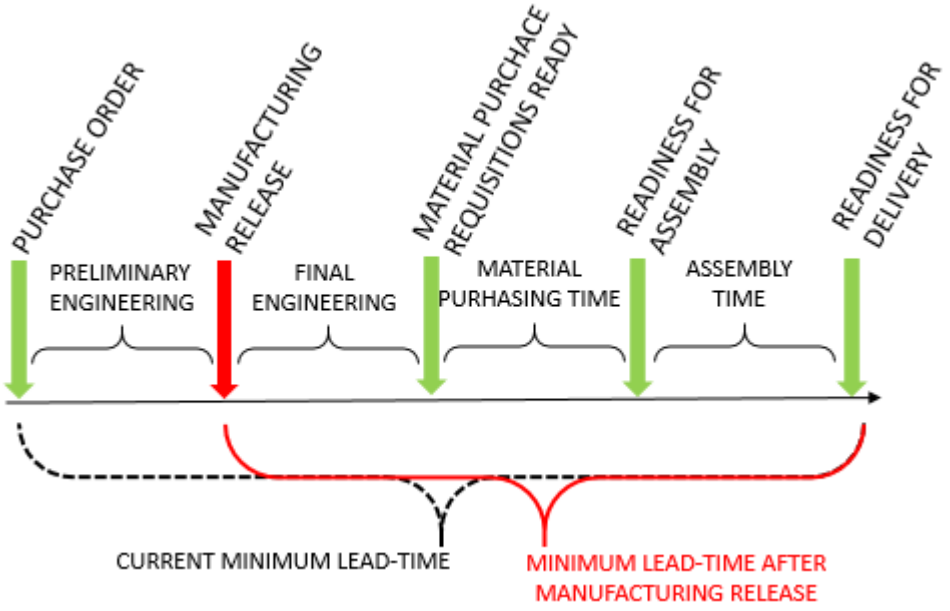

Figure 18. Comparison of the current and proposed OFP model

In the proposed lead-time model the preliminary engineering, i.e. phase for creating and modifying the documentation, would be detached from the lead-time of the actual product. The delivery date would be confirmed once the manufacturing release is given. The most suitable indication of the release is approving the documents.

As discussed in chapter 5.2.4, also alternative approaches to tackle the challenge of current lead-time model can be introduced. Increasing the level of product knowledge in LSU's or improving the sales configurator cannot change the situation dramatically, but

the evolvement will be incremental in nature. In addition, based on the author's experience, communicating the final scope adjustment with the project documentation is common practice within the industry. Thus even the most detailed plans in the sales stage might be modified in the project execution stage. This highlights the significance of the flexibility in the production unit.

LSUs have central role in implementing the proposed lead-time model. Using the new model in the project execution needs to be the decision of the customer. Related advantages need to be clearly communicated for customer buy-in. The proposed model provides three benefits for the customer side. Firstly, flexibility would increase in the order scope changes. The scope could be adjusted freely until the documentation is fulfilling the acceptance criteria of the customer. Secondly, the price for the changes would decrease as there would be no rework costs. In the current model order scope changes often cause rework costs as the changes are made on existing products. Thirdly, due to absence of the rework cost evaluation the change request process would be faster. In the current model a remarkable part of the evaluation work is to determine the cost for rework.

The case organization can be seen benefiting from the new arrangement in two ways. First of all the capital efficiency will improve. Until the manufacturing approval is given only costs involved would be from engineering, which typically are a fraction of the total project budget. Once the manufacturing approval is given the right material can be purchased at once. Need-based timing of the material deliveries respecting the production schedule minimizes the capital tied to stock. Secondly, as a contribution to the objective of this thesis, the proposed model releases resources from labour intensive structural changes during the production. All process steps from engineering to work shop employees would face less rework.

Released resources could be utilized by focusing on efficient and disciplined execution of the change request process. The last proposal thus closes the loop by connecting the lead-time model change to the re-implementation of the change request tool.

5.3.5 Summary of the Proposal

This chapter summarizes the section by presenting the initial proposal in a nutshell. Even though the proposed actions are seemingly loose from each other, they all are targeting to improve order scope management practises within the case organization. Table 11 shows the CSA findings and related initial proposals.

FINDINGS FROM THE CSA	INITIAL PROPOSAL	UTILIZED EXISTING KNOWLEDGE
1. Change Request tool not used as instructed	Current Change request tool needs to be taken to use. Search for a new tool needs to be started.	Kotter (1996), utilizing planned change approach in re-implemetation; Kanter *et al* (1992), ten commandments as a framework for long term evolvement of the tools
2. Task flow in the Change Order tool is not adequate	Task flow to be adjusted as a Continous Improvent activity	Krajewski *et all* (2006), Six Sigma Process Improvement Model
3. Practices for communicating the project holds and other special situations are not clear	New guideline for handling such situations is about to get ready, implementation plan to be established	Kotter (1996), utilizing planned change approach in implemetating the new practises
4. General lack of understanding the next process steps needs	Process recap in team meetings	Zairi (1997), Success factors of BPM initiatives, aligning the employees to the case company goals
5. Current lead-time model not suitable for complexed projects	Alternative two-stepped model to be implemented	Olhager (2003), adjusting the Customer order-decoupling point

Table 10. Findings from the CSA, initial proposals and the body of knowledge utilized in the proposal building.

The first proposal is to take the current change request tool back to use. The tool is fully operational, but it is not used. This will solve the order scope management problems ensued from the change request process. However the tool's platform is obsolete and the search for replacement needs to be started.

Secondly the task flow in the change order tool needs to be adjusted. Currently the system does not notify the purchasing about on-coming changes. As the purchasing receives the change notification once the other steps are completed, additional costs might have cumulated in the meanwhile. An additional step for notifying the purchasing first needs to be added.

The CSA finding three and four can be resolved by arranging training that introduces to the staff the new instruction "*Guideline for project on-hold status, postponement and cancellation".* The training session can be department specific, so that each function's role in the over-all process could be highlighted.

Finally as fifth proposal an alternative lead-time model should be implemented. Current lead-time model, based on fixed delivery date, does not enable changes in the scope of supply within the time reserved for them. Thus a model with delivery time commitment starting from manufacturing release (e.g. design approval) should be established.

6 Validating the Proposal

This section explains how the initial proposal is validated by subjecting it for a critical review of the case organization's management team. First the validation process itself is explained. Secondly the findings of Data Collection 3 are discussed. This is the case organization's management team's input. Finally the section merges the findings of Data 3 with the initial proposal, thus creating the final proposal.

6.1 Validation Process of the Proposal

The initial proposal was co-created in one of the contemporary development groups targeting to improve the case organization's operations. The OSM group's first meeting was set up to discuss the objectives of the group and means for achieving them. The Current State Analysis, being in progress at the time, was considered to be a solid basis for the sub-group's work. Once the CSA was ready the group gathered to discuss the findings and to turn them into a development proposal.

