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Conceptualization of the Production Process

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The objective of this thesis was to conceptualize the production process for the case company, as the case company was not following a standardized production process.
The conceptualization project of the process started from the current state analysis, where the state of the current production process, was mapped as it was at the start of the project. Data was collected by interviewing employees and through a questionnaire. The questionnaire was sent before the interviews to get preliminary picture of the current production process. During the project, workshops were held, which consisted of two to three employees of the case company from different positions. The purpose of the workshops was to share ideas and follow the progress of the project.

After the interviews and questionnaire, the production process was divided into four phases, namely preparation phase, implementation phase, handout phase and maintenance phase. Based on the problems that the interviews revealed, theory was chosen to focus on process development and feedback collection in construction.

Several changes and additions were made to the production process map. The most important meetings during the project were added, because it is important to see when and where decisions are made and how the progress of the project is monitored. Also, the name of the first phase was changed to project preparatory and documentation storage was changed to cloud-based storage.

The outcome of this thesis was the conceptualized production process map. According to the feedback from the case company, the process map provides a clear and extensive description of the production and it can be used in the future process developments. Feedback collection is a relatively new concept in the construction field, thus the feedback system in the production process should be standardized and a questionnaire template created.

Keywords	Process mapping, process development, feedback collection, construction

Contents

1 Introduction

1.1 Business context

This thesis was carried out for a Finnish construction company KRY Rakennus Oy. The case company offers project management, design management and implementation for interior constructions and other difficult concrete structures. KRY Rakennus Oy is a Finnish family owned construction company that was founded in 2015.

It is part of Kalliorakennus-yhtiöt Oy concern. Additionally, Kalliorakennus-yhtiöt Oy includes two other different companies Kalliorakennus and Luja-louhinta. Kalliorakennus-yhtiöt specializes in quarrying, rock engineering, reinforcement work and stone aggregates. The headquarters of Kalliorakennus-yhtiöt are located in Vantaa and it has 60 employees. (KRY Rakennus Oy)

1.2 The business challenge, objective and expected outcome

At the moment KRY Rakennus is not following a standardized production process. The objective of this thesis was to create a conceptualized production process and find development areas. The case company wishes to formalize its core processes and apply certification from International standard organization. Additionally, the company might use the concept in the other business also. There are three core processes in the case company:

- Tendering procedures
- Production process
- Management process

This thesis concentrates on developing the production process. The expected outcome is a conceptualized production process that is compatible with ISO 9001 standard which is a standard for quality management systems.

1.3 Project plan

This thesis was implemented in Sammalvuori underground subway depot construction site in Espoo. Figure 1 shows the process of the thesis and its five different phases. The blue boxes indicate the process and orange color indicates the outcome from the process while the green box is data that is used in different process phases. The first phase was to identify the business challenge. It was identified in several appointments with the employees and at the same time the challenge was outlined to be suitable for this thesis. The second phase was to carry out a current state analysis. The current state analysis was carried out as qualitative research, meaning the information for the analysis was primarily based on interviews and questionnaire. The purpose of the current state analysis was to describe and define the production process. The third phase includes creating an information base from existing knowledge and creating a conceptual framework for thesis. In the fourth phase the outcome was the first version of the developed process.

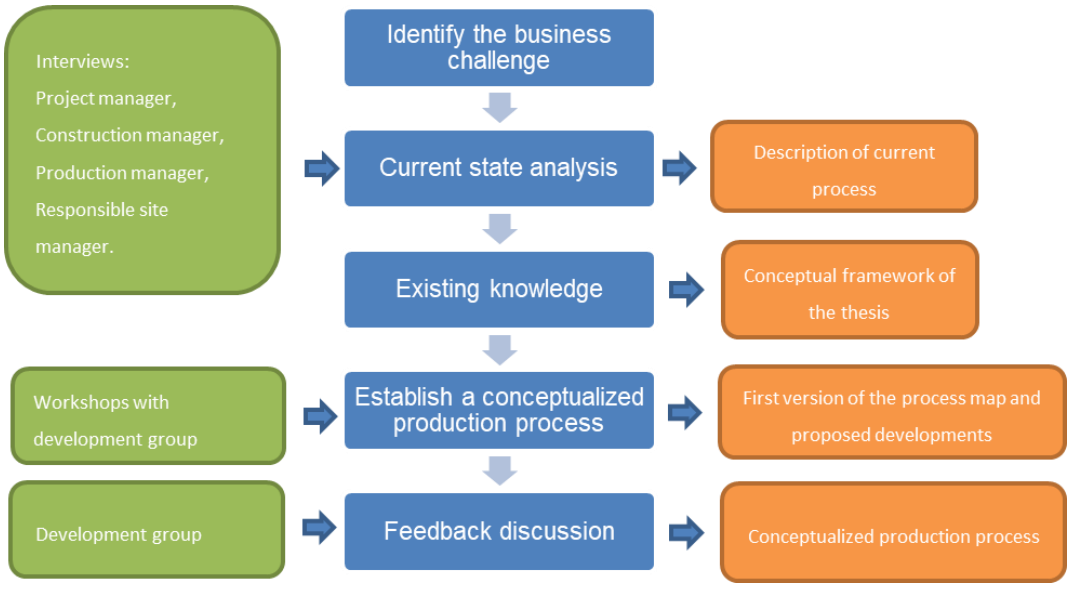

Figure 1. The process of the thesis

During the development process workshops were held regularly to track the progress of the project and to consider possible problems that occur during the development project. The workshop group consisted of two to four persons from the case company and each person had different position in the case company, meaning the group consisted of versatile professionals.

As seen in figure 1, the final phase was a feedback discussion where KRY gave the final improvements for the development work. The final phase consists of also conclusion and evaluation about the impact and usefulness of the work. This part includes also further development suggestions based on the state of the developed work.

1.4 Outline of thesis report

This thesis is divided into five different sections: Introduction, current state analysis, searching existing knowledge, establishing process and conclusion. The thesis begins with an introduction of the case company and determining the business challenge and the scope of the thesis. The next stage is to carry out the current state analysis and identify development areas of the case company's production process. In the third chapter, existing knowledge is selected based on the findings from the current state analysis. In the fourth chapter, knowledge is utilized in the development of the production process. The last chapter includes further development suggestions based on the state of the project and evaluation of how well the thesis met the goals.

2 Analysis of the case company's current process

2.1 Overview of current state analysis

In this chapter, the state of current production process and different work phases are described and mapped as they were at the start of this project. The aim of current state analysis is to model the current process and find possible development areas of the production process. The current state analysis was conducted by interviewing employees of the case company and a questionnaire. The questionnaire template can be found in appendix 1.

The first versions of the current process were made using paper, and they were refined to be specific enough. The final versions were made using Microsoft Excel. This production process is mapped in the general level, because the implementation phase contains several functions, processes and the type of projects vary, it is not ideal to describe the processes in detail.

2.2 Description of current intuitive production process

This chapter describes the work phases starting from construction site preparation phase. the next phases are an implementation phase, handover phase and the last phase is maintenance period.

2.2.1 Preparatory phase

The preparatory phase is divided into three sections that are shown in figure 2 and these sections are divided into more detailed tasks. The case company's preparatory phase starts after signing the contract. Starting a construction site preparation requires documents from inquiry for quotation and contract documents that the construction site is able to operate as agreed.

The responsibilities are defined at the start meeting and the size of the project determines how many different job titles there are at the construction site. In most cases there are at least a construction manager, responsible site supervisor, site supervisor and site engineer. If the project is bigger, there are separate persons to plan and monitor for example the schedules or quality.

