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PRODUCT CHANGE MANAGEMENT

CASE: Mid-sized forest machine manufacturer

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TIIVISTELMÄ

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Työn tarkoituksena oli perehtyä muutostenhallintaan ja tutkia sen puutteita kohdeyrityksessä. Yritys valmistaa metsäkoneita ja kuuluu valmistusmäärillään alan keskiluokkaan. Tuoterepertuaari on kuitenkin laaja, sillä koneita myydään joka puolelle maailmaa. Erilaiset tarpeet eri markkinoilla ja erilaiset määräykset tekevät tuoteperheestä laajan ja monimutkaisen kokonaisuuden. Muutostenhallinnan toimivuus tämänkaltaisessa valmistusympäristössä on todella tärkeää.

Työ toteutettiin tapaus tutkimuksena. Teoreettinen viitekehys valittiin muutostenhallinta (CM), tuotetiedonhallinta (PDM) sekä muutostenhallinnan toteutusmallit. Tutkimusaineistona oli yrityksen dokumentaatio ja kirjoittajan tekemät käytännön havainnot. Lisäksi haastateltiin kuutta yrityksen johtavassa tehtävässä toimivaa henkilöä.

Tutkimuksessa havaittiin, että kohdeyrityksessä on selkeitä puutteita nykyisissä muutostenhallintakäytännöissä. Yhteisestikäytettäviä sääntöjä ja prosessia ei ole laadittu. Kohdeyrityksessä käytetään argumentaatio lähestymistapaa muutoksien toteuttamisessa ja yleensä asteittaista käyttöönotto strategiaa. Tutkimus osoitti myös, että avaintekijöitä onnistuneeseen muutostenhallintaan ovat muutosprosessi, kommunikaatio sekä sitoutuminen tukien näin teoriaa. Lisäksi luotiin muutostenhallintarunko yrityksen käyttöön muutostenhallintatyökalun jatkojalostusta varten.

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ABSTRACT

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The purpose of this thesis was to study change management and research problems with it in the target company. The target company manufactures forest machines and is situated in the middle section of the industry based on the numbers of produced machines annually. The products are sold all over the world. Different market areas have different demands on the machines which makes the product portfolio large and complex. Successful change management processes are of the utmost importance in this kind of manufacturing environment.

This thesis is a case study. The theoretical framework discusses change management (CM), product data management (PDM) and change management implementation. The research material consisted of company documentation and the author's observation in practice. Additionally, six managers of the company were interviewed.

The study showed some clear problems in the change management methods practiced in the target company. Common rules and process flowcharts were not established. The target company uses argumentation approach in implementing changes and usually gradual implementation strategy. It was found that the key success factors for implementation of change management are change process, communication and commitment which supports the theory. Additionally, a change management framework was created for the company to develop a change management tool.

Keywords Change management, manufacturing, implementation

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ABBREVIATIONS

CTL	Cut-to-length logging method where trees are delimbed and cut to length straight after felling with a harvester
R&D	Research and Development
CM	Change Management
CN	Change Notice
CMS	Change management system or cost management system
ECR	Engineering Change Request
ECN	Engineering Change Note
PDM	Product Data Management
JIT	Just-In-Time
TQC	Total Quality Control

1 INTRODUCTION

Project management is a wide area of expertise which is becoming more and more important for successful businesses. The number of projects is growing and the projects are getting more complex. In manufacturing business projects occur as new product projects, product improvement projects or research. An order-delivery process can also be handled as a project.

One of the areas of project management is change control. Changes occur in all phases of a project or a product life cycle. Reasons for changes can originate for example from government legislation, customer demands, product quality improvements or design flaws. Some of the changes need to be implemented fast which can be very challenging. New parts might have long delivery times, people might need additional instructions and training and a change in one part often effects other parts as well. All this can cause delays in production and therefore delivery times. If a new part replaces another part a question of what to do to the old part needs to be addressed. Scrapping parts or keeping both old and new parts in stock increase the company's costs. Other changes with a longer due time might be easier to predict and prepare to but may tie resources for a long period of time. Managing these changes is crucial for businesses since they affect and involve many functions of a company and always cost money.

Having a good change management process helps a company to achieve better quality, productivity and reduce unwanted costs. Change implementation through an agreed process is important in order to maintain consistent quality, bring clarity to the work and clear change communication routines are essential in managing the changes over all areas of business. This way correct parts are kept in stock and used in production, sales are informed about new developments, purchasing is up-to-date on what part should be ordered and which are obsolete, production can run without unnecessary stoppages and company's after sales department is also informed about the changes.

1.1 Target company

The target company is a Finnish forest machine manufacturer. The company produces harvesters, forwarders and harvesting heads for CTL logging. Additionally, it produces forest machine simulators which are used for example for driver training. The company annually produces around 100-150 machines in total. All of the machines are assembled at the factory in Western Finland. The company employs around 100 people in Finland but there are distributors in 20 countries and its machines are currently working in over 25 countries. /1/

The target company offers seven models of each machine type. The main differences between the models are their load capacity and engine power. The smaller machines are used for thinning and the bigger machines are used for clearcutting. Different markets, however, have for example different regulations on emissions thus there are different versions of the models making the product range more complex in practice.

1.2 Background and the goal of the thesis

This thesis aims to research theory about change management, product data management systems and change management implementation methods in practice. The PDM system plays a significant role in change management implementation so a theory section dedicated to it is included in this study. The target company has been implementing a new PDM system during the writing of this thesis but the system is not yet completely in use in all areas and departments of the company. The goal is to assess change management systems and create a change management process that could be implemented in the R&D work.

1.3 Research problem

The idea was originally to study the impact of changes in production during the machine manufacturing phase and the control of the engineering changes designed by the R&D. This approach however, was realized to be far too wide and should be treated as separated change management areas. Also, there has already been a study about change management during production phase by Marita Luoma, so this thesis is focused on the

product development changes made by the R&D department of the company instead /4/. The point of view is mainly the electrical design and focus on managing the changes of the electrical related parts of the machine e.g. wiring harnesses and sensors. The reason to lean towards engineering change management from an R&D perspective rather than from the perspective of customer or company driven changes during the order-delivery process is the writer's position in the R&D department of the company.

1.4 Research questions

The research problem of this study is how the change management should be implemented in the target company R&D. So far there have been no official policies or systemized processes for change management in the company. The initialization process of a new PDM system in the company is also underway, which enables new opportunities but also challenges for the company. The goal is to also answer the research questions:

- 1) How is change management implemented in the target company R&D?
- 2) What are the critical factors in the implementation of change management?

1.5 Structure of the thesis

Chapter one briefly describes the research problems and the motivation for the study. This thesis introduces some theory of selected research methods in chapter two and chapter three discusses theory of change management as a part of project management. Chapter four introduces the basic ideas of product data management and how it is connected to change management. Chapter five introduces selected theories about change management implementation models. The empirical findings are viewed against the theories in chapter six and the finally the overall conclusions are discussed in chapter seven.

2 RESEARCH METHODS

2.1 Case study

The research method chosen for this study is Case study. Case studies are preferred method when dealing with the questions “how” and “why” /14/.

One of the most common methods of quantitative study in the field of business economics is case study. Case study is a research where one or few specially selected cases are studied. A case usually is a company, a part of a company, a department or a cabinet of a company. A case can be a process or a structural property of the company. /12/ A case study is used to get an understanding or deep analysis of singular cases in their specific context and to get knowledge of their dynamics and processes. Case studies can also produce new hypotheses and ideas for further studies. /13/

There are several ways of collecting data for a case study. For example, documentation, archival records, interviews, direct observation, participant-observation and physical artifacts. Sources of data should be selected suitably for the given case study and one should always try to use multiple sources rather than just one /14/. Using multiple sources allows triangulation, comparing results between different data, increasing validity of the results /13/.

There are many ways of categorizing case studies. One categorization by Robert E. Stake classifies case studies into three categories:

- | | |
|--------------------------------|--|
| Intrinsic case studies | A researcher has a special interest in a specific and unique case and wants to understand this case by detail |
| Instrumental case study | A case study is conducted to help understand some other case or phenomena than the case in question. The case in question has an instrumental meaning. |
| Collective case study | The research consists of multiple cases. /15/ |

Since this thesis is about a certain process in a specific company environment it is an intrinsic case study. It is also a single case study. Collective case study which is basically an extension to instrumental case study is more about testing, demonstrating and developing of theoretical ideas and concepts /15/.

The reasons for using single case study according to Yin (2009) are shown on **Table 1**.

Critical Case	Confirming, challenging or extending a theory
Extreme or Unique Case	Produces important information for example rare diseases
Representative or Typical Case	Captures the circumstances and conditions of an everyday or commonplace situation. Provides information about experiences of ordinary people or institutions.
Revelatory Case	Observing and analyzing a phenomenon previously unstudied
Longitudinal Case	The same case is studied more than once in different points in time. Provides information how conditions change over time.

Table 1. Case types /14/

2.2 Collecting data

2.2.1 Documentation

The researcher should consider if it is reasonable to start making new records of a topic or is there already documentation about the topic that he could use and save energy for analyzing the records /16/. Documentation should be used to corroborate information from other sources. If there is a contradiction, that problem should be investigated. Documents can also be used for making inferences for further investigation/14/.