The development team's initial proposal was presented for the management team of the case organization. All the sub-group's proposals were introduced simultaneously. Due to conflicting schedules the author was not able to participate in this meeting and therefore a specific feedback meeting for the OSM group was arranged with two of the management team members. This can be seen as an advantage for the proposal as in the earlier meeting with a full agenda some features of the proposal might have been ignored. Now the discussion about each proposed improvement was comprehensive and constructive. A second leverage comes from one of the management team members, who is about to move in a business development role. Driving changes like this one in the case organization will be this informant's main duty. Thus the final proposal formatted based on the data 3 collection meeting can be seen to have a positive drive.

6.2 Management Feedback on the Proposal

The initial proposal was presented to two members of the case organization's management team. The recommendations were discussed point-by-point and key findings were recorded in meeting notes (Appendix 5). This chapter summarizes the feedback received, thus helping in formatting the final proposal.

The first recommendation was to take the current CR tool back to use. In the validation meeting it was found out that the existing platform, the outdated Lotus Notes, will be disappearing from the case organization's software selection sooner than expected by the development team. Therefore the management team does not consider forcing the current tool back to use to be the right decision. However, one of the alternative solutions

introduced in data 2f has been found attractive. This SharePoint-based tool has been recently developed to an advanced stage. As it needs finalizing, it has not been implemented to operative use. In addition, another unit of the group is interested in co-creating the final tool. As the development of the tool is not within the scope of this thesis the management team expects the focus to be in the implementation plan. The long term aspect of the recommendation was agreed to be relevant. Development in the case organization's IT systems has to be followed closely to find supportive tools for LSU cooperation.

The second recommendation was to change the task flow in the CO tool. As the author presented the possible gains from this improvement, the proposal was accepted as it is.

The third recommendation was the implementation of a new instruction "*Guideline for project on-hold status, postponement and cancellation".* The proposed improvement was considered sufficient, but one sided. The management team noted the new instruction needs to extend to LSU cooperation as well. Thus also the plan for implementing the instruction to the LSU level needs to be included. It was argued by the author that the objective of the study was to improve the OSM process within the case organization. However the LSU communication aspect was seen to be such a remarkable factor in implementing the instruction that it needs to be included in the final proposal.

The fourth recommendation was to have process recaps in the teams in order to improve the processual understanding and this way improve the efficiency and fluency of the OSM process. The importance of the recommendation was highlighted by the management team. Accordingly, more depth to the recommendation was requested. One of the informants formatted the need as follows:

> "Current instructions regarding the change situations are not guiding enough. The new instruction for special situations will ease the special situations only. However some sort of a rough modelling of "ordinary" change processes would be needed as well. These models are needed primarily to guide the change initiative on the right track from the beginning."

The communication side of the problem was considered to be in an important role in the resolution. Therefore the models requested should also contain clear responsibilities as well as clear process inputs and outputs for each stakeholder. The management team noted that within the time constraints of the thesis a preliminary version of the models is expected.

Finally, as a fifth recommendation, the development team suggested implementing a new two-step lead-time model, where the documentation stage would be separated from

the production stage. As revealed by the initial discussion in Data 2 stage, the case organization's management had already started to prepare the organization for this change. A team targeting to refine the model had been established. The implementation is expected by the end of Q2/2016. Accordingly, the expected outcome of the thesis is to craft a proposal on how to take the model to use. The case organization's management also noted that there is even a third model for executing the projects. If the delivery is not time-critical, the documentation can be done as an engineering order. The price of the documentation is then deducted from the actual product price once the order is made based on the approved documentation. This additional model needs to be part of the final proposal.

6.3 Final Outcome

This chapter presents the outcome of the thesis. It is formatted from the development team's initial proposal by modifying the suggested actions according to feedback received from the case organization's management team. All the five points of the initial proposal were recognized to be purposeful for the case organization. Thus, the final outcome presented here is the implementation plan for the proposed actions. The descriptions and rationale for each item is given in textual form and supported by the appendices. Table 12 shows the evolvement from proposals to final outcomes.

INITIAL PROPOSAL	FEEDBACK ON PROPOSAL	FINAL OUTCOME
1. Current Change request tool needs to be taken to use. Search for a new tool needs to be started.	Current platform will dissapear sooner than expected. New tool on another platform is planned.	Implementation plan for the new Change Request tool
2. Task flow to be adjusted as a Continous Improvent activity.	Ok, can be implemented as proposed	Task flow to be adjusted as a Continous Improvent activity
3. New guideline for handling the Holds and Cancellations is about to get ready. Implementation plan to be established.	Such a situations involve LSU as well. External processes to be taken into account. How to engage LSUs?	Implementation plan for the new instruction taking into account internal and external activities to be established.
4. Process recap in team meetings	Needs more depth. Guiding models showing tasks, responcibilities and communication flows needed for different types of change initiatives.	Process description and implementation plan for different change scenarios.
5. Alternative lead-time model to be established	The new lead time model is being developed. Plan for implementation needed. Possibility for document order to be included.	Implementation plan for alternative project execution models.

Table 11. Initial proposals, related feedback and final proposals.

Implementation plan for the new Change Request tool. Firstly, the implementation of the new CR tool will face resistance as the re-implementation of the current tool would have done. The initial proposal provided a solution to three problems. It would have (a) increased the traceability and transparency of the change request process, (b) increased the accuracy of the change requests as sloppy handling of the request could be traced afterwards and (c) make related work load visible. The new platform selected by the case organization's management team solves point c only partly – the handling times of CR's cannot be measured, but at least they all are in one location thus enabling centralized handling.

Points a, b and c above remain as the main arguments in creating a sense of urgency for the employees. Each of the arguments is supported by a related benefit for employees as introduced in chapter 5.3.1. The case organization's management should utilize these benefits in introducing the new tool to the organization. Once the idea is introduced, a voluntary-based coordination team for the new tool development and implementation needs to be established. The coordination team consisting of at least one

member from each function is responsible for designing the tool to suit the case organization's purposes. It also enables the employee's engagement in the usage of the new tool by creating a positive atmosphere among peers. Informal communication, e.g. lunch conversations, and formal training are utilized. A detailed plan with a break-down of responsibilities and schedule for implementing the new tool are shown in Appendix 6.

Change order task flow. The second recommendation is not discussed further here as the implementation will be according to chapter 5.3.2.

Implementation plan for the new instruction "*Guideline for project hold, postponement and cancellation"* is extended to cover the LSU cooperation. In addition to the case organization's internal activities described in chapter 5.3.3., the new instruction needs to be internalized in LSUs. The need for these special situations described in the guideline is initiated by the customer. Thus LSUs are in a key role in explaining to the customer the impact of on-hold status, postponement or cancellation and then efficiently communicating the feedback to the PU. Project management, being the contact point of LSUs, has an important role in bringing the instructions to the operational level. The key content of the instruction needs to be summed up as a presentation and shown to the external peers e.g. in the form of a webinar. Roll-out to all LSUs can be done at once, as this full-scale implementation does not include an operational risk, but strengthens the basis for the cooperation. Further details about the implementation activities and schedule are given in Appendix 7.