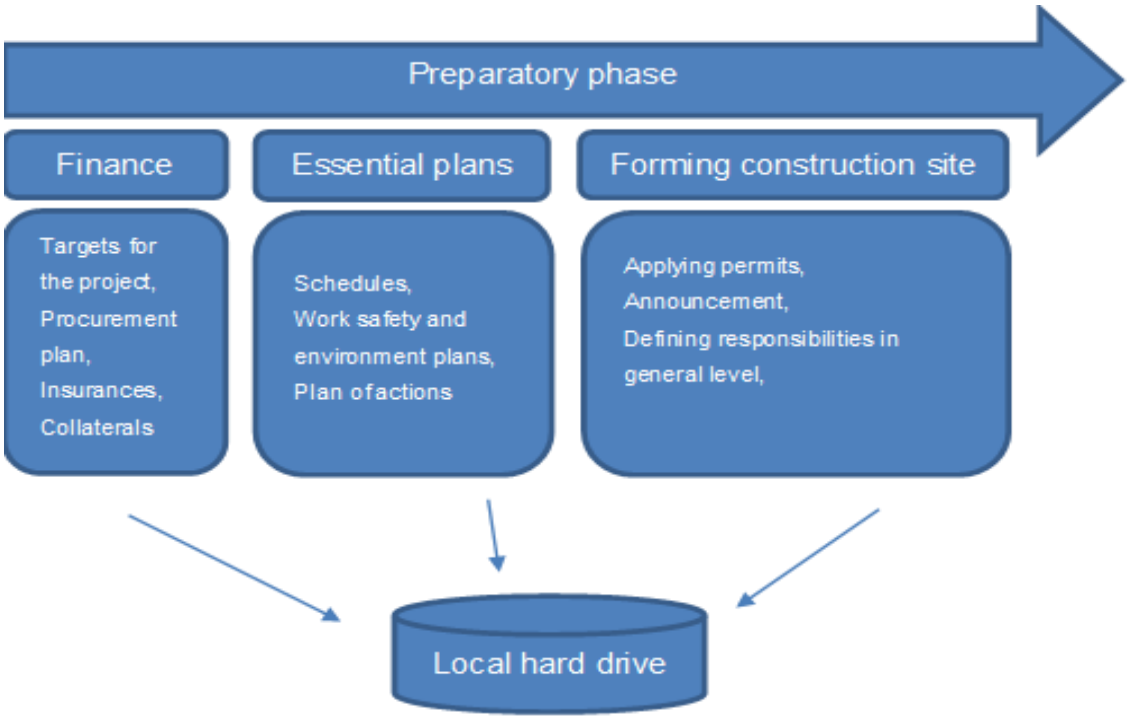

Figure 2. Process map of the preparatory phase

As seen in figure 2, preparatory phase is divided into three sections. In the finance part the construction manager defines targets for the construction site and makes procurement plans. The construction manager also obtains insurances and collaterals for the project. The construction site organization makes essential plans that are mandatory to start the building project, under the lead of the responsible site supervisor and the construction manager. After approving the building permit and other essential permits, the construction site informs the building supervision authority that the building project will be executed and forms a construction site. The documents created during the preparation are saved to the local hard drive.

2.2.2 Implementation phase

The implementation phase is divided into several processes and tasks that are shown in figure 3. Each process and task are carried out during the implementation several times until the project is ready for handover.

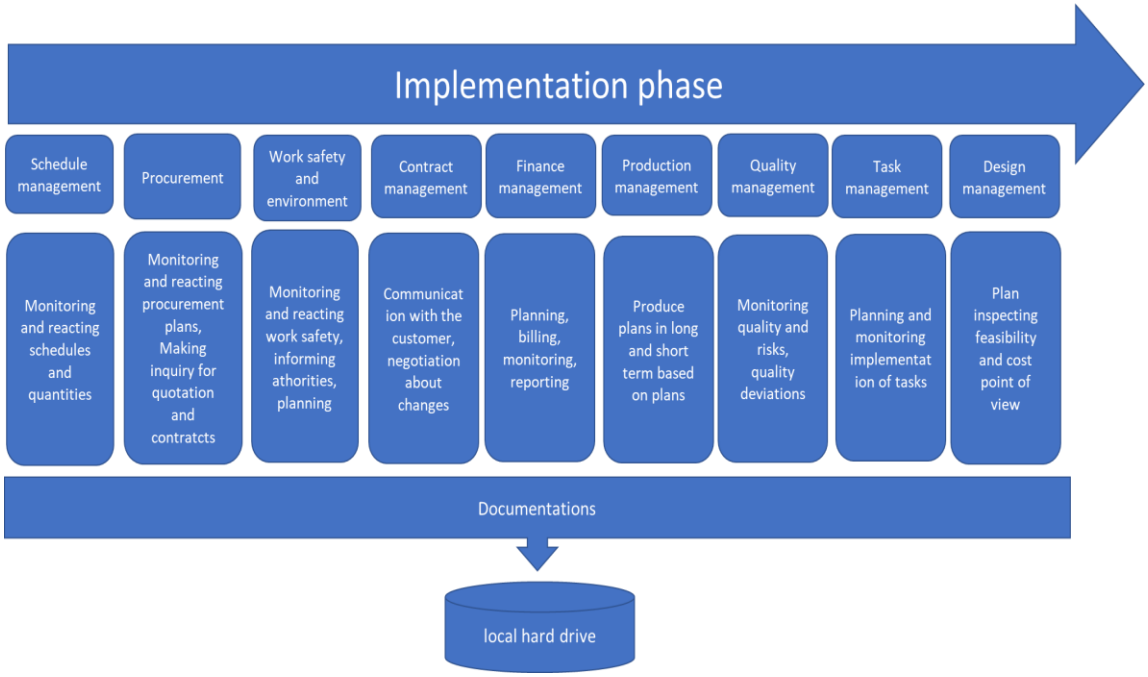

Figure 3. Process map of the implementation

Site supervisors are participating in almost every process during the project, but their main responsibilities are task management and work safety management. Additionally, they have to make and follow schedules, costs and make documents from each task. The main responsibilities of the construction manager are procurement, contract management, production management and design management. The main responsibilities of the responsible site supervisor is work safety management, but additionally participates in task management beside site supervisors if necessary. The site engineer participates in work safety management, finance management, quality management, schedule management and saves documents that the site supervisors have produced. The construction site organization has a meeting to follow the progress of the project and inform the client. Meetings also ensure that every task is going to be implemented and nothing will be forgotten. As seen in figure 3, all documents are stored to the local hard drive.

2.2.3 Handover phase

The handover phase starts three to six months before project completion. In this phase, the most important objective is to get the project finished on time and the quality of the product is as agreed. Figure 4 shows different parts of the handover phase. Each site supervisor ensures that their own responsibilities in the project are completed and documented. The site organization makes schedules for the handover and gives instructions to contractors, about finishing the project.

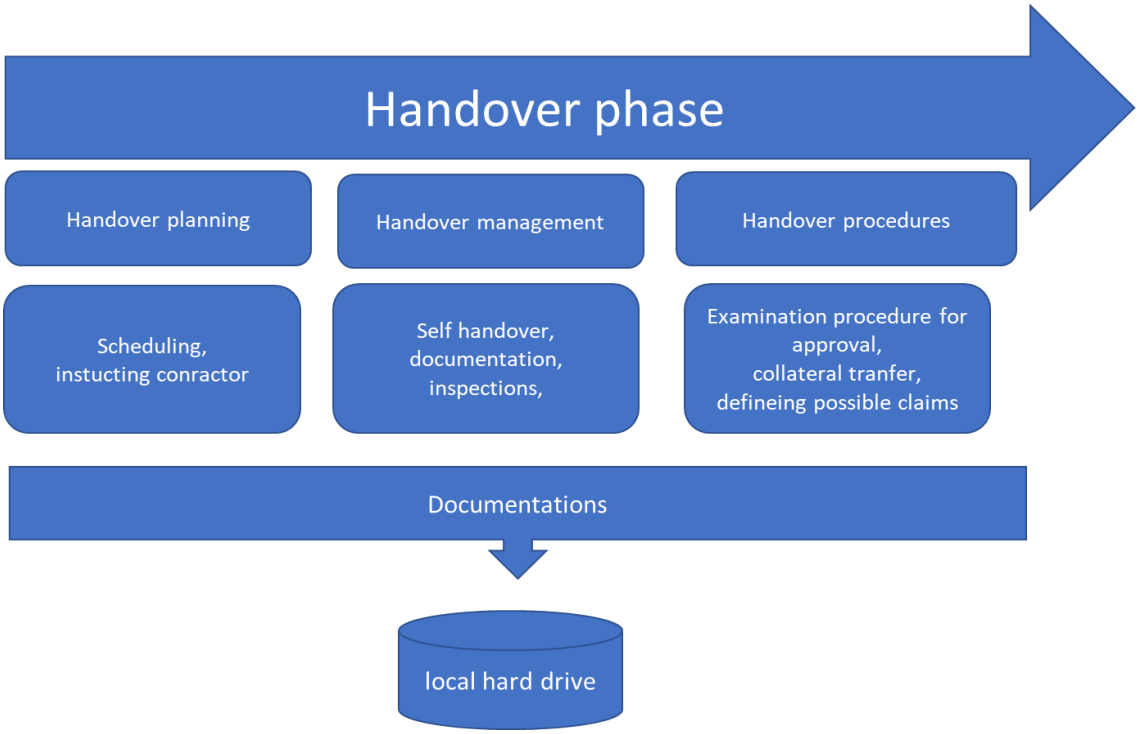

Figure 4. The process map of the handover phase

As seen in figure 4, after finishing the implementation phase, the construction site organization carries out self-handover, where the organization inspects quality of the work and makes a list of the defects, which are repaired. After self-handover, the site organization produces handover documents and organizes the official inspection that is carried out by a building supervision authority. If the inspection is approved, the construction organization dismantles the site and handovers the project to the client and documents that have been produced during the production. After approved handover, a construction manager transfers the maintenance period collateral and defines claims, if there is an unclear account relationship between customer and contractor.

2.2.4 Maintenance period

The maintenance period starts with an examination procedure for approval, where the customer and contractor inspect, if the outcome of the project meets the predetermined requirements. If during the maintenance period defects are occurred, the contractor repairs defects provided that they are covered by the warranty. The maintenance period is shown in figure 5.