Documents play an explicit role in data collection in doing case studies. Documents can be for example emails, letters, personal notes and documents or administrative documents. /14/

In this study documents such as emails and engineering documents are investigated as sources of change documentation and change communication.

2.2.2 Inquiry and interviews

Inquiry or structured interview is more used in quantitative research but can also be used in qualitative research and the respondents can be categorized into qualitative types. In structured interview the questions are tightly linked to the research problem. The aim is to get answers to all questions, within the given range of answers, and in the order made by interviewer /17/.

A semi-structured interview differs from a structured interview so that the questions are open /16/. Some literature calls semi-structured interview also theme interview /17/ or a focused interview /14/. The nature of a theme interview can vary from very open to structurally proceeding interview /17/ but usually these interviews are more open and there might not be specific questions and order for them, but the interview is a discussion about predefined themes /16/. All questions are not given beforehand. The advantage of half structured theme interview is that a researcher can make focused (further) questions and solve possible misunderstandings during the interview. In a theme interview the interviewee is asked some “easy” questions first like personal information but the anonymity of the interviewees must be guaranteed /18/.

Open interview is a type which is very close to an ordinary conversation. All themes might not be discussed with all interviewees. Often it is referred to as in-depth interview, which usually means that more than one open interview is conducted with the same interviewee. /16/

2.2.3 Observation

Observational evidence can be gathered through direct or participant-observation /14/. Observation is a common way to collect data in quantitative research but consumes much effort and time /17/. Participant-observation is a way of observing where the observer also has a role within the case study situation and may participate in the events being studied. Participant-observation has certain advantages such as gaining access to

events or groups that are otherwise inaccessible, ability to perceive the reality from “inside” the case and ability to manipulate minor events. There are some problems concerning participant-observation too. Biases can be produced when the observer must take an advocacy position, becomes a supporter of the group being studied, has not time to assume the observer role or has not ability to be at the right place the right time. /14/

Participant-observation will play a significant part in this study’s data collecting since the writer is an employee of the case company.

2.3 Reliability and validity

The trustworthiness of the research method is often proven with the concepts of validity and reliability. Validity means that the research has really measured what it was meant to measure, and reliability means that the results of the research can be repeated. These concepts are however criticized in qualitative research since they have been developed in quantitative research. /17/

Eskola and Suoranta (2008) introduce three other terms for evaluation of research:

Credibility	The researcher must check if his interpretations are the same as the ones of the research objects
Transferability	With certain preconditions the results could be transferred to some other context although generalizations are not possible due to the diversity of social reality
Conformability	The research is supported by other studies made of similar phenomena

3 CHANGE MANAGEMENT

From the mid-20th century when project management was starting to emerge as a profession, it has been more and more demanding /9; 8/. Project complexities and number of projects in business is growing /8/. A traditional way to depict project dimensions is the Project Management Triangle or Triple Constraints (**Figure 1**) where the project has dimensions Time, Cost and Scope /9/. Project management is about keeping those three dimensions in balance to maintain schedule, budget and achieve goals. Project management in detail is a very wide area of expertise including knowledge of many different fields.

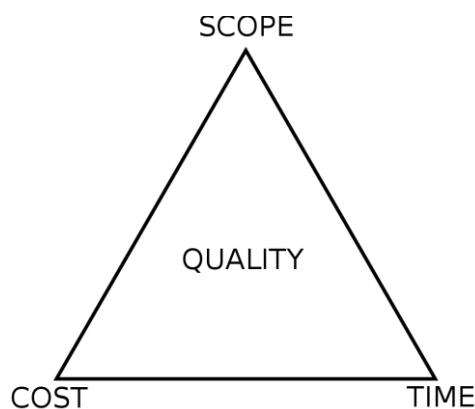


Figure 1. Triple Constraints /25/

There are several guide books about project management. One of them is the Competence Baseline from the International project management association and another one is Project management body of knowledge (PMBOK) from the Project management Institute.

IPMA (International project management association) Competence Baseline talks about skills needed for good project management. In that document a project manager's competence elements are categorized in three section:

- Contextual competences
- Behavioural competences
- Technical competences /8/

The IPMA - Competence Baseline (ICB) lists “Changes” belonging to the technical competencies as one of the competence elements of project manager (**Figure 2**). A proper change management system is agreed upon before starting a project. The agreed system anticipates changes and is overall comprehensive including identifying, describing, classifying, assessing, approving or rejecting, realising and verifying changes against legal and other agreements and notifying all involved stakeholders about the change. /8/

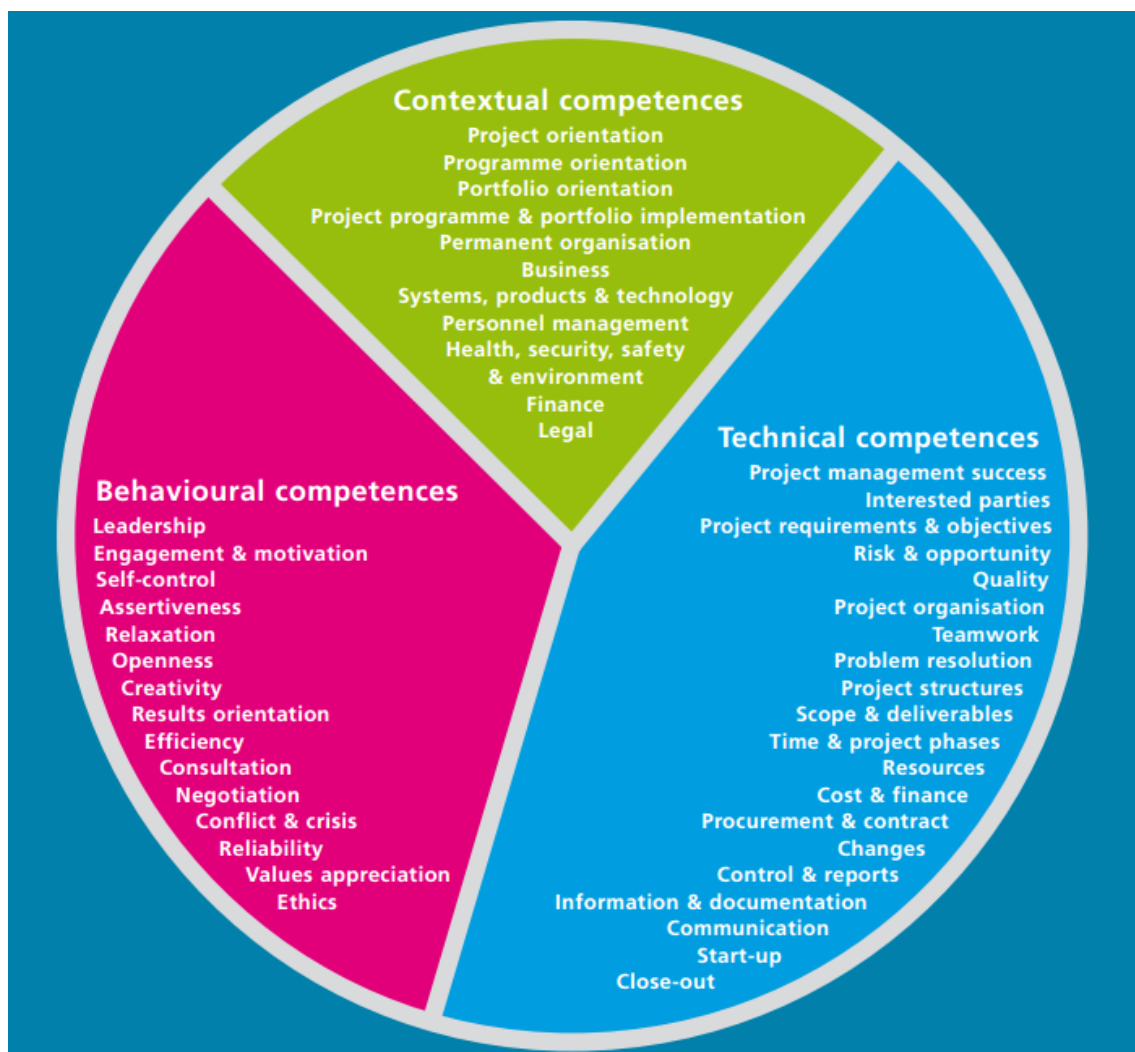


Figure 2. The eye of Competence /8/

Example of the steps of change management:

1. Decide on change management policy and process to be used.
2. Identify all proposed changes.

3. Analyse their consequences to the project.
4. Seek authorisation for the changes, where necessary.
5. Get changes accepted or rejected.
6. Plan, execute, control and close approved changes.
7. Report status of changes after completion.
8. Monitor effect of changes against project baseline.
9. Document lessons learnt and apply to future projects. /8/

In the PMBOK project management areas are categorized in ten project management knowledge areas.

1. Project Integration Management
2. Project Scope Management
3. Project Schedule Management
4. Project Cost Management
5. Project Quality Management
6. Project Resource Management
7. Project Communications Management
8. Project Risk Management
9. Project Procurement Management
10. Project Stakeholder Management

Project Integration Management includes the tasks for Change Control making it the most relevant knowledge area regarding this thesis. This chapter focuses on the Project Integration management but gives a short description of each area.