Process description and implementation plan for different change scenarios. Fourthly, to support the process recap and future development of the tools, three alternative change scenarios are made. These scenarios are also an instruction on which path to proceed with a certain type of scope of supply modifications. Thus, by acting according to commonly agreed rules, the scenarios will standardize the handling practices for different types of changes. The scenarios are (a) minor change, (b) standard structural change and (C) major structural change. This division was proposed by the case organization's management.

The main strength found in the CSA, i.e. recognition of the natural working flow within the case organization, was a good basis for the models. Guiding rules in building the models was involving only the stakeholders really needed and avoiding unnecessary work. The case organization's current instructions were utilized. The initial models and implementation schedule is show in Appendices 8 and 9.

The implementation plan for alternative project execution models is established. The plan also covers the existing engineering-order model, which has not been familiarized for the LSU clearly enough. The case organization thus has three alternative project execution models (or depending on the point of view “lead-time models”): (a) normal fixed lead time model bonded to a certain delivery date, (b) two-step flexible lead-time model, where the manufacturing activities are started once the documentation is approved and (c) engineering-order, where the documentation is ordered as a separate service, and the product itself ordered according to the documents later on. The alternative project execution models b and c increase the flexibility of the OSM process by facilitating the value-adding co-creation by document updates. However, the models simultaneously target at reducing the inventories, as the capital-bonding purchasing activities start as late as possible.

The management of the case organization naturally acts as a facilitator for the on-coming change. In the initial stage the management’s duty is to monitor and guide the work of the development team setup up to refine the model. To engage the rest of the employees the information about the new model should be shared as soon as practical. This information sharing should be extended to the selected LSUs for collecting preliminary feedback on the models and for probing for pilot cases. The development team refines the model and also prepares the instructions and presentations needed in the roll-out. This material is in a huge role in the implementation of the new models as it is supposed to “sell” the new models for internal and external stakeholders. Especially the project management, whose duty the training of the LSUs will be, needs to understand deeply the pros and cons of each option. Detailed tasks for each stakeholder on a time line can be found in Appendix 10.

To sum up, the author recommends assigning a sponsor to each of the proposed development activities. Even though the implementation plans and schedules shown in the attachments specify the actions required from each party, the coordination and keeping up the momentum of the changes needs to be ensured. Plans and schedules presented in the thesis are preliminary creations of the author. Hence, involving the employees widely enough is required to increase the engagement in the proposals and to reduce the resistance. Wide acceptance of the individual change initiatives also smoothens the path for a proactive development culture, where change is seen as a normal state. Facilitating such a development is crucial also for the long term evolvement of the OSM process.

7 Discussion and Conclusions

This section first summarizes the content of the thesis and then suggests the next steps after the activities proposed. Secondly the thesis is evaluated by comparing the outcome to the objective and by assessing reliability and validity.

7.1 Executive Summary

The objective of the thesis was to propose improvements to the Order Scope Management process of the case company. There are two existing sub-processes, one for clarifying the impacts of the changes requested by the customer and a second one for implementing them. The latter process, the Change Order Process, does not always, however, meet the commitments made in the first one process, the Change Request Process. The research question of this thesis was to find out why the Change Orders do not actualize as quoted based on the Change Requests.

To create a solid methodological basis for the thesis, a well-known research approach was utilized. The research design of the study is based on a multiple case study approach. The cases were projects that had passed through the OSM process. The case studies formed the Current State Analysis of the order scope management process. The Current State Analysis was carried out by interviewing the employees related to two exemplary projects that had been through the Order Scope Management process. Analyzing the interview notes revealed five weaknesses hindering the Order Scope Management process. Based on these findings the existing knowledge was selected. As the findings were partly managerial and partly process related problems, the relevant fields to explore were Change Management and Business Process Management.

The findings of the Current State Analysis and existing knowledge were merged as a Conceptual Framework for this thesis. This framework guided the building of the initial improvement proposal that was co-created together with a development team set up specifically to overcome the challenges of the order scope management process. The development team's initial proposal was validated by the case organization's management team. The final proposals were (a) Implementation plan for the new Change Request tool, (b) Change order task flow to be adjusted as a Continuous Improvement activity, (c) Implementation plan for the new working guideline to be established, taking into account internal and external activities, (d) Process description and implementation plan for different change scenarios (types) and (e) Implementation plan for alternative project execution models.

7.2 Managerial Implications

This chapter first draws two conclusions for the managerial purposes. Then an approach for the near future activities after the operational implementation of the proposals is given. Finally the chapter discusses the future development needs loosely related to the OSM process.

The first conclusion is that the OSM process and related tools should be seen as an entity. Improving only one part makes next part outdated. This has happened for example with the CO and CR tools. As the CO tool has been developed by closely listening to all the stakeholders, its shadow is now covering the CR tool. This leads to an unbalance between the tools and divergence to the processes. The second conclusion is that despite all the efforts to improve the OSM process within the case organization, the external stakeholders always have a major impact on the success of the change initiatives. Hence, cooperation and fluent communication with LSUs and customers facilitates a reciprocal change process targeting at maximizing the value for all parties.

The primary managerial action recommended by this thesis is following-up on the proposal's implementation. The actions proposed in the thesis are mostly on a conceptual level. When taking them to the operational level practical problems will be faced. The management teams' duty in such situations is to help the employees forward by guiding and removing possible obstacles. Secondly, as noted in the above conclusions, facilitating the long-term evolvement of the OSM-related process and tools requires probing the future and following up closely the development of the IT tools in the case organization. The actions proposed in this thesis are based on the current knowledge, but considering the pace of change within the IT field thorough re-evaluation is needed within some years. However, the existing knowledge presented in this thesis is a substance that can be utilized in the later reviews.

This thesis also revealed several other areas for future development. These findings were excluded from the scope, as they didn't meet the objective of the thesis. For example the need for strengthening the process ownership on all levels, sales configurator improvement and investigating the communication in the case organization's value chain can be recognized from the collected data. Especially the two last ones would benefit greatly from involving the LSUs in creating the new solutions.

7.3 Evaluation of the Thesis

Firstly this section evaluates the reliability and validity of the thesis in comparison to the plan in chapter 2.4. Secondly, it compares the outcome of the thesis to the objective.

7.3.1 Reliability and Validity

Reliability and validity were planned in paragraph 2.4. According to planning, the validity is assessed in terms of construct validity, internal validity and external validity. Construct validity was built in to the research design of the thesis. The evidence trail is clearly shown and it consists of several informants from all the departments of the case organization. The data collection is done in a disciplined manner and the findings are clearly presented in this thesis. As the research was done using qualitative methods, additional evidence in the form of quotes is used to support the author's interpretations.