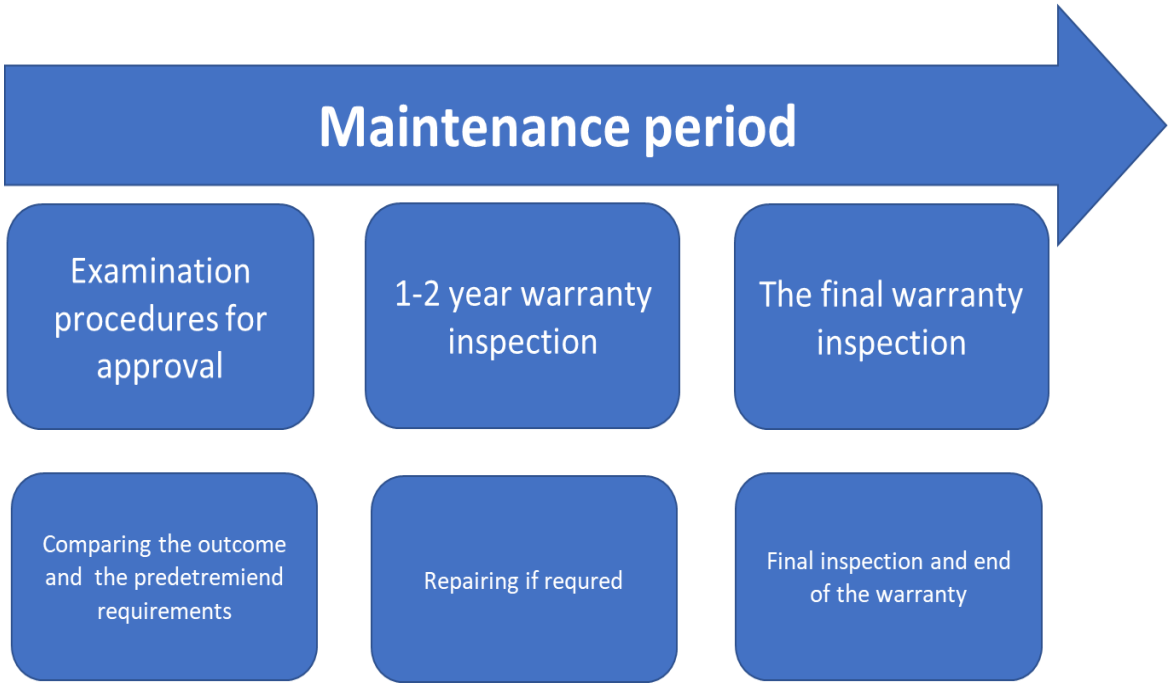

Figure 5 Process map of the maintenance period

The contact person for the customer during the maintenance period is the construction manager or determined person, who takes care of the repairing defects. Depending on the contract, usually warranty inspections are carried out once or twice during the maintenance period and it ends to the final warranty inspection, where the contractor and customer inspects, whether the defects have been repaired. The warranty period can be also longer than two years, but generally construction companies follow general conditions for building contracts recommendations.

2.3 Identifying strengths and development areas in the current process

Identified development areas were recognized by interviewing employees of the case company. The case company has a functional production process, but during the interviews following weaknesses were found:

- The case company uses local hard drive in documentation
- Document templates are not standardized in the case company
- The case company does not collect feedback

At the moment, the case company saves documents to the local hard drives and prints paper versions. Saving documents to the hard drives restricts accessibility, because access to the hard drive is only from the computers at the site. Documentation templates are not standardized in the case company, meaning if different persons produce the same document, its layout might be a little different and it might contain different information. At the moment, the case company does not collect feedback from the customer or subcontractor.

2.4 Summary of existing process and its strengths and weaknesses

The case company's production process can be divided into four different parts. Figure 6 summarizes the production process of the case company.

Phase	Content	Outcome
1. Preparatory	preparing and forming the construction site	Functional construction site
2. Implementation	Building and managing the project	Completed construction
3. Handover	The product is delivered to the customer	Project is finished
4. Maintenance	Warranty period	Defects are repaired

Figure 6. Production process

As seen in figure 6, the production process starts from preparatory phase. In the preparatory phase, the company has signed the contract and starts preparing the construction site. In the implementation phase, the building process has started, and the company manages the project, then handovers it to the customer. After handover, the company maintains the product for the predetermined time period, which is defined in the contract and carries out reworks if necessary. Usually the length of the maintenance period is in accordance with general conditions for building contracts, which is two years, but it can be also longer. Figure 7 shows strengths and weaknesses of the current production process

Strengths	Weaknesses
• Process is functional • Communication inside the case company	• Documentation is not cloud-based • Document templates are not standardized • No feedback collection

Figure 7. Strengths and weaknesses

As seen in figure 7, the production process is mainly functional, but it lacks important points from the process improvement point of view. At the moment, the case company does not collect feedback from clients, users or other subcontractors. Documentation in the case company is not cloud-based, meaning the case company uses local hard drives as a documentation storage and in addition its document templates are not standardized. The layout of the current documents varies depending on the document producer.

3 Existing knowledge on improving processes

Process mapping is a visual method for people to improve processes. A process map helps to identify unnecessary tasks and focusing on the processes that are important to customers, quality improvement and generate income for a company. (Savory and Olson 2001; 2)

3.1 Process definition

According to Luukkonen et al. (2012: 8) a process can be described as a chain of events, where a company uses resources to create extra value for the customer. Processes are always customer to customer chains, which is shown in figure 8.

Figure 8. Process example

As seen in figure 8, a process uses resources such as material, money, time and man-power to add value to the inputs, which are processed into outputs. The outputs can be for example products, solutions and services. The extra value, that is added to the inputs depends on the customer's needs, expectations and demands. The customer can be external or internal, meaning the customer can be also from inside the company. The customer creates expectations, needs and demands for the process. (Martinsuo & Blomqvist, 2010: 4)

In business, a process can be divided into different levels and categories based on its purpose for example business processes and processes. Difference between the business process and the process is, that company makes profit with the business processes and the process can be any process in the company. Additionally, the process can be

divided into core processes and support processes or main processes and subprocesses. The core processes are always connected to the external customer whereas, the support processes are for internal use. The main process can be mapped in many different levels, meaning the chain of subprocesses forms main processes. In a process development, a process can be mapped in the current state or in the target state. The development areas in a process can be found from the difference of a current state and target state. (Martinsuo & Blomqvist, 2010: 4-5)

A process might require resources from all departments of the company, and this connects processes into organizational structures of the company for example core processes usually requires different resources from all departments. The role of processes varies depending on the management, because business can be managed many ways not only through processes. (Martinsuo & Blomqvist, 2010: 4)

In a process management, it is important to set goals for the process and follow the feedback from the process, because these feedbacks are used to make improvements to the process. Figure 9 shows the feedback collection points in processes. (Martinsuo & Blomqvist, 2010: 5)

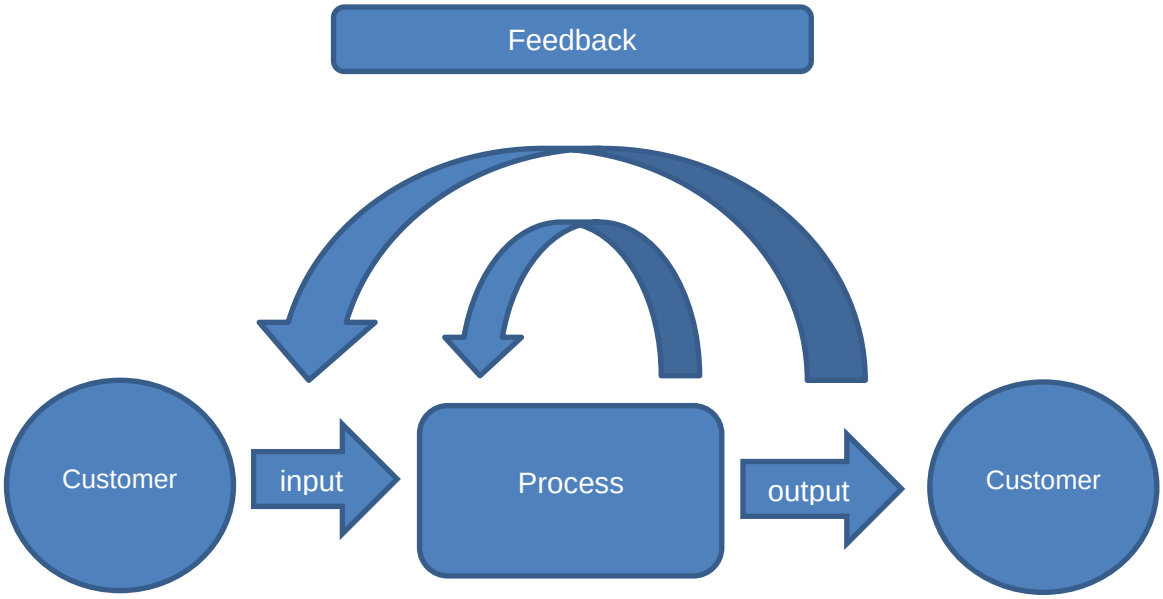

Figure 9. Feedback in processes

As seen in figure 9, the feedbacks are collected from the end output, but also during processing and comparing them to the predetermined goals, how well the process met the targets. (Martinsuo & Blomqvist, 2010: 5)