Project Integration Management is about coordinating project work and processes to form a unified whole. Integration management is divided into seven processes (**Figure 3**). The process 4.6 Perform Integrated Change Control describes management of project changes. This process is needed in order to handle all change requests in an integrated manner while considering the risks arising from the changes. The Integrated Change Control is performed throughout the process. /11/

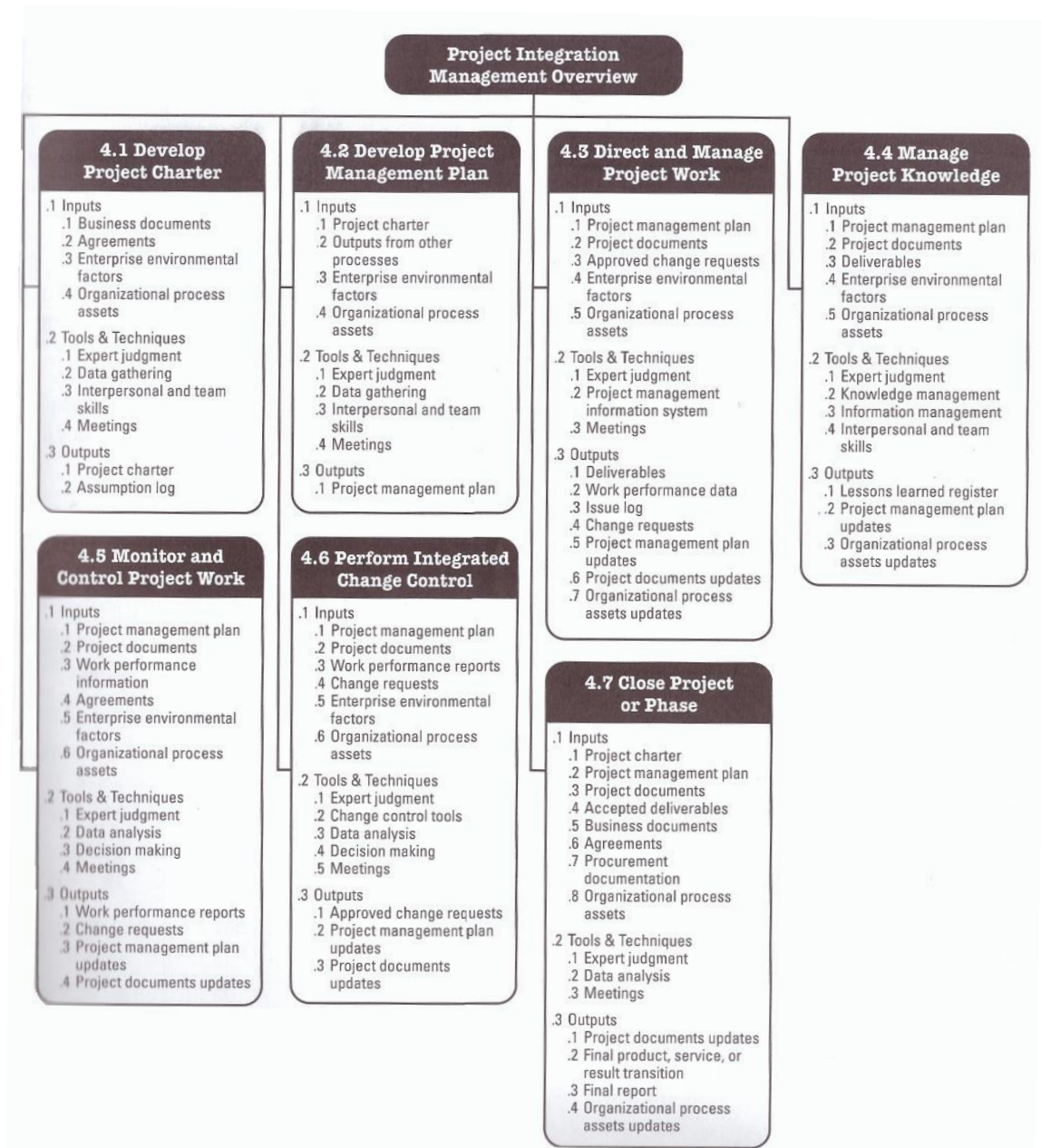


Figure 3. Project Integration Management /11/

The level of needed change control is project dependant. Some variables affecting that are project complexity, requirements and the environment where it is carried out. Changes can be requested by any stakeholder and they should always be written down formally, even if the request has been delivered verbally, to be recorded and processed. The requested changes go through the process of estimating the impact on project cost,

schedule and documentation before being approved, deferred or rejected by responsible person or group of people. /11/

Project Scope Management involves the tasks and boundaries of the project. It is very important to define what is included and what is not in the project in advance. Project Scope Management is about defining and controlling the extent of the project.

Project Schedule Management is about making and controlling the project schedule. It involves for example defining and activities, developing schedule and controlling changes to schedule generated by changes to the project.

Project Cost management involves estimating costs, making the project budget and controlling it.

Project Quality Management includes planning the project quality level in balance to time and cost. The processes and deliverables are then managed and controlled to ensure that the quality level is met.

Project Resource Management consists the tasks needed to plan, acquire, develop and manage the human resources for a project. The project team is one of the most important factors in the success of a project.

Project Communication Management is planning, managing and monitoring communication between stakeholders of the project.

Project Risk Management is needed to identify and analyse risks of the project. It also includes planning risk responses, implementing them and monitoring expired risks.

Project Procurement Management is about planning and managing subcontractors and other outside labour used in the project. Procurement work can have unexpected impact on project cost, schedule and quality.

Project Stakeholder Management is an important knowledge area involving identifying the stakeholders of the project. Stakeholder management involves addressing their needs, communication and managing and monitoring stakeholder engagement. /11/

“Engineering change management can be described as an activity in which the complete design change life cycle is closely monitored and controlled. Design change proposals may arise for a variety of reasons and during the review of a change proposal all possible implications should be considered before accepting or rejecting the proposal.” /7/

Having a change management system brings many benefits for companies. Some of the benefits are listed below.

1. It helps to improve Engineering Change Order cycle times
2. It Shrinks errors, delays, scrap and rework
3. Improved product quality and reduces cost of manufacturing
4. Avoids delays in product launch
5. Faster response to customer requirements
6. Helps to improves customer service /19/

3.1 Change

There are many ways of defining a change, but what is generally agreed on is that change always includes modification to a component, software or documentation of the product and that change always costs money. Changes also consume production and engineering capacity /5;10/. Changes, even though tried to be avoided, often take place in design of a product during its lifetime. The need for change may appear before, during or after the production and they may arise from the customer’s requests or company driven motivations to correct design errors or to extend the product life /6/.

Changes always generate cost so gathering up several ECRs (engineering change requests) related to the same component saves money rather than performing the changes one by one as they arise. A good example of this are molded parts where the mold costs play a markable role. /6/

The change should be considered when it offers a significant improvement to the...	The change should be rejected when...
the health/safety/ environment standards of the project	The project satisfies the statutory requirements/standards without the change
chances of shortening the project schedule	the project meets its duty, performance and quality specifications within the budget and on schedule without the change
the technical performance of the project	
profitability of the project	

Table 2. Evaluating change /2/

There are many reasons why changes should be avoided. They usually impact negatively on project budget, schedule, demand for resources and project team's morale. **Table 2** lists some guidelines on whether a change should be accepted or not. It is, though, rare that a project goes through without changes. Therefore, it is very important that the changes are controlled in an organized way. The changes should be requested by a standard form and then evaluated by a change control committee consisting of for example the project manager, the appropriate technical specialist, project cost or planning engineer and QA representative. John Dingle /2/ lists a few general guidelines for dealing with changes:

- Change control procedures should be simple, and understandable by everyone in the project team
- change control procedures should promote prompt, authoritative decisions
- they should be flexible enough to accommodate the requirements and constraints of the various project phases (note that the later the change, the greater its effect on budget and schedule)
- any change proposal must be supported by fully documented analysis and appraisal of its likely impact on the project budget, schedule and performance
- if a proposed change will affect contractual obligations, the consequences and implications must be agreed by the contracting parties before approval – variations to contract terms and conditions must be made only after an approval been given

- approval for a change should never be given ahead of full documentation – as a minimum requirement, the change must be approved by the level of authority which approved the original plan
- proposals for changes should be made in accordance with a formal procedure and endorsed by the line (operations) management who will be affected by the proposed change. /2/

3.2 Notification of change

A change process of a product should start with an Engineering Change Request (ECR). This contains a description of desired change but not the fact that is it technically or financially feasible or possible. After the ECR, possibly multiple ECRs, an Engineering Change Proposal (ECP) is made. This contains detailed plan for executing the change and its cost and benefits. If the ECP is approved the products are changed as planned and an Engineering Change Order or Engineering Change Note (ECO or ECN) is made which has all information to the those it concerns about needed actions. This information may contain for example what must be done with the parts already in stock, what is to be done to the product already delivered to the customers and what is the schedule for the change. /3/

A crucial part of change management is informing the related people of the change. One way to keep track of people related to any document is to attach a list of those people in every document in the PDM system. A document may be also included in a project and related people are also included in that same project. Information can be passed along for example by printed papers or emailed documents. /3/