Internal validity refers to validity of the data analysis. In this thesis several tactics were used, including pattern matching, explanation building and addressing rival explanations. External validity in a multiple-case study can be tested by using a replication logic in research design i.e. can the findings from an individual case be used to explain another case. As the case organization's projects are rather heterogenic, the findings of this thesis might apply to other projects as well.

Reliability refers to the quality of the study. If the research was repeated by another researcher the results should be the same. In this thesis reliability is achieved by using a case study protocol and case study database, the field and meeting notes. The case study protocol was the plan for the research work and guided the research work for example by creating a uniformed structure to the interviews. The case study protocol of this thesis can be found in Appendix 5. Also a wide selection of academic and business literature increases the reliability of the study. However depending on the project, different employees from the organization could have been interviewed. As the perception of complex organizational systems such as the OSM process varies greatly between individuals, this might have changed some of the CSA findings. Nevertheless, the most severe findings seem to be so widely recognized within the case organization that they would have come out in any research.

Finally can be concluded, that the reliability and validity of this thesis are on a credible level.

7.3.2 Outcome vs Objective

The objective of the thesis was to propose improvements to the Order Scope Management process. The objective was set in the initial stage of the thesis project. It was based

on an assumption that something was wrong in the sub-processes of the OSM process, as the COs do not always actualize like quoted based on CRs. The current state of the OSM process was mapped by interviewing employees related to two exemplary cases. Based on the thorough interviews it was found out that that basic design of the OSM process is supporting the natural working flow of the case organization. However operational implementation of some parts of the process and related tools were done insufficiently.

The outcome of the thesis is an implementation plan to overcome the discrepancies identified. Thus, the outcome corresponds to the objective of the thesis. However the outcome leaves room for a rhetorical objection. Some of the proposed actions were not actual corrections to the OSM process itself, but more aimed at facilitating the success of it by modifying the process inputs. Accordingly, it can be argued whether the objective was, in fact, met. Nevertheless, as the core problem, the hit rate between the CR and CO, is likely to improve, the outcome can be seen highly purposeful from the case organization's perspective.

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Data 1 Interview template

Field Notes of the Research Interview

Reference

Topic	
Data collection step	Data 1x
Informants position	
Method of interview	
Date of the interview	
Duration of the interview	

Field notes

#	Topic(s) of the interview	QUESTIONS	NOTES
1	**Current state of the Change Management Process**	Can you roughly explain the CMP flow from customer request to executed change according to current instructions of the case company	
		Is this process generally followed?	
		Rationale for yes/no of the previous question.	
2	**Change request process in the current case**	How was the change request process carried out (via email, the data base, f to f…)	
		Was the input data sufficient for processing the change request?	
		Were the reason and urgency of the request clearly communicated?	
		What could have been improved in the change request process of this case?	
3	**Change request process in an ideal case**	What would be the ideal method for handling the change requests	

		What is the correct level of engagement i.e. should the request come directly from LSU or even the customer.	
		Is there a typical lack of data preventing the Change Request processing?	
		Are the reasons behind the changes generally understandable and clearly communicated?	
		Is the time urgency of the requests usually clearly communicated?	
4	**Change Order process in the current case**	How was the change order processed (via email, phone, the data base, f to f…)	
		Was the input data sufficient for processing the change order?	
		Was the orders timeTable clearly communi-cated?	
5	**Change Order process in an ideal case**	What would be the ideal method for handling the change orders	
		What is the correct level of engagement i.e. should the request come directly from LSU or even the customer.	
		Is there a typical lack of data preventing the Change Orders processing?	
		Is the expected readiness of the requests usu-ally clearly communicated?	
6	**Proposals for changing the Change Management Process (open topic)**	What should be done to improve the change management process?	

Summary of Data 1 Notes

QUESTION GROUP	DATA SOURCE	MAIN FINDINGS	REASONS/EXPLANATIONS	UNDERLYING THEMES
1 - Current state of the Change Management Process	Data 1b	CR tool not used	Rigidy of the tools	Change Request Process: -The tool mostly not in use for various reasons Change Order Process: -Current CO tool is considered to be sufficient for its purpose -CR is not linked to CO. Context and background for the change is then missing OSM Process in general: -Lack of communication in complexed cases -Instructions not up to date, even though agreed working practices exist
	Data 1c	CR tool mostly used only as "notepad"	Slow process, foot work needed to speed it up	
	Data 1d	Previous system failure makes people think that CR tool does not work	Poor communication	
	Data 1e	Instructions not available but agreed working practises internalized	Processes suit well to logical working order	
	Data 1f	Processes learned by doing; CO tool has improved significantly within some years	Common practice; determined priorities	
	Data 1g	Current CO tool is good for its purposes	Everything needed in one place	
	Data 1h	CR and CO not linked together means manual data transferring and possibility of an error	Additional work if something is forgotten and added later on	
	Data 1i	In complexed changes tools are not the place to agree what will be done	Communication between all parties	
	Data 1j	New work station don't have Lotus Notes installed, no access to CR tool; Understanding of the process needs	Tool obsolete; lack of knowledge	
2 - Change request process in the current case	Data 1b	Clear request from LSU, problems in internal communication	Communication (hold)	Change Request Process: -Unclear communication of holds -Unclear responsibilities/task owners
	Data 1c	Unclear responsibilities regarding the task owners	Manual input of the person responsible, poor instructions	
	Data 1d	Urgency of the request was well understood	status indicator in the system and delayed handling	