3.2 Process development

According to O'Connor and Swain (2013: 32) process development is often referred to establishing effective and efficient processes in the company or project organization. Process development includes two basic steps, defining the current state and future state of the process (O'Connor & Swain, 2013: 32). Before starting the process mapping and development work, it is very important to clarify the outlines of the project for example which processes are included and what are the goals of the company. Savory and Olson (2001: 4) says that the purpose of improvement determine, which processes are included, meaning the goals of the company defines, which processes are included to the development project. Figure 10 shows common stages of the process development. (Martinsuo & Blomqvist, 2010: 6)

Figure 10. Common stages of process development

As seen in figure 10, the next stage is analyzing the current process and collect information, that are available. If the target is to develop completely a new process, collected information is from old method, that is used to add value. There are many methods to collect information, that is used to process mapping such as interviews, process observing and process simulation. (Martinsuo & Blomqvist, 2010: 6)

After analyzing the current process, the next stage is to find development areas and re-structure whole process or part of it, based on the customer's expectations, needs and outputs. In most cases re-structuring concerns only part of the processes for example subprocesses, resources or connections between processes. After founding the development areas and re-structuring processes, the target process should be modelled. (Martinsuo & Blomqvist, 2010: 6-7)

The target process model should be tested in a model or in real circumstance. Testing is necessary to find little details, that should be changed. Testing also tells, if the process achieves the determined goals or if the process is insufficient. The process might have wide scale impacts to the company's operations and implementing insufficient process in wide scale is not ideal. (Martinsuo & Blomqvist, 2010: 7)

Implementing in a wide scale means, that old habits ja instructions are replaced by the new versions. Employees and other stakeholders are instructed in compliance with the new process and monitoring and other systems are adjusted to be compatible. The whole process is monitored, and feedback is collected during the process. These are collected to control process towards determined targets and make improvements continuously. (Martinsuo & Blomqvist, 2010: 7-8)

3.3 Process mapping

Before starting the process mapping, mapping level and purpose of the mapping must be known, because mapping should offer only necessary and relevant information about process. Processes can be mapped in four different levels: (JUHTA, 2002: 6)

- Process map
- Activity model
- Process flow
- Activity flow

Process maps are read from left to right in all process map levels. The process map is the highest-level description, which illustrates only the core processes in the organization. The activity model splits one core process into several subprocesses. The process flow is more accurate version of activity model and activity flow is the most detailed process map version.

3.3.1 Symbols in process mapping

Specially in the lower level process maps, such as the activity flow or the process flow contains several different functions and flow, which are described with symbols. Figure 11 shows commonly used symbols in process mapping and their meanings. (Martinsuo & Blomqvist, 2010: 11)

Symbol	Meaning
	Start and end point
	Function, process or subprocess
	Desicion
	Flow and message flow
	Delay
	Document
	Information system or storage
	Data

Figure 11. Widely used symbols in process mapping

Symbols, that are shown in figure 11 are not standards, but organization may use combination of these symbols. If the organization uses its own symbols, it is better to use them in the process mapping. The process maps are often complemented with a text, that describes content of the process map in more detail. (Martinsuo & Blomqvist, 2010: 11)

3.3.2 Process map

Figure 12 shows an example of a process map. The process map describes an organization in the highest level and shows core processes and the most important subprocesses of the organization. (JUHTA, 2002: 6-7)

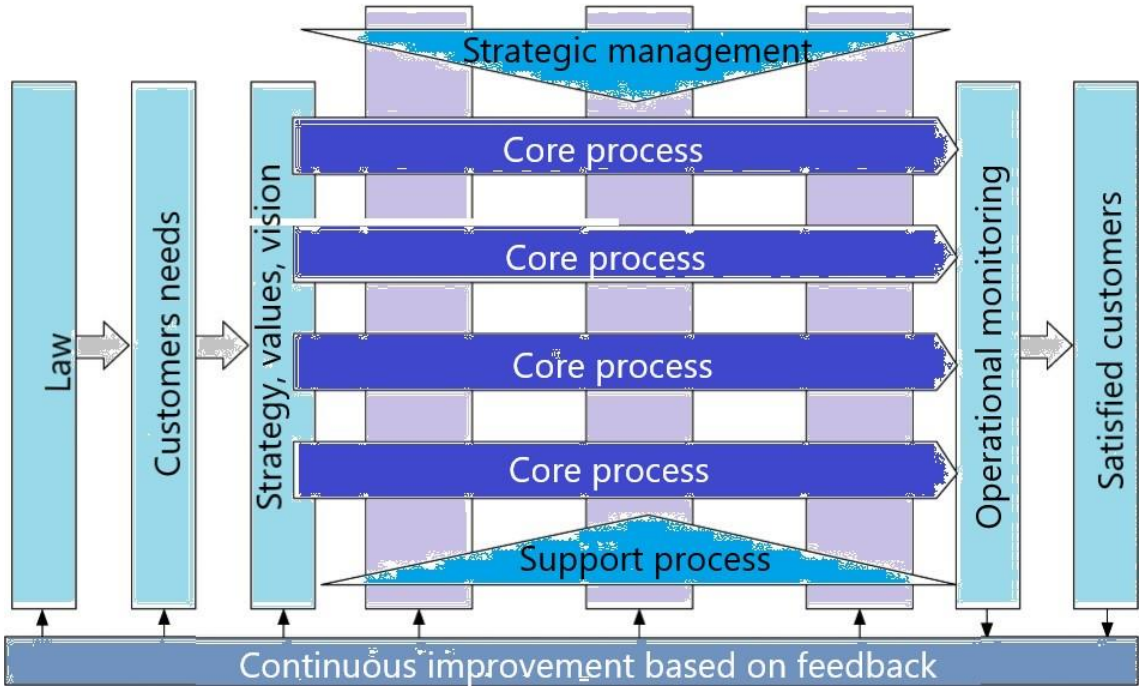

Figure 12. Process map example (JUHTA, 2002: 7)

As seen in figure 12, the process map shows structure of the organization, customers and its information producers. The process map is overall view of the organization and it can be used as a tool in external communication and decision-making. (JUHTA, 2002: 7)

3.3.3 Activity model

The activity model describes an organization more specific and gives overall view for the management about process flow and influencing factors. It breaks down core process into smaller subprocesses, where responsible person, target values and performance indicators are determined. Figure 13 shows an example of activity model (JUHTA, 2002: 7-8)

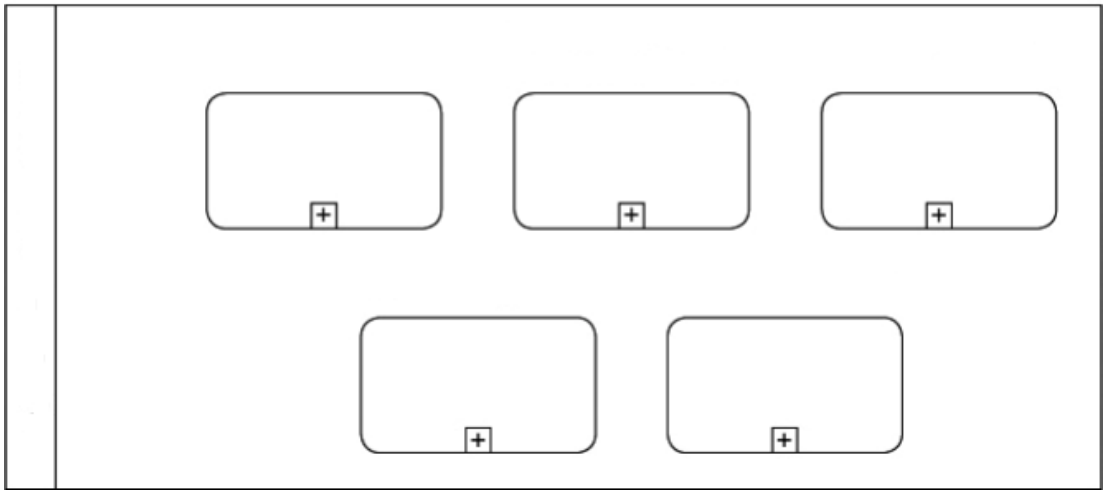

Figure 13. Activity model example (JUHTA, 2002: 8)

The activity model describes also, relationships between processes and other influencing factors around the process. Smaller boxes in figure 13 are subprocesses or tasks, and they are inside the bigger box, which is called a swimline. Each swimline has a responsible person or organization, who performs the subprocess. The plus sign indicates, that subprocess includes more subprocesses. (JUHTA, 2002: 8)

3.3.4 Process flow

The process flow is similar than the activity model but more accurate. Depending on accuracy of the map, subprocesses can be divided into smaller tasks and functions. In the process flow description, names and targets for the functions are given, and they are in numerical order. Figure 14 shows process flow example, where customer, process owner and other stakeholders are known, in addition their activities and tasks. (JUHTA, 2002: 8)