3.3 Workflow

The workflow of an engineering change is started by a change request or a so-called change trigger. After coming up with potential solutions to the change request comes the step of assessing the risk and impact of the possible solution. Evaluating the possible impact of changes is the most important part of the process. After that an authorized

body must approve the change before the change is finally implemented. Then after a certain period the change should be reviewed to check if it was successful or not (Figure 4). /20/

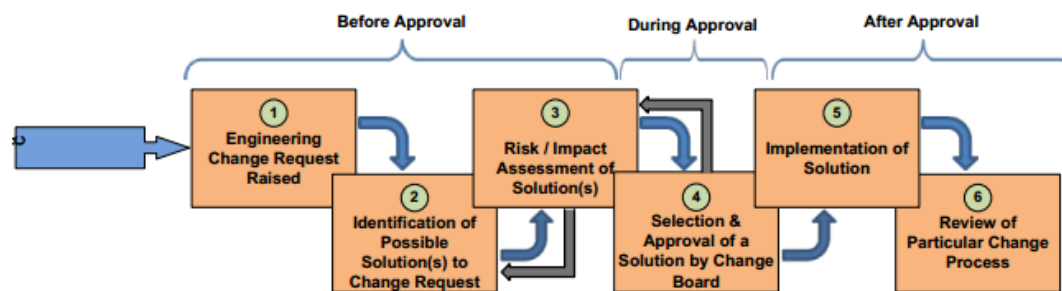


Figure 4. Generic engineering change process /20/

4 PRODUCT DATA MANAGEMENT

4.1 PDM system

Product data management (PDM) usually means a computer software with a centralized database designed to manage information related to products. The main users of PDM are engineers who feed the information into the system, but it also helps other employees such as managers, salespeople etc. /24/ PDM systems normally cover item management, document management, product structure management and change management /3/.

4.2 Item

A very important process in every company is item management. An *item* is generally any component, unit or an object that has an “identity”. Some typical items are listed in **Table 3**. Not necessarily all of them are needed and every company should decide what is convenient for them. It is not always easy to determine what is reasonable to have as an item. For example, if very small parts that are sold as packages of 10 pieces should be considered as one unit or handled individually. Another problematic type is generic interchangeable components that can be bought from multiple suppliers. /3/

- Physical items
 - Systems, assemblies, components, parts, etc.
 - Basic materials (i.e. steel rods)
 - Purchased components (i.e. screws and microchips)
 - In-house designed components
 - Installation accerories
 - Tools
- Services
 - Purchased services
- Sold services
- Functions
 - Special deliveries
 - Projects
 - Labor
- Stakeholders
 - Customers
- Suppliers

Table 3. Item types /3/

Normally items are given a code or some other identifier that makes the item unique and a description that is a little more informative. The description is commonly a word from standardized list or a list used by the company. Other information that can be given to the items are called *attributes*. Sometimes a descriptive word is used as identifier but it is generally more advisable to use for example a number as this leaves more freedom to change the attributes of the item without needing to change the item or create a new one. /3/

4.3 Item revisions

When a new version of an Item is produced so that the new one replaces the old one it is called *revision*. The new revision must be backward compatible with the old versions or otherwise the version is no longer a revision of an existing item but a new item. If both

the old version and the new version are used concurrently, they are called *variants* of the same item. Revisions are usually identified with a running number or a letter.

Sometimes the changes are distinguished to minor and major changes and therefore the revision identifier may look for example like 1.2, 1.3 or 2.0. Revisions can have attribute *effectivity* which indicates the time when the revision has come in use. Effectivity can be given as a date or, as often with serial production products, as serial number. /3/

There are many different reasons for making new revisions for example:

- The product is not performing satisfactorily
- Problems at production
- Changes in the production methods
- Performance needs to be improved
- Reduction of costs
- Decrease in the availability of some parts
- New market requires new features
- Changes in authoritative regulations /3/

4.4 Document management

One group of items consists of documents. Documents can be for example CAD models or drawings. Usually documents take forms in PDF and the original formats used by the computer program that the document was created with /3/. Documents are managed in the PDM system that can be integrated with design software and other data management systems of the company.

In PDM systems the modification of the documents is normally done so that the user takes temporary ownership of the document with *check-out* functionality. Then the modification can be done locally on the user's computer and once the modification is done the document is released back to the PDM system with *check-in* functionality. In order to make the check-out and check-in process reasonable for the designer to use, the program (tool) used for modification (i.e. a CAD program) is usually integrated with the PDM system so that the checking in and out can be done directly from the tool instead

of separately doing it from the PDM system. This has also the advantage that the needed attributes can be given with the tool and the tool has an ability to save the attribute values given into the PDM system as well. Checking in the document creates a new revision into the PDM system automatically or manually with a designated function (**Figure 5**). /3/

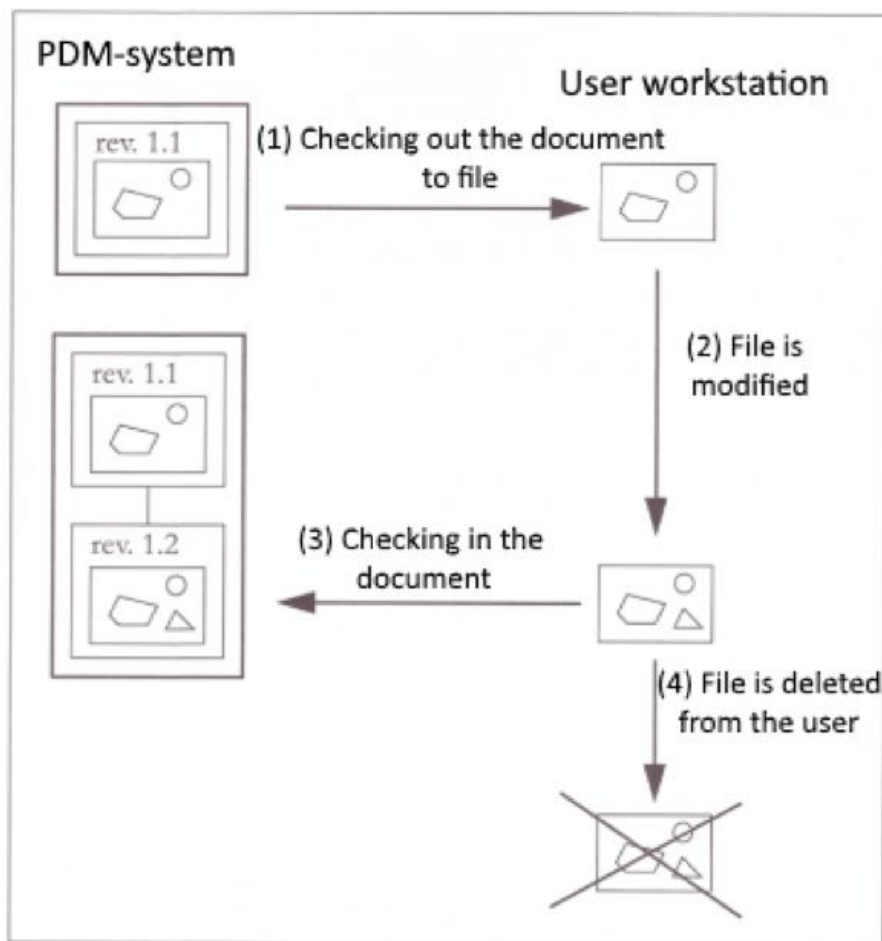


Figure 5. Creating a new revision with Check-in function /3/

4.5 Change process

A change in an item is often related to many documents and one change requires changes in other documents as well. Changes also require a lot of work and costs so one or more persons are often needed to review and accept the change. /3/

One way to execute a change is to follow a status diagram (**Figure 6**. Example of a status diagram /3/**Figure 6**). A new document version is first moved to the status “In pro-

gress” where it is being created. When the person creating the document considers it ready, it is moved to the next status called “Done”. At this state one or more persons review the document and if they are not happy with the document, they will return it back to the previous status where it will then be reworked. If the document is good by the reviewers, it will be moved to the status “Reviewed”. There it will be checked one more time and can be sent back to the status “In progress” or approved and therefore moved to the last status called Approved. Then the document is considered frozen and should more modification needs arise a new document version has to be created and started from the first status. /3/

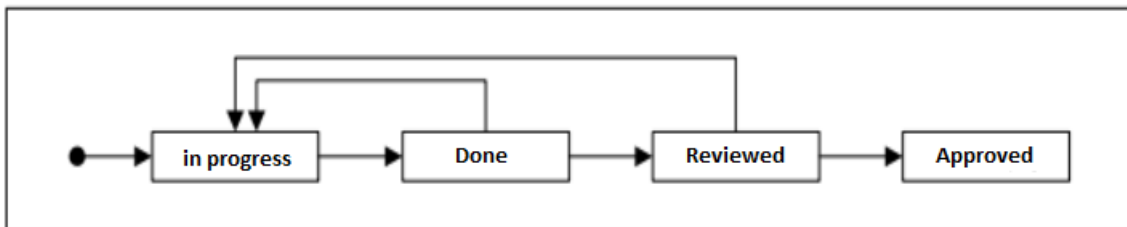


Figure 6. Example of a status diagram /3/

5 IMPLEMENTATION OF CHANGE MANAGEMENT

5.1 Strategy for implementing change management

A strategy for implementing change management was selected from a study about implementing concurrent engineering in UK businesses. Same criteria could be applied to implement change management system.