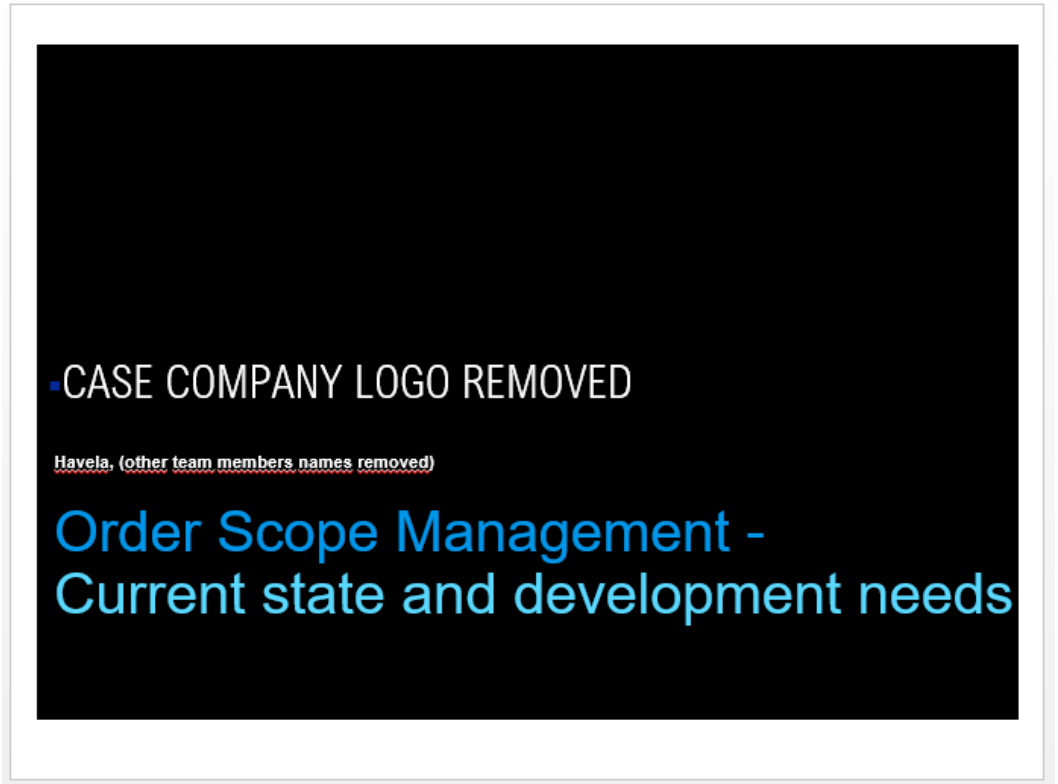
	Data 1e	CR process not followed	Skilful project manager was able to make the clarifications	
	Data 1f	Hold communicated by mail, release not communicated clearly	email forgotten	
	Data 1g	Cancellations communicated by mail, but too late	CR would have taken even more time	
	Data 1h	Mail communication created poor traceability	Impossible for others to follow the logic	
	Data 1i	Over-technical communication made the case messier then it after all was	Communication, understanding the process needs	
	Data 1j	All parties not informed about oncoming changes	Additional work for production planning	
3 - Change request process in an ideal case	Data 1b	CR tool should be implemented to CO tool	avoidance of manual work, loss of information	Change Request Process: - New CR tool needed -Context for the changes is often missing hindering the problem resolution and employee engagement -Work queue properties missing, leading to large amount of uncontrolled work -email communication blurs the difference between CR and CO
	Data 1c	New factory internal tool needed	Ensuring the proper information reception in engineering	
	Data 1d	Reasons behind the CRs would often help in problem resolution	Understanding the actual customer need	
	Data 1e	Work queue properties missing, "invisible work"; right amount of information, PM to filter the essence	CR tool not used; Designer might not understand the whole project entity	
	Data 1f	Face-to-face communication is the most effectice on small changes; understanding the context of the change for communication to down stream	efficient way to transform details; Communication	
	Data 1g	Due to email communication difference between Request and Order is not clear	Forwarding unclear mail threads	

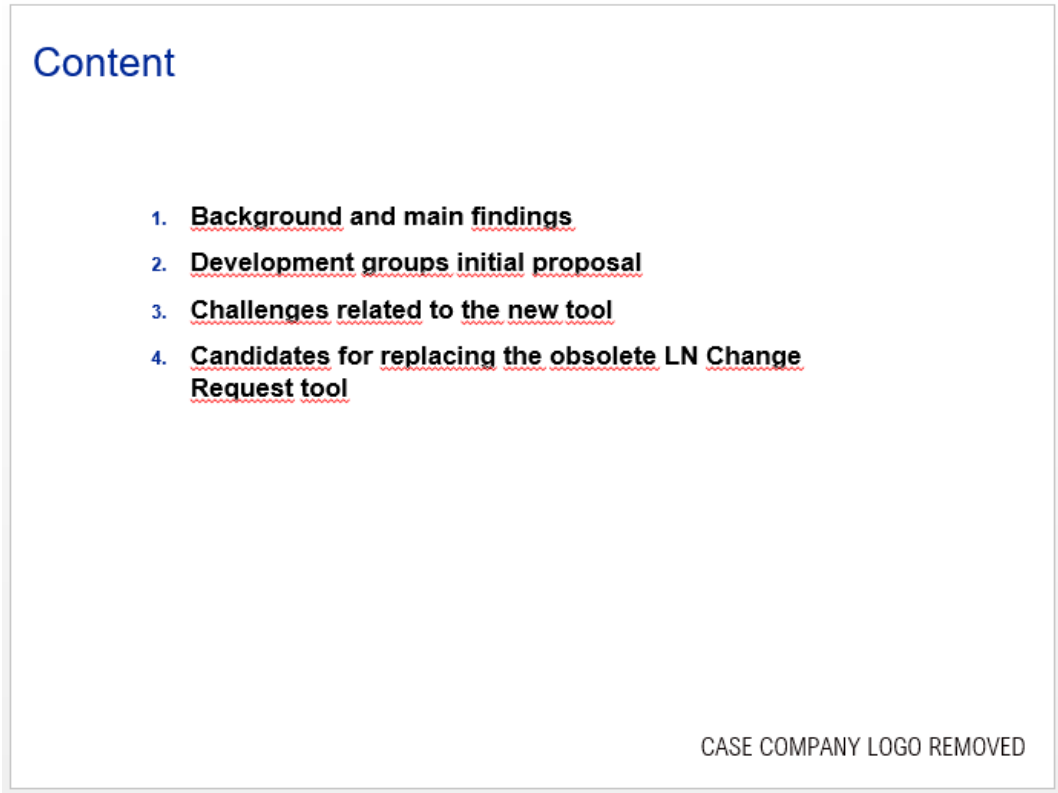
	Data 1h	Internal tool; regocnition of CR and CO	Clarity and simplicity of the communication; Mail communication	
	Data 1i	Reasons behind the CRs help to engage people; Urgency of the requests not clearly communicated	Communication	
	Data 1j	Changing delivery times cause fluctuation to manufacturing load	Difficulties on resource allocation	
4 - Change Order process in the current case	Data 1b	Good CR stage helped in CO stage	Diligence needed in CR stage	Change Order Process: - Thoroughly performed CR stage helps in CO execution - Communication (right amount of details, channel - Unclear priorities in working order - Task flow inadequate if major changes/cancellations. - Long delivery chain from PU to end customer often prolongs the decision making
	Data 1c	Uncertainty how to proceed after blurry CR stage	Purpose of the CO not correctly understood	
	Data 1d	Lead time change evaluation done is CR stage	according to existing process, but accuracy needed	
	Data 1e	Well articulated changes ease the handling	Communication	
	Data 1f	Communication by CO tool and email in parallel caused confusion.	Controversary information	
	Data 1g	CO properly made	Everything wen't according to planning	
	Data 1h	Purchasing informed in advance by mail about coming changes	Needs of the function and limitations of the system understood by project manager	
	Data 1i	CO supported by earlier phone calls	CO content tool limited or containing wrong data	
	Data 1j	Readiness dates of the tasks communicated under the tasks	Location is not easy to find	
5 - Change Order process in an ideal case	Data 1b	Current CO tool is sufficient, Change tasks keep on piling for certain designers	Work distribution regarding in changes	Change Order Process: - Communication of holds and cancellations is unclear - Purchasing task flow
	Data 1c	The CO tool should be more flexible to modify the content if needed	ERP system property	