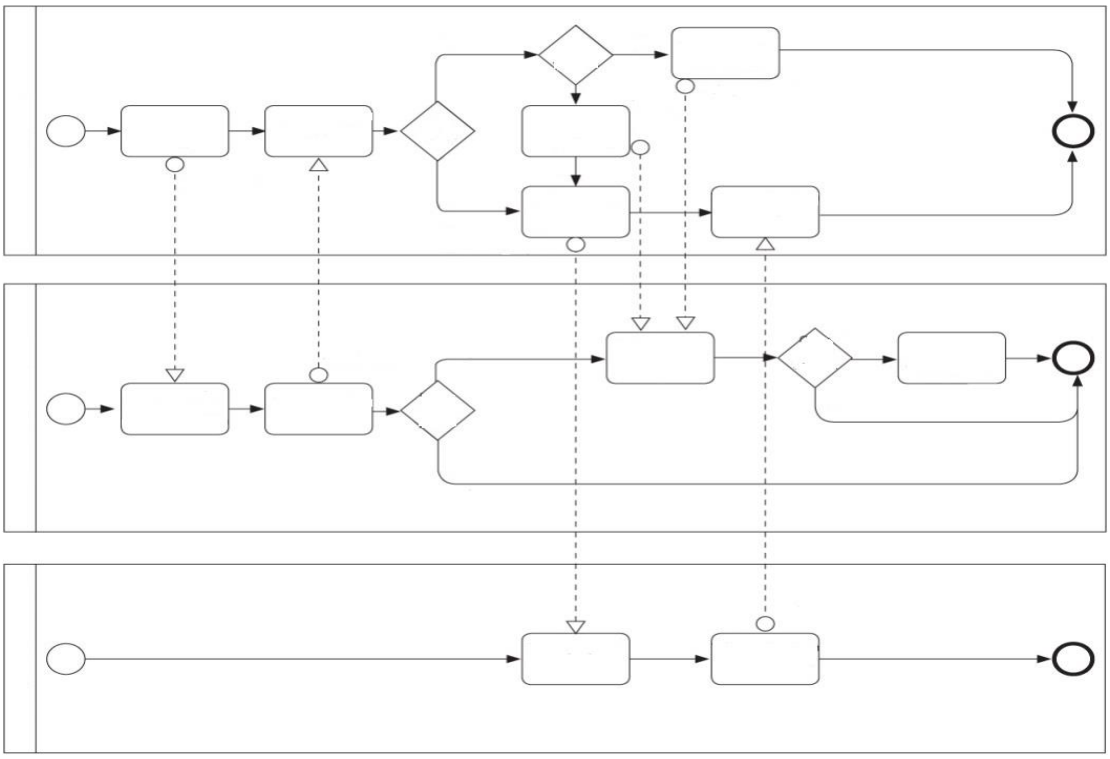

Figure 14. Process flow example (JUHTA, 2002: 8)

The process flow might contain several swimlanes and responsible persons. The process flow has always startpoints and endpoints, which are marked as a circle in figure 14. The darker circle is the endpoint of the process flow. In addition, process flow contains often several decisions, which are shown as a square in figure 14.

3.3.5 Activity flow

The activity flow map shows, how the individual task is carried out in the organization and it is more accurately description for the processes than process flow. It shows also how information is transferred between activities and in what form it is for example, information in form of email or paper. Figure 15 shows the idea of the activity flow. (JUHTA, 2002: 9)

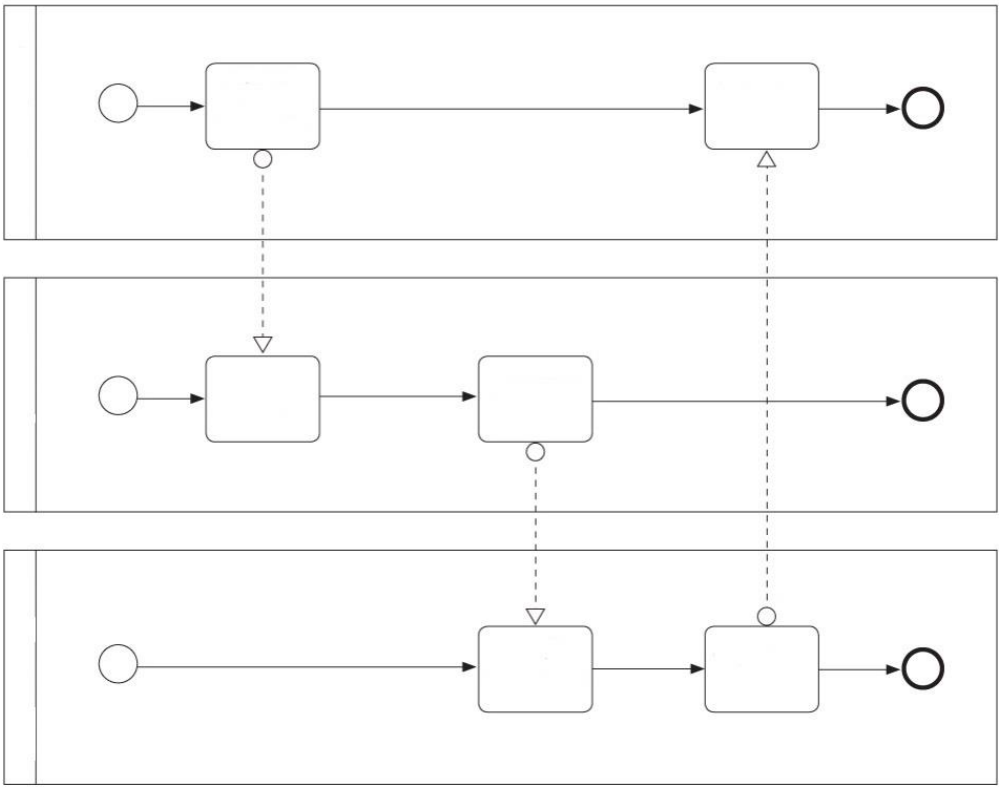

Figure 15. Activity flow example (JUHTA, 2002: 9)

As seen in figure 15, the activity flow maps show step-by-step, how specific task is implemented and what procedures are included to manage it. The activity flow maps are used, when for example the process development or work instructions are desired. (JUHTA, 2002: 10)

3.4 Feedback collection

Construction is essentially a service industry, meaning it is very important to collect feedback from customers and other stakeholders. Improving the quality of a construction projects, the customers feedback is crucial part. The feedback describes values and satisfaction of the customer. These values and satisfactions can be seen as a measurement tool or as a goal in the development of the construction process quality. Nowadays, construction companies have more often adopted the customer satisfaction as a one of the

success factors of a construction project. In a competitive market, construction companies should differentiate themselves from their competitors by increasing customer satisfaction. In order to manage and develop customer relationship and the quality of projects, construction companies should use multiple tools to measure customer satisfaction. Also, an organization gain benefit from measuring customer satisfaction for example, in development communication between parties. Figure 16 shows the feedback flows in the construction projects. (Junnonen & Kärnä, 2005: 1-2)

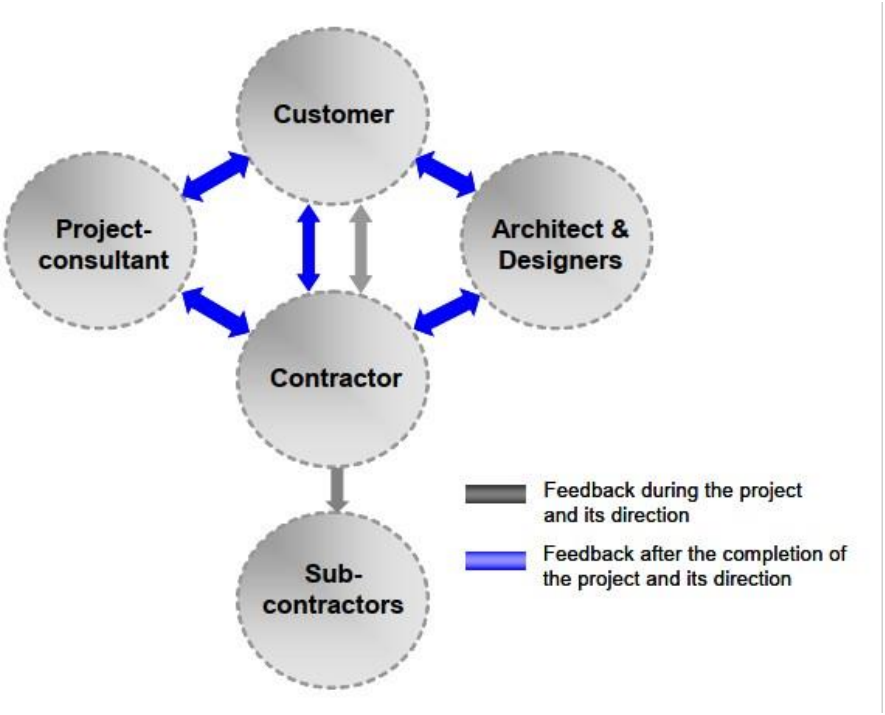

Figure 16. Feedback flows (Junnonen & Kärnä, 2005: 5)