The model offers pilot, radical and gradual approach to the change (**Figure 7**). The main deciding factors being the urgency of the required change and uncertainty about if it will be successfully deployed. /22/

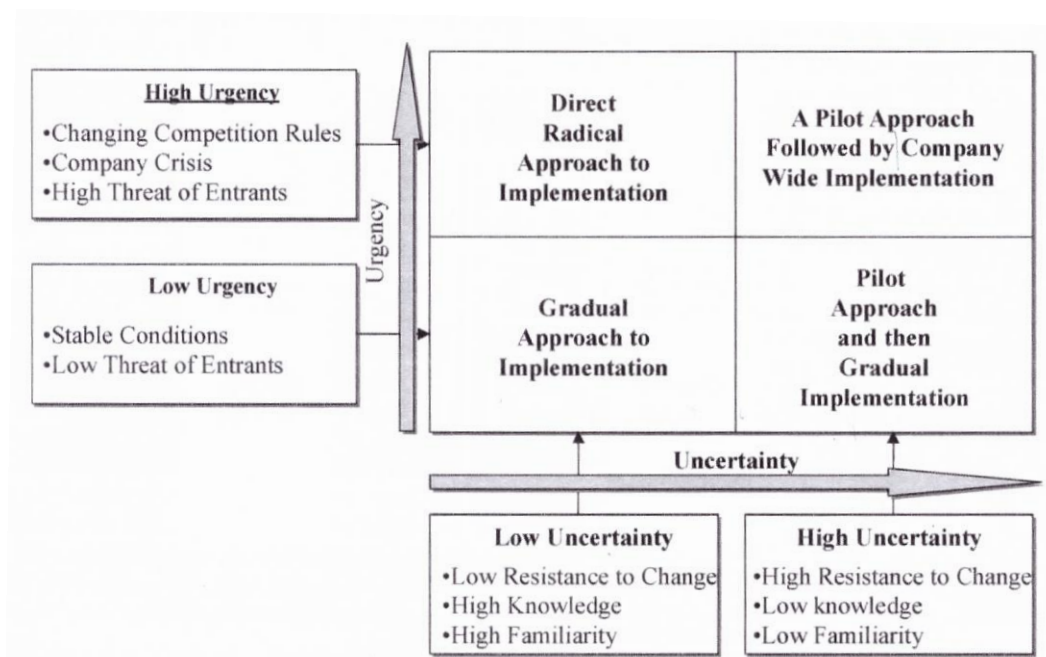


Figure 7. Implementation strategy tool /22/

An example of a model for design control process including steps describing the pilot phase was found from the literature (**Figure 8**). This model was adopted in a UK based automotive company.

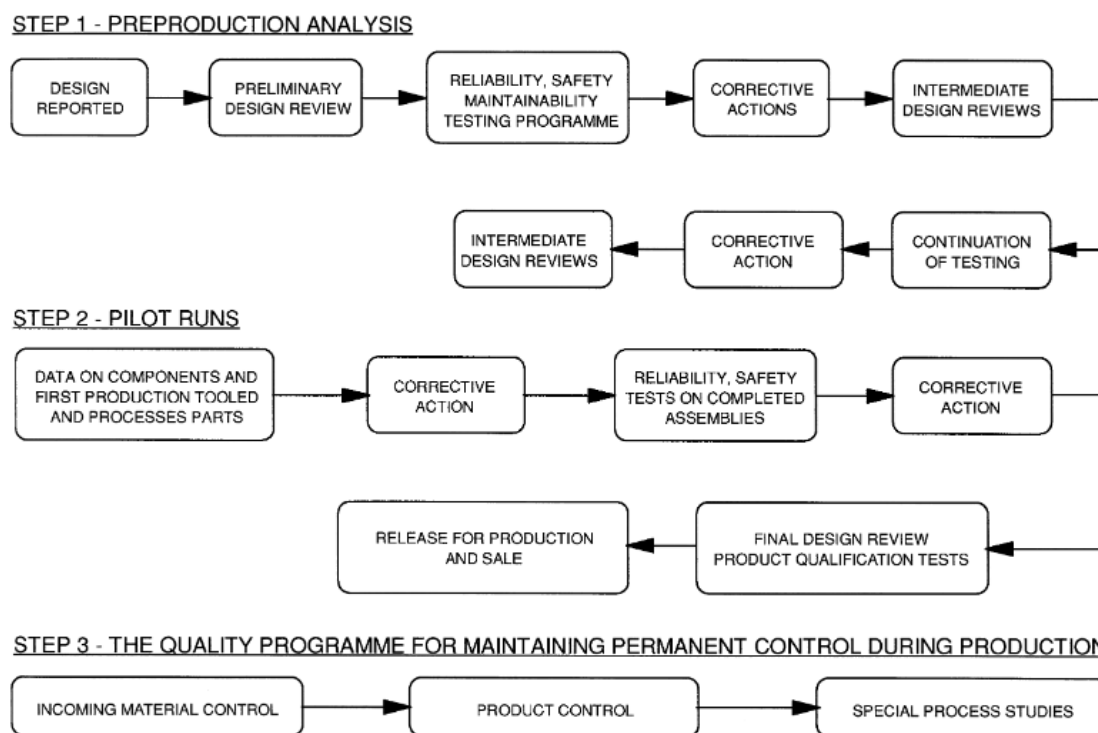


Figure 8. Design control sequence

The models shown in this section will be used as a base guide on comparing the practices followed at the target company and on generating new proposals for change management.

5.2 Implementation approaches

This part introduces a few different implementation approaches that can be used by managers to implement a change.

In the *accommodation* approach the implementation manager reflects and explores the implementation attempt. Stakeholders and different interests and points of view are tried to be identified in advance to see where there might be support or opposition. Contact with people is minimal. Manager tries to seek a compromise and win-win situations by making differences between antagonistic stakeholders seem small and insignificant. /27/

Bargaining approach makes the manager an agent of bargaining compromises using organizational knowledge. Bargaining approach involves contact with people (stakehold-

ers) to find compromises. The manager's role is to create forums to achieve agreement. /27/

Incentive approach is about utilizing rewards to persuade people to behave in a desired way. The desirable behavior must be communicated clearly and the reward linked to the behavior must be valued by the stakeholder. Rewards can be intrinsic for example an afternoon off or extrinsic for example a bonus pay. /27/

Argumentation approach concentrates on the benefits of the proposed change using illustrations, anecdotes and demonstrations. To convince reluctant stakeholders the plan must be assured to be in accordance to the organization's interests and appealed to the greater good. The manager using the argumentation approach must have a good reputation among the stakeholders in dealing with people and about assessing organizational needs. /27/

5.3 Success factors for implementation of change management

The Computer Aided Manufacturing Inc. has developed a behavioral model for implementing cost management system called the Seven Cs (**Figure 9**). The model consists of seven factors affecting the behavior of the employees of the company and its impact to the performance of the company. The model aims at management by continuous improvement. Their cost management system (CMS) model can be adapted to change management as well.

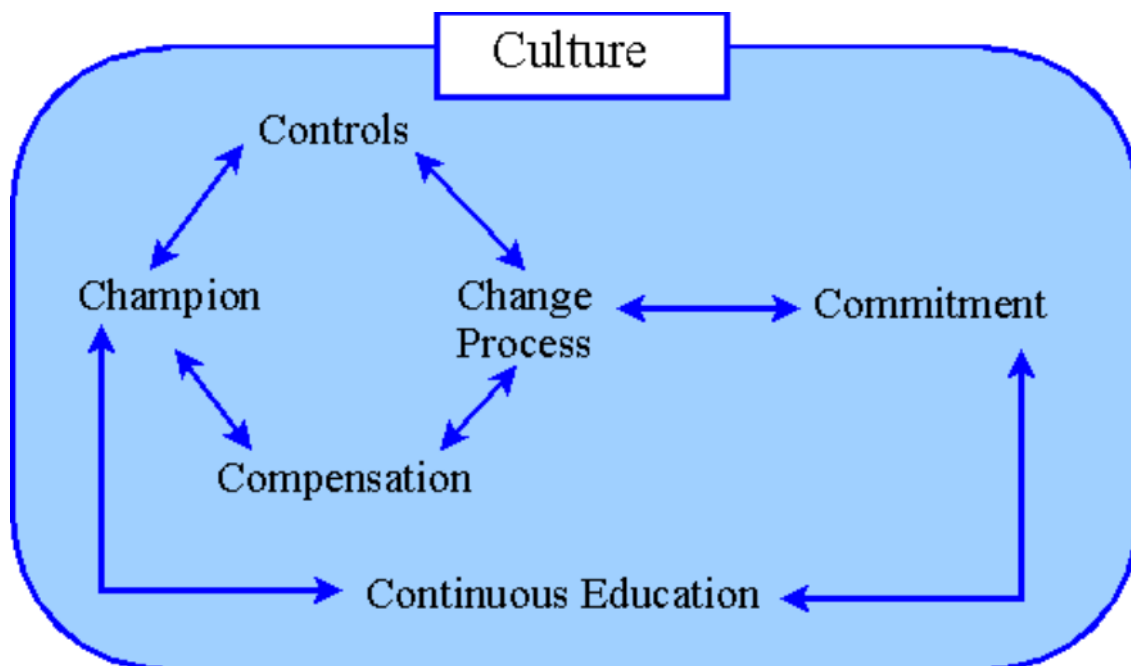


Figure 9. The seven Cs /21/

Culture. Corporate culture is shown to affect its performance. The culture is the mindset of employees including shared values, beliefs and goals of the company guiding their behavior.