	Data 1d	Urgency of the COs is not clearly indicated int he system	Trouble in prioritizing the work	- Prioritizing the COs - Handling times for Cos
	Data 1e	Communication method is insignificant as far as the agreed practises are followed; History browsing for earlier changes not possible	Instructions not followed; No "lessons learned impact"	
	Data 1f	Holds and cancellations not clearly visible in the system	Indications in the CO tool inadequate	
	Data 1g	Task flow in CO should notify purchasing earlier	now some delay in hold cases	
	Data 1h	Amount of details to be sufficient	Needed for communication, process understanding	
	Data 1i	Expected readiness of the changes unclear	Needs to be shown properly in SAP	
	Data 1j	Current CO tool is tailor made however order of the tasks needs minor adjustment	Satisfaction to current tool	
6 - Proposals for changing the Change Management Process (open topic)	Data 1b	Lack of inital details in change requests, Heavy CR process, Employees engament	Lack of knowledge in LSU, Poor platform for CR	Change Request Process: - Traceability and transparency missing: all info in emails - stakeholders are not committing to given impacts, leads to postponements Change Order Process: - Lack of understanding the needs of the next process step OSM Process in general: - More face-to-face communication
	Data 1c	Task should be assigned as soon the CR occurs	Engagement and efficient communication	
	Data 1d	Traceability of the CR stage	all the record mostly in emails or elsewhere	
	Data 1e	Stability and monitorability of the work load needed; Clear communication with pricise terminology required	Lack of CR tool usage; professional and communication skills	
	Data 1f	More direct communication to bring efficiency and agility	The tools of blur the actual request	
	Data 1g	Needs of the next process step must be understood	Lack of understanding the needs of the other stakeholders	

	Data 1h	Timeliness of the communication; Clear communication	Finetuning the load with suppliers; clear desicions on holds etc.	needed to support the tools - Clear and guiding messaging - Unclear Hold/Proceed practises - Slow process encourages to take short cuts, especially in the CR process - Timeliness of the communication
	Data 1i	Clear and guiding messaging; Clarity on hold / proceed needed	Communication	
	Data 1j	Engineering load in CRs, monitoring and prioritizing	As the CR tool is not used can't be monitored	

Data 2 Example (Data 2f)





Background and findings

- Current state of the order scope management was mapped by going trough two examplary cases (XXXXHG ja XXXXHG).
- The aim was to understand the "slippage" in the change execution stage (Change Order)
- People involved to cases were interviewed (totally 10 interviews)
- Main findings as follows:

FINDINGS FROM THE CSA	KEY ISSUES AND DERIVED THEME
1. Change Request tool not used as it should	-Engaging the employees to use the tool -Action plan for taking the tool back in use in all functions needed -Action plan for long term evolvement of the Change Request tool needed **=>Change Management**
2. Task flow of the Change Orders	-Modifying the process in the tool
3. Communicating the projects holds	-Lack of instruction/communication
4. Lack of understanding the next process steps needs	-Training of the employees and simulataneoulsy subjecting the processes for a critical review
5. Order-To-Delivery process model not working in complexed projects	-Alterations to Order-To-Delivery model needed **=>Business Process Management**

CASE COMPANY LOGO REMOVED

Development team's proposal 1/2 ,"Instant actions"

Issue 1. *Change Requests* – CR tool back to use

- Team leaders ensure that everyone has access to CR tool
- Short re-cap on how to use the tool e.g. in team meeting
- All the structural changes trought the tool!!!
- Document requests can be done without the tool as"fast track", to avoid unnecessary communication via IT systems

Rule of thumb: More F2F communication, avoid unnecessary emails!☺

Issue 2. *Change Order Workflow* – Proposal to change the process to be done as Continous Improvement activity

- Additional step for the purhasing team needs to be added
- Purpose of the step is to notify the team earlier in order to cancel/hold the material when changes are coming

Issues 3. and 4. *Hold/cancellation training with process recap*

- New instruction about handeling the hold and cancellation situations will be ready within april 2016
- Teams to be introduced to the instruction along the change process recap

CASE COMPANY LOGO REMOVED

Development team's proposal 2/2 ,"The long run"

Issue 5. – Order-Fulfilment Process

- In the current model company commits to the certain lead-time even thought the projects where the scope is likely to change can be recognized in advance.
- Selected projects could be executed using two-step process, where purchasing and manufacturing activities start only after manufacturing permission (approved documents)

Issues 1. – Change Request Tool is on expiring platform

- New tool needs to be selected, list of current alternatives can be find from the end of this presentation
- Main characterestic are clear for all realistic options, but further clarifications are needed
- Needs to be global tool to support the Group's IT strategy

In addition – Order Scope Management needs a process owner

- Responcibilities are now fragmented
- Tools and processes related Order Scope Magement are thus developing unevenly

CASE COMPANY LOGO REMOVED

Challenges and limitations for the new CR tool

1. **Platform**
   - Several options exist
   - Some of the options are more realistic than others but all are included here to indicate the variety of the systems
2. **Users**
   - PU internal use or to support cooperation with LSUs
   - PG/BU-level scalability
   - How to deal with R&D support request?
3. **Schedule**
   - Need for a new system is instant
   - Too little data to compare the exact implementation schedules, but rough estimates on the next slide
4. **Costs involved**
   - Some softwares are licence based, limiting the user group?
   - Also all existing platforms need modification

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Summary of the options for the new CR tool

+Positive
- Negative
?Unclear

SALESFORCE

Very pervasive tool covering everything from lead generation to warranty handling. This will be included to tool box of all company unit within 2017. Piloting in Helsinki Q2/2016 by XXXXXX XXXXXX (informant for Data 2D).

+Will be used in all units of the company anyway

+Learning system, utilisation of previous requests

+Implementation approx Q1/17

-User specific licence (about 40$/a)

-Limited modifiability of the user interface

?Users (LSU-PM?)

?Linking to SAP Change order

SERVICENOW

Ticketing system being piloted by financial services in headquarters. According to YYYYY YYYYYYY (informant for Data 2C) software owner within the company is not keen on listening deveopment proposals from single production unit as the project in early stage.

-Implementation schedule not known

-User specific licence

-Single user interface, no modifications possible

?Suitability for CR use not know due to lack of details

?Used in the whole Group

SHAREPOINT-SITE

We have almost ready tool developed in another project. The tool needs some finializing but only minor details. Main contact within the company XXXXX XXXXXX (informant for Data 2e).

+Implementation possible within couple of months

+Cost effective solution but needs, external company to code the platform ready.

+Platform is flexible and existing

-System does not recognize the user – is all the information to be shared with LSUs?

?Users. Only LSU and PM or also PU organization?

SAP

Possibility to Create SAP CR tool has been clarified when the SAP CR tool was made. XXXXX XXXXXX (informant for Data 2e) was involved and knows the details.