The arrows in figure 16 shows direction of the feedback and also when the feedback is given in the project. The feedback flow between contractor and sub-contractor is pointing only one-way, because sub-contractors are usually only for a limited time involved in the project. (Junnonen & Kärnä, 2005: 5)

3.4.1 Customer satisfaction

According to Cheng et al. (2005: 1054) there is no clear definition to the customer satisfaction, but Junnonen et al. (2007: 13) says that the customer satisfaction can be approach from two different point of views, a satisfaction to individual activity and an overall satisfaction to all activities. The satisfaction in the individual activity level means customer's satisfaction or dissatisfaction to the specific event in the project. Whereas the overall satisfaction forms a customer's satisfaction to all events in the project. The customer can be dissatisfied to one individual event but still satisfied overall performance of the constructor or vice versa. This means, that dissatisfaction to the individual event cannot be seen to have a direct effect to the overall customer satisfaction. (Junnonen et al. 2007: 13)

The customer satisfaction can be simplified define as a comparison between a customer's expectation of the outcome and actual outcome. Often, only fulfilling the customer's expectations is not enough to make the customer satisfied, but the expectations must be exceeded. When the outcome and experiences of the customer is bellow the customer's expectations, the customer will be dissatisfied. (Junnonen et al. 2007: 13)

3.4.2 Collection method

Usually, a customer surveys construction companies produce separately, and their quality and usage are underdeveloped. In construction projects, the feedback is often collected at a late stage, meaning the feedback has not significant effect on operations during the project. Construction projects are often very complex and unique, in addition project parties have different objectives. These characteristics make the previous customer feedback hard to utilize in future projects. (Salminen, 2005: 630)

At the moment, construction companies often use questionnaires to collect feedback from the customers and other stakeholders. Questionnaires are easy to make and gives clear numerical results, but it is good to know following principles when producing questionnaires. (Salminen, 2005: 630)

- Measure relevant objects, that gives information about customer satisfaction
- Questions under the same question category measures same objects
- Questionnaire layout is appealing and easy to answer

Besides planning a questionnaire, also execution of the survey should be planned and how results are utilized or how they are presented. Currently, questionnaires are carried out via internet. In addition to customers, questionnaires can be made for other stakeholders such as sub-contractors, material suppliers and designers. (Salminen, 2005: 630)

3.4.3 Benefits and usage

A feedback system in construction project provides benefits for each stakeholder. For a contractor, high client satisfaction might lead new projects in the future, because satisfied clients might use contractors again, that are considered good. Additionally, the feedback system is a tool for a contractor to improve service quality, competitiveness, helps to understand problems in the process, evaluates the progress towards the goal and help to determine the position of the company in competition on the company level. According to Kärnä et al. (2004; 2) satisfaction measurement improves also communication between parties. In the long run, the feedback system also helps to improve the image of construction company and whole construction industry. (Junnonen & Kärnä, 2005: 5)

For a client, the feedback system helps to improve end-user's satisfaction, develop co-operations procedures and trust in relationships, reduce unclarity during construction project and overall service quality in the construction supply chain. (Junnonen & Kärnä, 2005: 5)

Client's feedback can be used in strategic level and tactical level. At the strategic level, feedback can be used for example, in development of customer relationship management or benchmarking. At the tactical level, feedback can help for example in solving client's complaints or analyzing critical incidents. (Junnonen & Kärnä, 2005: 5)

3.5 Conceptual framework

This chapter explains conceptual framework of this thesis. The purpose of conceptual framework is to summarize theory that is used in this thesis and show relations between theory and result. Figure 17 shows the conceptual framework of this thesis.

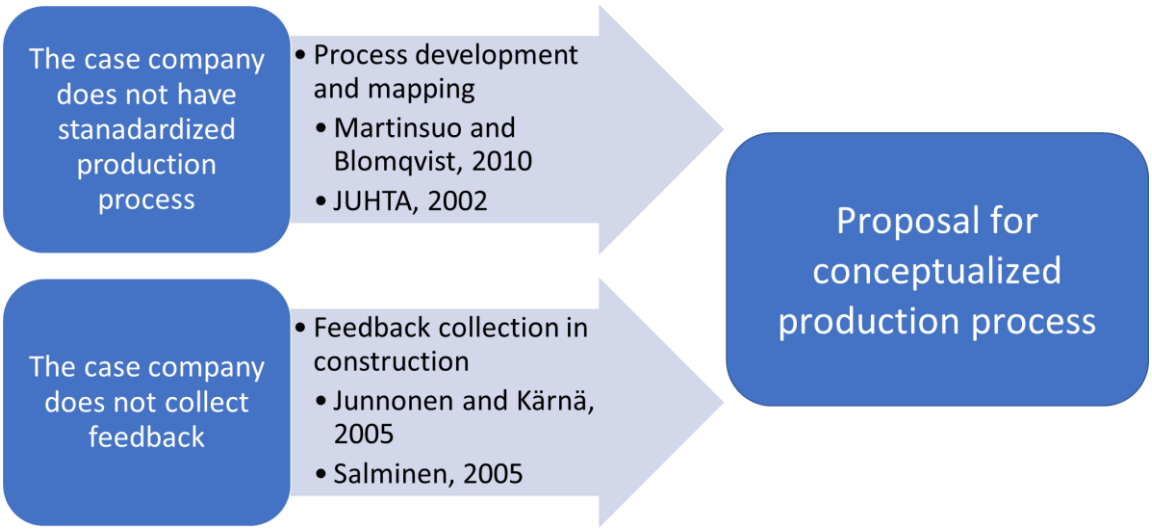

Figure 17. Conceptual framework

Figure 17 shows the relations between the business challenge and theory, but also the most used and the most important sources in this thesis are shown.

4 Establishing a conceptualized production process for KRY

4.1 Overview of proposal build

This chapter shows the results from this project. The purpose of this thesis was to create a conceptualized production process, because the case company did not follow a standardized process. Establish process started from the current state analysis, where the state of current production process was mapped by using paper and Excel program. After identifying the problems in the production process, the searching process for relevant theory, tools and best practice was started. Theory areas were chosen to focusing on process development and feedback collection. The next stages are to apply theory to the new production process and collect feedback from the case company to make the final improvements to the concept.

4.2 Proposal for production process

Based on the ideas that revealed during the workshops, changes to the production process are shown in following figures in orange color and the feedback collection point are in green. Changes to the preparatory phase are shown in figure 18 in orange. The name of the preparatory phase was changed to project preparatory, because it describes the content of the phase better. In the preparatory phase, the construction organization shares responsibilities among the organization and defines the goals for the project. The organization also makes the schedules for the essential plans to start implementation such as work safety and environment plans.

In addition, the local hard drive was changed to cloud-based storage, because the case company should change the document storage to the cloud-based in order to improve document accessibility. Accessibility in this context means that user can access to the documents and other information through mobile phone or laptop. The cloud-based storage provides also other benefits and opportunities such as creating backup files is easier. Naturally, saving to the cloud-based storage requires internet connection, but user can read and make changes to the files in offline. After recovering the internet connection, the changes that were made are saved to the cloud automatically.