Types of culture can be categorized into three broad types: functional, dysfunctional and ill-defined. A strong culture emphasizes its values, beliefs and goals clearly for example by expressing company slogans or mission statements. Other characteristics of a strong culture are for example clear budget, norms of behavior and effective communication network. In long term the best performing corporate culture should be a strong functional culture where employees feel that doing their work well benefits both them and the company. In a strong dysfunctional culture is personnel have poor attitude and low commitment to the firm due to management fiat, which also leads to high turnover of employees. A strong dysfunctional culture may show good performance in short term as employees managed by numbers (not continuous improvement) try to maximize short-term indicators. The least successful corporate culture is the ill-defined type where employees don't have similar values, goals and beliefs. They are just a group of people who happen to work at the same company. /21/

Champion. An individual, often with high entrepreneurial skills, leading the CMS implementation team. The champion comes often from fairly high in company hierarchy and must have support from the top management. The CMS implementation team consists of:

1. The champion
2. A sponsor – Often someone from top management
3. A project manager responsible for administration
4. An Integrator with strong behavioural skills /21/

Change process. Implementation of the change process is done through the remaining C's: compensation, controls and continuous education which are introduced later. Here are the key elements of the change process.

Top management support. Essential for successful implementation of a CMS. Without the support and commitment of top management the implementation team will be blocked by bureaucracy and individuals protecting their own turf.

Financial resources. Changing to a CMS requires also funding which is vital for developing and implementing information technology, new software and education.

Resistance to change. Can be the biggest challenge in implementing a new system. Both individual and organizational resistance exist.

Time frame. Big changes are adopted slowly. A realistic time frame should be given for implementing a CMS system.

Strategy. There are a few approaches for the implementation strategy. The revolutionary strategy is a risky and costly plan to bring the changes simultaneously in all parts of a company. The evolutionary strategy attempts to implement the CMS one unit at a time. Carries the possibility to fine tune the implementation process on the go and mitigates risks but takes a lot of time to acquire the CMS in the whole company. Third introduced strategy is the greenfield strategy or a pilot project where a new model operation is set up to introduce the innovation.

Second strategic decision considers driving the implementation from top-down or bottom-up. The upsides of top-down are similar to the revolutionary strategy with a centralized, coordinated nature of the change process but the downside is usually greater employee resistance. In many cases the employees have had very little involvement in changes that have great effect on their work. Additionally, employees' local information is lacking from the decision process and the changes may be different than they think would be the best. A bottom-up strategy involves employees much more and allows their information to contribute in decision making. However, the employees might not initiate changes if they do not believe it to be best for them and the process may turn out different than what the managers wanted. The combination of both strategies is probably the best approach for successful implementation.

Commitment. A critical part in implementing CMS is commitment of employees to continuous improvement. Compensation, controls and continuous education are used to increase the level of commitment and to develop the mindset for continuous improvement. /21/

Controls. The Seven Cs introduce three controls that the champion may employ to obtain increase in rate of continuous improvement and probability that the firm will achieve its strategy.

JIT/TQC. Implementing JIT or TQC system is a key step for a company. It aims to simplification, continuous improvement, standardization, zero defects and elimination of waste. The control is also moved to visual control rather than relying on paper reports making it more effective and efficient. Posting information about current performance publicly encourages continuous improvement.

Organizational structure. Many modern companies have organizations consisting of multiple horizontal and vertical levels which create a lot of organizational subunits. This structure is not ideal for developing characteristics needed for a successful firm. Such qualities are innovation, integration, flexibility and speed.

In order to acquire a high level of continuous improvement a company must be good at developing and implementing innovation. One successful structure is called “Organic structure” with such characteristics as:

- flat organizational structure
- very little vertical differentiation
- decentralization of power and decision making
- low formalization of rules and procedures
- low job specialization
- high concentrations of professionals with widely shared knowledge
- emphasis on horizontal rather than vertical communication. /21/

Teams. For control purposes teams are a critical unit of behavior. Teams should include people from different functions and even include members from suppliers, distributors and transporters in some occasions. Teams with people from many functional areas should be the basic unit of organizational structure and control for continuous improvement. An organization should consist of just four to six team-based levels to encourage integration, innovation, flexibility and speed. /21/

Compensation. One tool for the CMS champion is compensation which can be used to motivate and control the behavior of the employees to increase the rate of continuous improvement. Traditionally the compensation systems reward focusing on individual performance and results of the current period. The Seven Cs model suggests five key changes to the model.

1. Tying the compensation directly to continuous improvement (e.g. reduction in the number of parts per product, process variability, cycle time, ECOs or increased manufacturing cycle efficiency)
2. Contingent compensation in both team performance and individual skills
3. Emphasis on longer-term performance
4. System must encourage employees to be innovative by permitting some risk taking

5. Use of nonfinancial compensation to create an atmosphere of positive reinforcement /21/

Continuous education. Continuous education can be the cornerstone of a program designed to develop a culture of managing by commitment to continuous improvement and requires constant innovation, which is expedited by exposing employees to new information. All employees of the company should take part in continuous education programs. Engineers, managers and accountants should be thought the technical aspects of the CMS, at least important is to educate the employees especially the production workers to perform their tasks more efficiently. Creating a culture where workers want to find better ways to accomplish activities is a vital matter.

Continuous education should point out the flaws in managing by numbers and then provide examples of managing by commitment to continuous improvement, the implementation of CMS and its potential impact on performance. Employees must be thought the technical aspects of CMS and understand the new compensation system to increase motivation to adopt the philosophy of continuous improvement. Continuous education is vital for creating generalists through job rotation and cross-training. These are enhanced by informal education along with formal education making every employee both teacher and student. /21/

5.4 Summary of implementation of change management

Change management is a very wide area in business. There are many types of change and changes and way to manage them corresponds to the type of business or industry change management is applied to. There are for example many tools for project change management which can be applied for example to construction industry where each project is unique. Some of the tools are more abstract but some offer very detailed processes and steps. This study focuses on changes in manufacturing business of series production machines. Product changes, customer customization and new product development, however, add project type of features to this series production environment. A model described in section 5.1 will be used as a reference for implementation of change management.

Managing change requires knowledge of change management theory and use of proper tools or processes in order to succeed. Tools and processes can be found from literature and should be tailored to fit the business in question. To control and monitor the change a centralized product data software is usually used. In this study the role of the company's PDM system will be taken into account as possible as the company is in process of introducing a new PDM system so the real advantages of that will be seen in a few years' time.

6 FRAMEWORK FOR IMPLEMENTING CHANGE MANAGEMENT

This chapter introduces a framework for the change management process derived from the literature review.

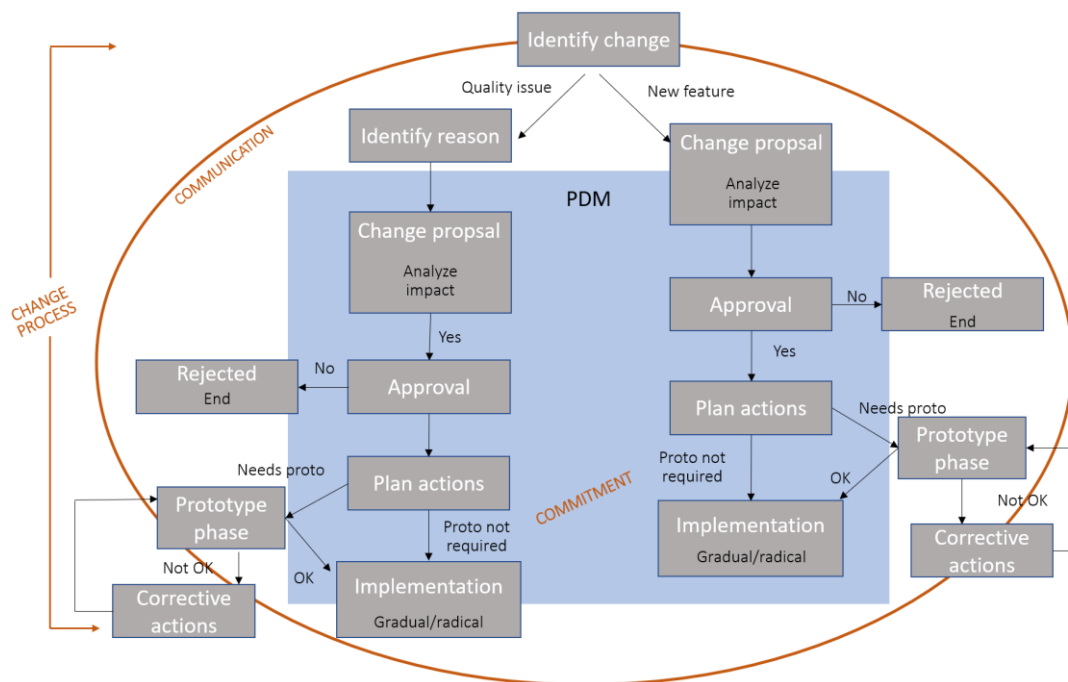


Figure 10. Change management framework

From the literature review a framework for change management including branches for both quality issue and a new feature for the product. The division of change comes from the viewpoint of theory about prototype implementation strategy. The theory of change management generally does not address prototypes at all, but they have a major role in the manufacturing industry and could be used for implementing quality related issues as well. This model thus adds the prototype strategy to both sides of the framework. In quality issue related changes there is also the step “Identify reason”, which is very important to understand the motivation for the change and to come up with the right solution (change proposal).