+Based on interviews the most desired platform

+All Change information in one place

-PU internal tool (no LSU, R&D)

? Technical feasibility

Sales Configurator

New technical file to separate database

+Unambiquity of the electrical desing

-Clarity of the mechanical changes

? Technical feasibility

CASE COMPANY LOGO REMOVED

Data 3 Meeting Notes

Meeting notes

Reference

Topic	Validation of the proposal
Data collection step	Data 3a
Participants	Head of Project Management, Engineering Manager
Date of the Meeting	19.4.2016
Duration of the Meeting	90 min
Meeting notes validated by the participants	yes

Meeting notes

#	Topic	NOTES
1	**Current Change request tool needs to be taken to use. Search for a new tool needs to be started.**	-In the current planning the platform of the Change Request tool will disappear by the end of year 2016. Therefore it makes no sense to force the usage of this tool. -The case company has been contacted by another unit of the group to co-create a new CR tool. In these the preliminary discussions the Share-Point-point based solution has started to look an obvious choice. There exists almost ready tool that just needs to be piloted (as shown in data 2f). -However this new tool is likely to be only in the internal use. Therefore the mean to improve LSU co-operation needs to be searched. -New tool ideas to be utilized in the request came out: Procom, Doc-Stage and Rework functionality in SAP. However no concrete ideas how to implement the tools in existing process appeared.

2	**Task flow to be adjusted as a Continuous Improvement activity**	-Can be implemented as proposed.
3	**New guideline for handling such situations is about to get ready, implementation plan to be established**	-Clarity needed in communication the impacts of the changes for customer. In return the indication for hold should come from the customer. -Case company needs give firm dates for making changes the changes. Currently there is readiness to sell "change slots", time windows for doing the changes.
4	**Process recap in team meetings**	-Determining the communication flows in different type of change cases would be ideal. -Current instructions are not guiding enough to know with which tool to proceed -Output of the Change Request should be the "rescheduling of the project if the new scope is applied". Can come in form of Gant chart or something else. -Importance of the communication was highlighted. It should appear on all levels.
5	**Alternative two-stepped lead-time model to be implemented**	-The case company is facilitating this change already by defining the details of the model e.g. by detaching the customer documentation and preliminary engineering. -The thesis should focus on implementation plan of the new model

Case Study Protocol

Reference

Research project	Master's Thesis "Order Scope Management Process improvements"
Author	Jussi Havela
Date of issue	19.1.2016
Version	A – First issue

Features of the Research Project

#	Topic	Notes
1	**Research design**	The study is done as case study. Multiple cases will be used to have wider organizational coverage and thus richer data.
2	**Case selection**	The cases are selected in co-operation with project management team. The selection criteria for the cases: • Passed through the change process • Containing both Change Request and Change Order Stage • Complexed in nature and have participants from several functions • Be representative example of a success or failure • Preferably rather recent to get as much case specific data as possible.
3	**Validity and reliability design**	Construct validity • Multiple sources of evidence • Chain of evidence • Key informants review draft report Internal validity • Pattern-matching • Explanation-building • Addressing rival explanations External validity • Replication logic in study Reliability • Use case study protocol • Develop case study database

4	**Data collection**	Data will be collected in three steps. Data 1: Interviews for the Current State Analysis Data 2: Development teams contribution to the issues raised from CSA and review of existing knowledge Data 3: Managements feedback
5	**Interview Procedures**	Data 1 is is the only step where the strict interview policy is followed. This is to ensure purity of the data and avoid bias.
6	**Data analysis**	Data is analyzed using thematic method.
7	**Reporting**	Intermediate reporting to the university is done as the schedule below indicates. For the case company intermediate reporting is done on need-basis. Final report of the study is the final printed thesis.
8	**Schedule**	The schedule will follow Metropolia University's Gate model. Main mile stones are the following: Gate1, Introduction 21st December 2015 Gate2, Research design 31st January 2016 Gate3, Current State Analysis 28th February2016 Gate4, Conceptual Framework 28th March2016 Gate5&6, Proposal ready 24th April 2016 Gate7, Deliverable thesis 6th May 2016

Change Request Tool Implementation Plan and Schedule

Document	Action plan and schedule for implementing new Change Request tool
Author	Jussi Havela
Version	22.4.2016 Rev. A : First issue

Party	Activity	04/2016	05/2016	06/2016	07/2016	08/2016	09/2016	10/2016	11/2016	12/2016	01/2017	02/2017	03/2017	04/2017	05/2017
Management	Decision to proceed with new platform	X													
	Informing the organization about the new tool giving rationale for the change		X												
	Establishing a cross-functional coordination team		X												
	Guiding the coordination teams work			X	X	X	X	X							
	Release for piloting								X						
	Keeping the organization informed about the tool development and schedule			X		X		X		X					
	Full-scale implementation										X				
	Follow-up of the imlementation										X	X			
	Communicating the positive gains of the implemention										X	X			
	Monitorign the tools usage											X	X	X	X
Coordination team	Review of the current instruction														
	Review / Demo of the draft tool		X												
	Workshops for finding the refining points / obstacles		X	X											
	Coordinating the tool development done by a third party				X	X	X								
	Creation of instruction/training/ implementation material					X	X	X							
	Training the employees to use the tool							X	X						
	Supporting the users in implementation									X	X				
	Creating a positive approach to tool by exemplary behaviour									X	X	X	X	X	X
	Development based on user feedback										X	X	X	X	X
Other departments	Participating to trainings							X	X						
	Provide feedback for development									X	X	X	X	X	X

Hold Guideline Implementation Plan and Schedule

Document	Action plan and schedule for implementing *"Guideline for project hold, postponement and cancellation"*
Author	Jussi Havela
Version	22.4.2016 Rev. A : First issue

Party	Activity	04/2016	05/2016	06/2016	07/2016	08/2016	09/2016
Management	Approval for new guideline			X			
	Follow-up of implementation				X		
	Communicating the "success stories" for employees					X	X
	Ensuring that the new guideline is followed / overcoming obstacles					X	X
Coordination Team	Final comments on the draft guideline	X					
	Refining the draft as a final version e.g. in a workshop		X				
	Creation of roll-out material			X			
	Release for approval			X			
	Training the case company internal stakeholders in team meetings			X	X		
Project Management	Training the LSU's				X	X	
	Providing the feedback continous improvement activities					X	X

Change Scenarios and Implementation Schedule

Document	Change scenarios with breakdown of needed communication
Author	Jussi Havela
Version	22.4.2016 Rev. A : First issue
Description	The purpose of the document is to determine needed input and output for each stakeholder covering the CR and CO processes. The Table below categorizes the changes in three groups: 1. Minor change 2. Standard structural change 3. Complexed structural change