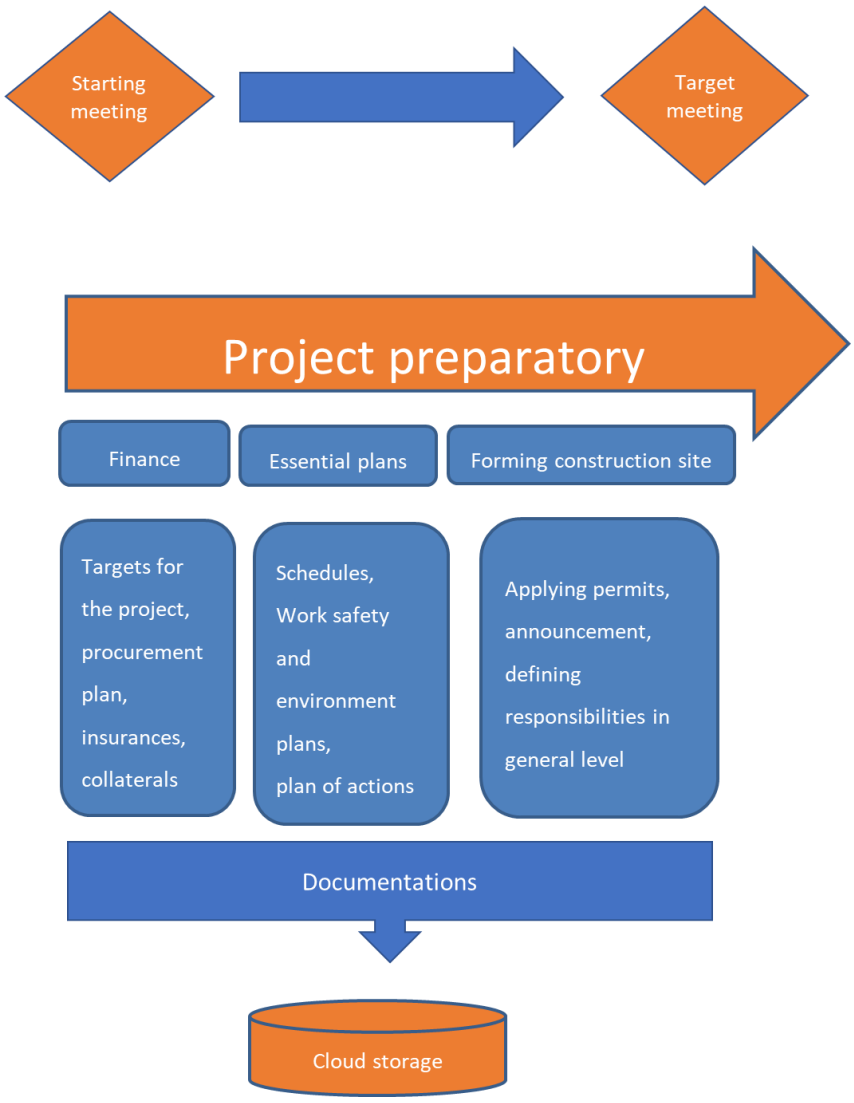

Figure 18. Proposed project preparatory

As seen in figure 18, the Important meetings in the phase were added to the process map, because it is important to show for example to the client, how progress of the project is monitored, and the information is shared. There are two meetings in the project preparatory, starting meeting and target meeting. In a starting meeting, construction site organization creates schedule for the plan of action, shares responsibilities ja tasks among the organization and makes a list of remaining tasks. The plan of action describes, how the case company manages quality in the project and it also known as a quality management system. In the target meeting, construction organization agrees objectives of the project and how the fulfilment of objectives is measured.

In the documentation should be used standardized document templates, for example, in the starting meeting standardized document template guides the flow of the meeting and nothing will be forgotten, when the template is already done. At the moment, used document templates varies, depending on the user and the version of the document template. From the documentation storage can be found several different versions of the same document, because it is updated during the project. To solve this challenge, documentation templates should me storage in a place, that can be found easily and only the newest versions only. The older ones are deleted or storage to the other folder.

Figure 19 shows changes to the implementation phase in orange. In the implementation phase process map, also important meetings are added and in addition the documentation from subprocesses are made to the standardized document templates and storage to the cloud. In the implementation phase, the standardized document templates are necessary, because documents that are produced during the project are handed over to the client. The handover documentation should give clear picture to the client about methods and materials that are used during the implementation phase.

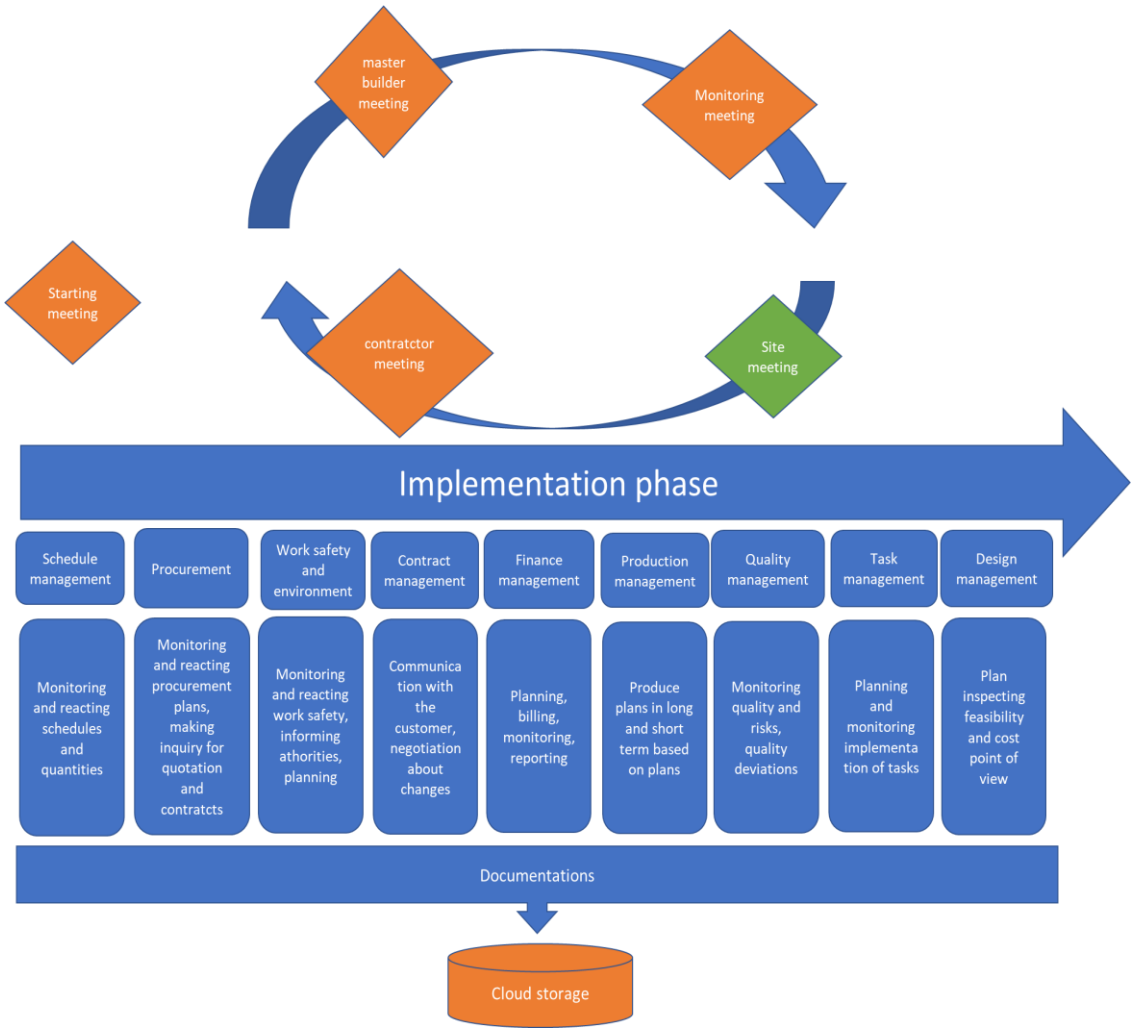

Figure 19. Proposed implementation phase

As seen in figure 19, the implementation phase starts with a meeting which is held by a building supervision authority and in addition the building supervision authority leads the site meeting. During a project, several meetings are held to monitor progress of the project, share problem and flaws that have occurred. During the implementation it is also important to collect feedback from the client so the construction organization can react and make corrective action towards better result and higher customer satisfaction. The feedback could be collected in the site meeting, because the client is participating also to the meeting. The site meeting and the feedback collection point is marked in green in figure 19. This is excellent point to collect feedback because it is held regularly during the project.

To the handout phase, changes are shown in orange in figure 20. Just like pervious phases, also to the handout phase process map, important meetings are added, and the documentation storage is changed to the cloud-based storage. At the beginning of the handover phase is organized a starting meeting, where the construction organization make a list about remaining tasks, before handover the product to the client.