7 FINDINGS

7.1 Data sampling through interviews

To acquire company-wide understanding of status of the of change management in the target company six managers were interviewed (**Table 4**). Interviews lasted approximately 40 minutes on average and produced 38 pages of transcript text each. All managers had an extensive experience in the business and managerial positions. The interviews were semi-structured by nature and done in Finnish language to allow all (except one Swedish speaker) to speak their native language and keep the conversation going naturally. The interviews were recorded and transcribed, for reliability and validity, in Finnish and the writer has translated them while writing this part of the thesis. The answers varied to some degree depending on the managers' position reflecting their point of view of the change management. The analysis will be done question by question and the quotations will be used from the managers who had the most pertinent answers to the specific question.

The interviews were conducted between August and November 2019. For confidentiality reasons the names of the people have been left out.

Title (November 2019)	Name	Work experience in machine building (years)	Work experience in managing (years)	Date of the interview
Development manager, present product engineering	A	over 15	over 5	21.10.2019
Development manager, customer documentation	B	over 30	25	24.10.2019

Vice President of production	C	20-25	20-25	24.10.2019
Development manager, software and electrics	D	15	5-10	29.10.2019
R&D director	E	30-35	30	1.11.2019
Vice President of Services (ex)	F	15-20	15-20	1.11.2019

Table 4. Interviewees

7.2 Findings from the interviews, through participant observation and company documentation

QUESTION 1: How are the company's current data systems utilized as Change management tools today?

This question did not bring any coherent answer to how the systems benefit change management or work as change management tools. Four of the six interviewees talked about lack of process description and clear rules on change management. Two persons talked about steps that are currently being taken to improve the change management of the company and what the situation should look like in near future. Since those actions are not in effect yet today, they will not be discussed in this study.

“We have one PDM system or Work group which is used as drawings data bank. With that we do revisioning of mechanical drawings and that is basically it. It is such a data bank that only the CAD users can access the information. Then when the data export to ERP system is done it goes directly from the PDM system. - About the change management, well there is certainly a big problem that today we don't have clear and openly discussed and written rules on what needs to be done and who needs to be informed.” /Interviewee A/

The interviewed manager F talked about Change Notice that can be created in the company's online portal by a designer. In his opinion this was the most important tool.

"The most important tool in my mind is the CN which was the end line." /Interviewee F/

Also, he mentioned the lack of a process.

"The <software x>, and <software y>... that process just didn't exist. It was only that CN which we managed somehow" /Interviewee F/

The Change Notice is a document that the designer can create in the company online portal. There are no written rules nor has any education been given on when and how to create CN documents. The quality therefore varies and for example the information on when the change will be implemented is often just a designer's best guess and often, the CN is done after the implementation which clearly is against the theory in section 3.2.

Currently there are different ways of storing information about changes. Some information for example is stored on excel sheets and lots of information must be manually updated to different systems because the software is not integrated.

"There is an informal procedure when talking about CM that when for example some drawing is updated or a new revision made, it is the designer's responsibility to update ERP and make sure that it goes correctly, and all structures and revisions are correct. Then the designer must inform purchase team and production meaning sending them new drawings and to send the new drawings to the supplier."

"Then if it is a significant or a concrete change a CN must be made. This is basically the designer's job and if it requires action from the dealers or customers the After Sales makes a bulletin about it. This should be written down... the process must be described." /Interviewee A/

QUESTION 2: What are the main problems of the company's current information systems?

The problem with the ERP system was seen that everyone can do changes to the data and there is no feedback to any other system. On the other hand, a data export from PDM changes attributes in ERP automatically which may also cause unwanted results.

“Somebody fixes an error in ERP it doesn't fix it in CAD or anywhere else. Next time somebody exports data to ERP then there goes that fix again.” /Interviewee A/

One of the interviewees brought up an important point about informing sales department about changes so that price sheet which is used as the sales tool would be updated accordingly.

“It doesn't matter how well we run product data management here when the price sheet is completely detached like a satellite and updated very seldom so our product might be on totally different level than the one on price sheet. There is a big problem.” /Interviewee B/

It was mentioned that the problem with CNs is that they are not properly made and it is unclear what should be done with old revisions of the changed part and what is the schedule of the change.

“It (change) comes into effect uncontrollably so that production and purchasing doesn't always know what and when and after sales doesn't know the timing of the change.” /Interviewee E/

Aforementioned problem with CNs shows that the Risk/Impact analysis of changes talked about in theory section 3.1 and 3.3 is not made.

Also, during the discussions about this question, the lack of systematic process was brought up in many interviews and one person summarized the whole question in one word.

“Maybe a short and pithy answer is that processes are missing from many parts” /Interviewee D/

“Communication. That’s it.” /Interviewee C/

It can be seen from the answers that a few key factors mentioned in the theory are clearly not addressed properly in the target company. Since the processes are not communicated and documented clearly the whole *change process* cannot succeed. Proper impact analysis is often left undone and therefore the *time frame* is not realistic and the *strategy* for change is unclear and cannot be carried out properly. The implementation method talked in section 5.1 is simply not selected and followed through.

QUESTION 3: Who accepts or rejects changes?

The answers to this question were relatively consistent. Three interviewees mentioned the quality team as the responsible body for decision making and three motioned the team of R&D managers. The division can be explained by the view of the type or the scale of the change. In most minor changes it was quite agreed (4/6) that in most minor cases it is the designer himself who decides and carries out the change. These should be simple revisioning updates that do not require complex impact analysis. It was mentioned though that the changes are not categorized systematically.

“It is, on the other hand, not documented which is a minor, medium or major change. They are handled pretty much on case by case basis.” /Interviewee A/

Change management theory generally suggests one authorization group or an individual to approve or reject changes but it seems according to the interviews that the type of the change should determine the authorization body for the change.

QUESTION 4: How does the atmosphere of the company support or hinder changes?

The chaotic nature of the current change management shines through the answers to this question.

“Probably it can be quite heavy on a designer that suddenly some small things from their point of view arise that need fixing in the middle of a new design project. That we

(quality team) want something urgently done when they would need to focus on something else. I imagine that it might have caused some tension.” Interviewee F/

The workload of the designers was mentioned in other interviews too as a factor that can hinder CM as there are no written processes as mentioned many times.

“We have so many projects going on and in the middle of that people get a little uncertain feelings if they are doing the right things, which is important today and which is the top priority.” /Interviewee A/

It was also discussed that the culture if the company is open to change but changes are not handled systematically. Three of the interviewees mentioned specifically that there is no resistance to change which is one of the critical success factors of CM mentioned in theory part 5.2.

“There is no resistance to change. We are ready to make changes when needed and we see that they (changes) will take us forward.” /Interviewee A/

“Well, I think we are an agile company and sometimes even too agile. We dare to make changes and often do them very hastily and maybe too carelessly, so the impact analysis is not done.” /Interviewee D/

This question revealed that at least there is a positive atmosphere towards changes. This should help in implementing a new CM system. It must be said, though, that these results reflect the opinion of white-collar workers of the company. Resistance to change on production workers side, which was not surveyed in this study, could hinder the process of continuous improvement and *continuous education* significantly when the workers would resist job rotation and new ideas to improve working efficiency and holding on to “this is the way it’s always been done” -mentality.

QUESTION 5: Do employees get enough information about changes?

It was unanimous that not all workers get enough information. However, a framework for communication distribution and a communication plan should be established before this question can be properly answered and the level of information distributed across

the company measured. Two of the managers emphasized the employee's responsibility to self-imposed obtaining of information that is available.

"Obtaining information in this company relies to persons' curiosity and desire of information. One must talk to people and ask questions. I'm sure this concerns all organizations (in the company)." /Interviewee D/

"White-collar workers have the ability to get information from CNs but if anybody reads them is another question..." /Interviewee A/

For production workers following up on CNs is problematic simply because their work is not done on computer, which is required to access the online portal, so they simply don't have the same freedom to read through them at any given time of the day.

QUESTION 6: Why changes are needed?

Most commented reason for changes was quality improvements. Five out of six managers talked about quality. Quality is naturally monitored closely and almost all changes are linked to it one way or another. Other reasons that were mentioned brought up were demands from customers, requirements and legislation on new market areas and regulations from forest companies.