STAGE	SCENARIO	PARTY	INPUT	OUTPUT	NOTES
	1. Minor change E.g. TAG number updates, Other plate updates, Small document updates, Other non-structural changes	Project Management	Request from LSU/Customer to change the scope	Review of the required updates with relevant engineer	Usage of the CR tool not required in Minor changes
		Electrical Engineering	Discussion with PM	Delivery time for updates	Discussions are basis for the CO
		Mechanical Engineering	Discussion with PM	Delivery time for updates	Discussions are basis for the CO
		Purchasing	NA	NA	No purhases involved
		Production Planning	NA	NA	No stuctural changes, no need to involve

	2. Standard structural change (std cuusamo selection) E.g. Change in capital parts before FP, ATB location change ,MTB location change	Project Management	Request from LSU/Customer to change the scope	Creation of CR Notification	Explicitly expressed technical description. Asking for details from LSU if needed.
		Electrical Engineering	Exact impact on el. desing, e.g. desired power in kWs or load curve needed	-Component level impacts listing the changing parts -New performance values. -Engineering hours for implementing the change -(Preliminary data sheet for new desing)	Preliminary data sheet needed if the performance is guaranteed
		Mechanical Engineering	Exact impact on mechanical desing	-Component level impacts listing the changing parts. -Next possible slot for implementing the changes with relevant evaluation time -Engineering hours -(Preliminary drawings for the new desing)	Preliminary drawings only in case they are need for agreeing/explaining the final scope

		Purchasing	List of changing components	-Lead-times and -prices for changing sub-components	
		Production Planning	Scope of changes and in-house dates for the compenent related	-Decision if the manufacturing schedule remains the same or postpones. -Exact delivery date.	Respecting the factory capacity
	3. Complex structural change (special component or time critical) E.g. Change in capital parts after FP, ATB special location, MTB special location	Project Management	Request from LSU/Customer to change the scope	-Calling up informal meeting for going trough the request -Creation of CR Notification accoringly	Explicitly expressed technical description. Collecting the comments from drawings e.g. to spread sheet for internal and LSU review.
		Electrical Engineering	Exact impact on el. desing, e.g. desired power in kWs or load curve needed	-Component level impacts listing the changing parts -New performance values. -Engineering hours -Preliminary data sheet for new desing	Preliminary data sheet needed for customers acceptance

		Mechanical Engineering	Exact impact on mechanical desing	-Component level impacts listing the changing parts. -Next possible slot for implementing the changes with relevant evaluation time -Engineering hours -Preliminary drawings for the new desing	Preliminary drawings can follow later once the changing components are know -> speeding up the purchasing processes
		Purchasing	List of changing components	-Lead-times and -prices for changing sub-components Cost for sub-supplier rework	
		Production Planning	Scope of changes and in-house dates for the new components	-Cost for internal rework -Decision if the manufacturing schedule remains the same or postpones. -Exact delivery date.	Respecting the factory capacity
	1. Minor change E.g. TAG number updates, Other plate updates, Small document updates, Other non-structural changes	Project Management	Confirmation for communicated impacts	Creation of CO Notification	
		Electrical Engineering	CO according to earlier discussion	Updated datasheet	

		Mechanical Engineering	CO according to earlier discussion	-Updated drawings -Updates plates to eLap	
		Purchasing	NA	NA	only including small marking plates made in-house
		Production Planning	Information about the changed documents and plates	Updating the working cards of the production	
		Production	Information about the changed documents and plates	Acting according to new instructions	
	2. Standard structural change (std cuusamo selection) E.g. Change in capital parts before FP, ATB location change ,MTB location change	Project Management	Confirmation for communicated impacts	Creation of CO Notification	
		Electrical Engineering	CO according to earlier CR	Updated datasheet	
		Mechanical Engineering	CO according to earlier CR	-Updated drawings -Updated BOM -Updates plates to eLap	
		Purchasing	Purchase requisitions	-Purchase orders for sub-suppliers -Confirmation for delivery times	

		Production Planning	Information about the changed documents and structures	Updating the working cards of the production	
		Production	Information about the changed components and documents	Implementing the changes	
	3. Complex structural change (special component or time critical) E.g. Change in capital parts after FP, ATB special location, MTB special location	Project Management	Confirmation for communicated impacts	Creation of CO Notification	Utilizing the earlier summary of changes. (see CR stage)
		Electrical Engineering	CO according to earlier CR	Updated datasheet	
		Mechanical Engineering	CO according to earlier CR	-Updated drawings -Updated BOM -Updates plates to eLap	
		Purchasing	Purchase requisitions	-Purchase orders for sub-suppliers -Confirmation for delivery times	
		Production Planning	Information about the changed documents and structures	Updating the working cards of the production	

		Production	Information about the changed components and documents	Implementing the changes	

Change Scenarios Implementation Schedule

Document	Action plan and schedule for process recap and implementation of the change scenarios
Author	Jussi Havela
Version	22.4.2016 Rev. A : First issue

Party	Activity	05/2016	06/2016	07/2016	08/2016	09/2016	10/2016
Management	Informing the organization about the new scenarios. Communicating the advantages.	x					
	Establishing a coordination team to further develop the scenarios and produce training material	x					
	Participation to the coordination teams work		x	x	x		
	Follow-up of implementation and providing positive feedback					x	
Coordination Team	Kick-off and review of preliminary scenarios	x					
	Workshop for refining the scenarios		x				
	Preparation of the training material			x	x		
	Updating the instructions				x		
	Training the employees					x	
Employees	Participating to the trainings					x	
	Providing feedback as continous improvement activity						x

New Project Execution Model Implementation Plan and Schedule

Document	Action plan and schedule for implementing alternative project execution models
Author	Jussi Havela
Version	21.4.2016 Rev. A : First issue

Party	Activity	04/2016	05/2016	06/2016	07/2016	08/2016	09/2016	10/2016	11/2016	12/2016	01/2017	02/2017	03/2017	04/2017	05/2017
Management	Establishing a development team	X													
	Follow-up of the model refining work		X	X											
	Consulting LSUs about the new models for development ideas & piloting		X												
	First indication of new models in team meetings		X												
	Release of the model for piloting. Informing the employees in team meetings				X										
	Follow-up of the implementation and adjusting the models and new working practises if needed					X	X	X	X	X	X	X	X	X	X
	Informing the organization of projects with new models highlighting the success stories						X	X	X				X	X	X
	Full scale implementation									X					
Development team	Refining the new lead-time model	X	X												
	Clarifying the impacts on each white and blue collar department	X													
	Adjusting the model to suit the existing processes		X												
	Creation of the instructions		X	X											
	Creation of the training material to internal and external use			X											
	Training the employees to work according to new model			X	X										
Project Management	Participating to training sessions			X											
	Implementing the new model to LSUs				X	X				X	X				
	Directing the own and LSU's feedback to continous improvement activities					X	X	X	X	X	X	X	X	X	X
Other departments	Participating to training sessions					X									
	Communicating development needs as continous improvement activities						X	X	X	X	X	X	X	X	X
LSU	Training sessions for piloting LSUs				X	X									
	Training sessions for the rest of the LSUs									X					
	Actively communicating the new models for the customers					X	X	X	X	X	X	X	X	X	X