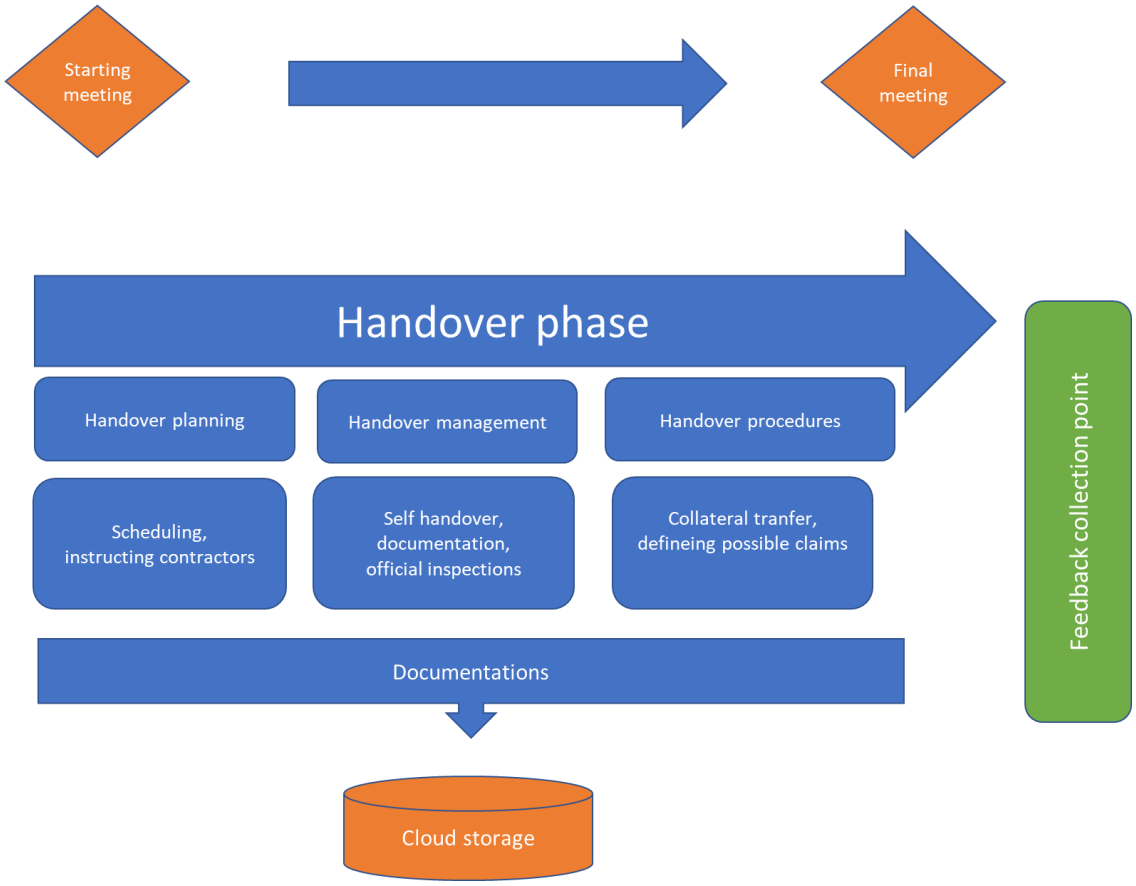

Figure 20. Proposed handover phase

The final meeting is organized at end of a project. In the final meeting, the construction organization gives feedback and evaluate, how well the project met the predetermined objectives. The feedback collection point is marked in green. As seen in figure 20, the best feedback collection point could be after the handout, because then the project is finished, and the client is able to give feedback on overall performance of the company and success of the project.

4.3 Feedback from the case company on the proposal

The feedback from the case company was positive. The process map provides clear and extensive description of the production process and the case company is able to use it in the future process developments. The feedback system in the production process should be more specific and create a standardized feedback collection process and a questionnaire template.

4.4 Summary of the proposed production process

The production process map that was created during the current state analysis was changed in several ways. The changes that were made to the whole production process are shown in figure 21. The orange color indicates changes to the production process map and the green color indicates feedback collection points, where the case company could collect feedback from client and other stakeholders.

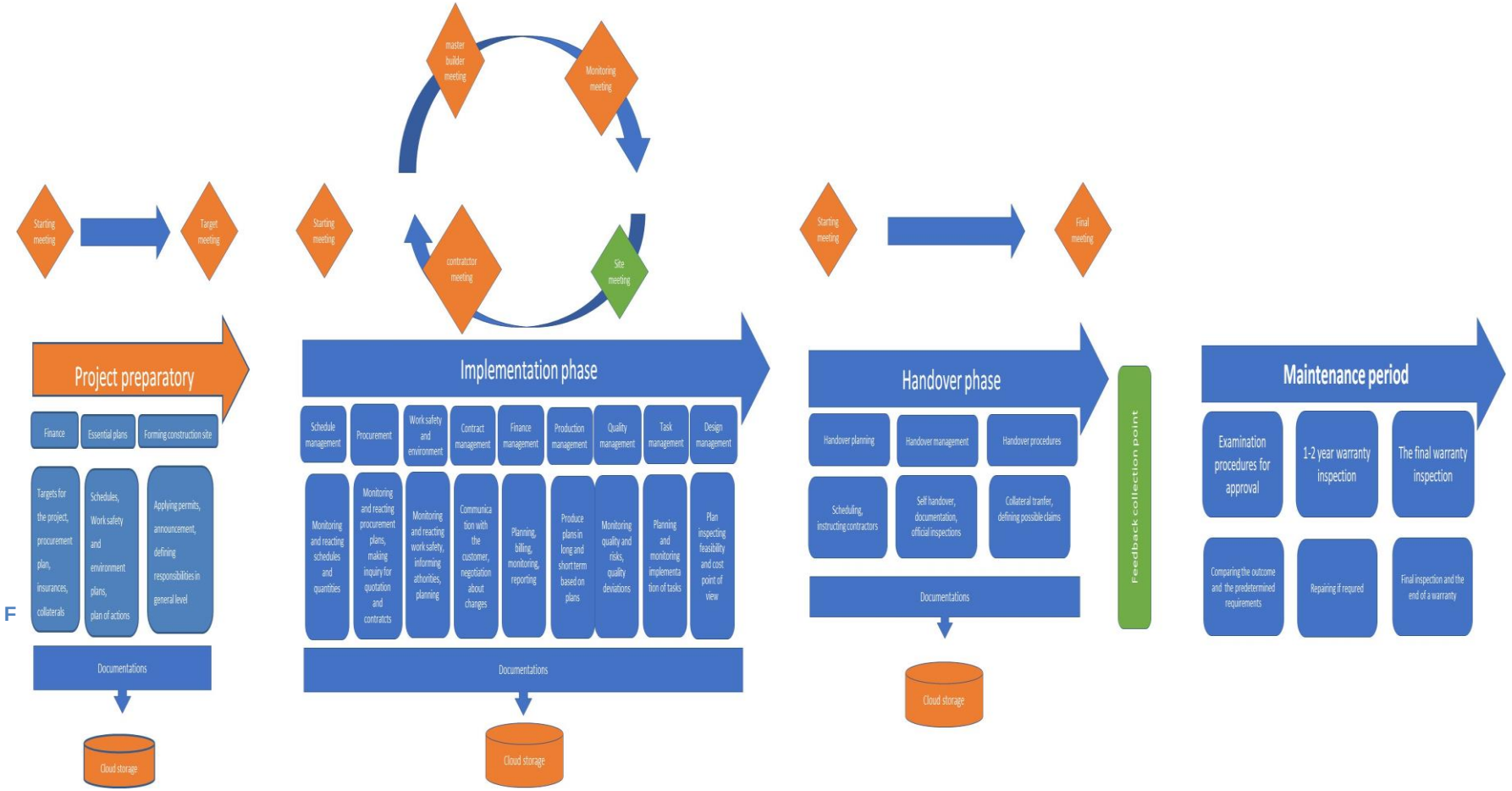

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Figure 22. Summary description of the conceptualized production process

The most important meetings were added, because it is important to see, when and where decisions are made and in addition, how the progress of the project is monitored. The meetings are shown in figure 21 in shape of square that are orange. The orange arrow is the name of the preparatory phase was changed to project preparatory, because the new name describes content of the phase better. Additionally, the local hard drive storage was changed to cloud-based storage, in order to improve accessibility of the documentation.

5 Conclusion

5.1 Executive summary

The case company was founded in 2015 and it is a part of Kalliorakennus-yhtiöt concern. The business challenge was that the case company was not follow a standardized production process, meaning the purpose of this thesis was to conceptualize the production process of the case company and find possible development areas. The development project started with the current state analysis, where the state of current production process was mapped as it was at the start of the project. The current state analysis was based on interviews and a questionnaire, where the process phases were identified along with responsible persons of the tasks. Based on the interviews, the development areas included following:

- Lack of cloud-based documentation storage
- Lack of standardized documentation templates
- The case company does not collect feedback

After identifying the current state and development areas, the search process for best practices and tools was started. Based on the development areas, process development tools and feedback collection were chosen to be the focus of existing literature in this thesis.

The outcome of this project is shown in figure 21. Changes to the process map are shown in green and orange. The green color indicates a feedback collection point, where the case company could collect feedback for the client in an effective way. Additionally, important meetings were added to the production process. Also, the type of the documentation storage was changed to the cloud-based and the preparatory phase was changed to project preparation.

5.2 Further developments

For the further developments to the production process, the case company should create a standardized feedback collection process, where it is defined how customer feedback is collected and how the feedback is processed and used to improve processes. The case company could use an external service that collects feedback from all stakeholders and provides processed feedback that is ready to be used for the case company. The case company should also create standardized document templates for projects and meetings, because they guide meetings and other processes, so nothing will be forgotten. The case company could also create a basic folder structure to the documentation storage, which is used in every project and during the project the necessary folders are created. In this way, the folder structure is familiar to every user and will not create confusion. Also, creating the storage for new documents at the beginning of the project is faster.

5.3 Evaluation of thesis quality

In my opinion the quality of thesis is in good level, because its business challenge is a very classical topic and important, but I should have paid more attention to documenting the interviews and questionnaire, because the questions in the questionnaire were too general and took too much time to answer. Overall, the project was carried out as designed and the objective and the outcome also met quite well. The findings from the current state analysis and business challenges have a strong connection to selected data and conceptual framework as figure 17 indicates. The expected outcome was the conceptualized production process and the outcome of this project was a process map that describes each phase in the production and how decisions are made, and progress monitored. The solution provides a clear and extensive description of the conceptualized production process that can be implemented and used in future process developments.

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Questionnaire

1. **Describe different stages in the process.**
2. **Who starts the phase of the process?**
3. **What information process requires to be started?**
4. **Where documents are stored?**
5. **Who is responsible person for the success of the process?**
6. **Who else participates to the process?**
7. **What are their most important tasks?**
8. **Is there something important that was not mentioned in this questionnaire?**