"Products are being changed because they are not tested enough" /Interviewee A/

This statement presented by one manager is of course a paradox since the products are very complex and compromises of different features. One thing that works in one area well does not necessarily suit in somewhere else. It is a valid comment, however, in a sense that a lot of quality issues could be prevented with thorough pilot/prototype phase talked in section 5.1.

QUESTION 7: Who initiates the change?

According to the answers there are mainly three sources for change initiatives. They are feedback from the customers, feedback from the service and R&D development ideas. Basically, the initiative or request can come from any employee of the target company or from the dealers around the world. Again, the conversation circled around the quality

improvements and manufacturing process improvements, but one interviewee remembered an additional important aspect that should be addressed as well.

“Sales team might demand some new feature that we don’t have. Then we start developing that and... well, that’s new product designing but it will lead to a change.”
/Interviewee B/

This applies to a lot of R&D tasks too. A design change or a new feature addition will eventually lead to a change in the product and its production so new product management is tightly linked to CM. A model for new product implementation through CM was introduced in section 5.1.

QUESTION 8: What are the benefits of change?

All managers saw changes beneficial. Some points they listed were better quality, happier customers, more efficient and cheaper manufacturing, better brand image and safety.

“Better products. The quality improves and manufacturing is more cost efficient. Then the products serve our customers better allowing them to succeed in their work which helps us to succeed.” /Interviewee D/

QUESTION 9: What is the meaning of prototype machines?

Prototypes are an essential part of any manufacturing business. All interviewed managers agreed that prototypes should be made. Still, prototyping is done largely on individual series production machines instead of purpose-built prototype machine. This has many major problems since for example traceability and follow-up of prototype installations and testing is very difficult. The reason is that the prototype machines tie lots of resources and are thus quite expensive. One of the main principles behind model of management by continuous improvement is to secure cost efficiency and profitability in long run. To achieve this the company should adopt a pilot phase model and invest in prototype machines regularly. This would save money in warranty costs and lead to better overall quality.

“It’s a no-brainer. We have seen that already in the past that if we had put more time into prototype testing, we would have been saved from many of these field cases (warranty issues).” /Interviewee F/

“The more we test with prototypes and the more we productize the readier products we launch to market and less we need to change them later.”/ Interviewee E/

7.3 Summary of findings

This aim of this study was to investigate the state of change management in the target company and compare the practices used to theories and theoretical models available. The research questions of this study are addressed in the following subchapters.

- 1) How is change management implemented in the target company’s R&D?
- 2) What are the critical factors in the implementation of change management?

Question 1 is about a specific practical issue while keeping in mind the framework offered by the theory. Question 2 is more theoretical but tries to find answers from the point of view the target company as well.

RQ1: How is change management implemented in target company R&D?

Findings show that current state of CM creates a challenging environment in the target company. Information is scattered and the information does not move fluently from system to system or from people to people. The process of change management does not exist and people do not know exactly what they should do and when. Through experience people have learned to deal with changes somehow and major errors have been managed to avoid but as the company is growing the need for systematic CM is becoming vital. On the positive side, the atmosphere in the company was generally agreed to be open to change.

The company does not have process descriptions, so the CM is basically people doing things they think that is right. Quality of documentation and implementing changes in production leaves a lot to be desired and is costly in the long run. Research question one

thus, was answered in this study and judging against common CM theories there are some similarities on what people try to do, but since the real guidelines in target company do not exist the quality of CM is random.

RQ2: What are the critical factors in the implementation of change management?

The most brought up factor during interviews was *change process*. Without that nothing is fixed and the results can be good or bad but usually something is forgotten or shortcuts taken. It is hard to determine a few individual factors from the Seven Cs theory as the most critical ones, but the *strategy* is definitely a factor that must be set and maintained. That way there is a concrete method of running CM that can be monitored, evaluated and developed. The base of operation and list of actions must exist. To mention some of the other crucial factors in implementing CM *commitment* should be underlined. Once the steps of the *change process* are communicated to everyone it is vital the personnel are committed to the process. One way to boost *commitment* is through *compensation* to increase employees job satisfaction. Several studies show that job satisfaction increases company performance like described in Jouni Kytövaara's master thesis /26/. Another crucial factor rising from the empirical findings is *communication*. It is not listed as an individual factor in the Seven Cs model but is something that is a part of a strong company culture. Like mentioned in the chapter 5.2 The culture is the mindset of employees including shared values, beliefs and goals of the company guiding their behavior. Communication should be planned in the change process model, but it is also something that will improve as the company culture gets stronger. Communication between employees can be encouraged for example through internal education as part of continuous education plan.

If narrowed down to the findings from the empirical study the crucial factors are *change process* and *communication*. It should not be, however, underestimated the significance of other factors of the theoretical model since the change almost always requires actions from all of the organization of the company.

8 CONCLUSIONS

8.1 Theoretical contribution

Given how recognized the importance of this topic is in today's manufacturing business environment it turned out surprisingly difficult to find related studies and models for implementing change management models in suitable areas of industry. This study showed that the principle of change management should be understood in manufacturing companies and defined processes are very important in successful change management.

Some of the critical factors of the Seven Cs model /21/ were mentioned several times during the interviews supporting the theory that the model should be applied for change management. Communication and the flow of information between workers was regarded as important factor which can be connected to the *continuous education* factor. When asking about the atmosphere in the company the answers told that the people are open to the change which is vital for *commitment* which is required to carry out successful changes. It was also widely agreed that the *change process* is the absolute key factor in change management thus strongly supporting the theory.

Additionally, the importance and benefits of prototype machines was widely acknowledged in the interviews. From several years of also participant observation of this topic this study supports the need for a prototype implementation model like the one from the UK study /22/ introduced in chapter 5.1. Because of the complex product portfolio the gradual implementation is usually the most suitable strategy.

The typical approach to implementation in the target company is the *argumentation* /27/ approach. Usual argumentation refers to the quality monitoring results, customer needs, regulations, company's goals and long-term visions and values.

8.2 Practical contribution

The practical meaning of this study was to bring out the systematic problems of the change management practices used in the target company today. Now that these bottlenecks have been identified they can be addressed and focused on. This thesis also intro-

duces the theories behind change management which will be taken into account when developing practices. A change management chart was already partly planned outside of this thesis in the company while writing this thesis. The results and theories talked about in this study will be reflected on the chart and considered when the tasks for each step in the change management chart are started to be written down.

This study also introduces a model for prototype implementation in theory part 5.1 which can be taken as a base for a change management model in the target company. This thesis also emphasizes the importance of this implementation strategy and sticking on to it.

8.3 Limitations and future research

One interesting point that goes a little against the theory came up from the interviews. The theory usually describes one decision body but according to empirical findings it seems that there could be two decision bodies responsible of different types of changes. How these different decision bodies should communicate with each other and pass on the information could be a topic for further study. It will be seen how these will be implemented in upcoming process charts and how will it work in practice. The general feeling among the people talked to when conducting this study is that some flexibility and dexterity in decision making must remain in a company of this size and too strict and rigid decision-making process would cripple the company.

At least all CRs that will lead to a CN should be written down systematically. Now there are lots of improvements going on untraceably. This is acceptable for small revision updates where documenting the CM process would be unreasonable comparing to the amount of work needed to do the update work. So, the first thing needed to do would be to evaluate and categorize the CR and then apply the corresponding process chart and actions.

The results of this study are specific for the case company. The size of the company, the computer software used and the applied practices in CM are specific for the case company so the results cannot be widely generalized. Also, in this study only white-collar workers were interviewed so a comprehensive picture of the company culture cannot be

concluded even for the case company. The aim for this study, however, was to investigate the process of CM from the R&D perspective so that exclusion of production personnel was done on purpose. It could be beneficial to carry out another research to find out more about the companywide culture and atmosphere.

Another topic for future would be to check the state of CM in target company after some period of time. There has been some parallel work around the topic of CM processes going on during making of this study and a change process model will be designed and implemented in near future. In the spirit of continuous improvement, it is essential to monitor and develop the process and the RQ1 should be answered again after some time once the new CM model has been implemented.

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APPENDIX 1. INTERVIEW QUESTIONS

QUESTION 1: Miten PDM/ERP/muita järjestelmiä hyödynnetään muutostenhallinnan työkaluna tällä hetkellä? / How the company's current data systems are utilized as Change management tools today?

QUESTION 2: Mitkä ovat nykyisten tietojärjestelmien suurimmat ongelmat? / What are the main problems of the company's current information systems?

QUESTION 3: Kuka päättää muutoksista/hyväksyy muutokset? / Who accepts or rejects changes?

QUESTION 4: Miten yrityksen ilmapiiri tukee/haavoittaa muutoksia / How does the atmosphere of the company support or hinder changes?

QUESTION 5: Saavatko työntekijät riittävästi tietoa muutoksista / Do employees get enough information about changes?

QUESTION 6: Miksi tuotteita muutetaan? / Why changes are needed?

QUESTION 7: Kuka alullepanee muutoksen? / Who initiates the change?

QUESTION 8: Mitä hyötyjä muutoksilla saavutetaan? / What are the benefits of change?

QUESTION 9: Mikä on protokoneiden/-asennusten merkitys uusien ominaisuuksien käyttöönotossa? / What is the meaning of prototype machines?