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# IMPROVING QUALITY MANAGEMENT TO REACH PROJECT SUCCESS

## a case study on power network construction projects

School of Technology
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Project Management, Master's degree

## ABSTRACT

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| Author | Christopher Roddis |
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This thesis has been made to improve the quality management processes at Vaasan sähköverkko Oy. The company is in the process of replacing overhead lines with underground cable to improve the resilience and the reliability of the distribution network. This study has been limited to underground cabling projects only. The research method for this thesis is a qualitative interview-based case study with project managers who manage underground cabling projects.

The aim of this study was to conduct research about quality management in projects and to in-depth describe the quality management practices at the company and, on the basis of the literature review, propose improvements to these practices. The literature review provides an insight into what quality management is and what it encompasses. An interview guide and a quality management model have been prepared as a basis for the interviews. The study has also examined how the project managers determine project success and how project success factors relate to managing quality in projects.

Through the interviews, the quality management processes that are implemented in the company were surveyed and set out in the quality management framework proposed by the researcher. The study has identified success factors that works as measurement of project success for Vaasan sähköverkko´s network construction projects in general. This framework can be used by Vaasan sähköverkko in order to understand their quality management framework and as a basis for developing their quality management further. In addition, this thesis has, based on the interviews, highlighted several activities that could be added to the project in order to enhance the quality.

Keywords Project management, quality management, project success, power network construction

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## TIIVISTELMÄ

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|---|---|
| Tekijä | Christopher Roddis |
| Opinnäytetyön nimi | Improving Quality Management to Reach Project Success<br>A Case Study on Power Network Construction Projects |
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Tämä tutkimuksen tarkoitus on ollut laadunhallintoprosessien parantaminen Vaasan sähköverkko Oy:n hankkeissa. Yritys on korvaamassa ilmajohtoja maakaapelilla parantaakseen jakeluverkon häiriönsietokykyä ja luotettavuutta. Tämä tutkimus on rajattu koskemaan vain maakaapelointihankkeita. Opinnäytetyön tutkimusmenetelmänä on kvalitatiivisiin haastatteluihin perustuva tapaustutkimus, jossa haastateltiin maakaapelointihankkeita johtavia projektipäälliköitä.

Tutkimuksen tavoitteena on ollut laadunhallinnan tutkiminen hankkeissa ja kuvata syvällisesti yrityksen laadunhallintakäytäntöjä sekä teorian perusteella ehdottaa parannuksia näihin käytäntöihin. Teorian avulla saadaan käsitys siitä, mitä laadunhallinta on ja mitä se käsittää. Haastattelujen pohjaksi on laadittu teoriaan perustuva haastatteluopas ja laadunhallintamalli. Tutkimuksessa on myös tarkasteltu, miten projektipäälliköt määrittelevät projektin onnistumisen ja miten projektin menestystekijät liittyvät projektien laadunhallintaan.

Haastattelujen avulla kartoitettiin toteutetut laadunhallintaprosessit ja ne esitettiin tutkijan ehdottamassa laadunhallintamallissa. Tutkija on myös tunnistanut menestystekijöitä, jotka toimivat Vaasan sähköverkon verkkorakennushankkeiden projektimenestyksen mittareina. Yritys voi käyttää tätä mallia ymmärtääkseen ja kehittääkseen laadunhallintaansa. Lisäksi tässä opinnäytetyössä on haastattelujen perusteella nostettu esiin useita toimintoja, joita yritys voi lisätä hankesuunnitelmaan hankkeiden laadun parantamiseksi.

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## ABSTRAKT

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| År | 2023 |
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Detta examensarbete har gjorts för att förbättra kvalitetshanteringsprocesserna vid Vasa elnät Ab. Företaget håller på att ersätta sina luftlinjer med jordkabel för att förbättra distributionssäkerheten. Den här studien har begränsats till enbart kabelprojekt. Forskningsmetoden för denna avhandling är en kvalitativ intervjubaserad fallstudie där intervjuerna gjorts med projektledare som leder kabelprojekt.

Syftet med studien har varit att bedriva forskning om kvalitetshantering i projekt och att på djupet beskriva kvalitetshanteringsmetoderna företaget använder, samt att på basis av litteraturgenomgången föreslå förbättringar. Litteraturdelen ger en inblick i vad kvalitetshantering är och vad den omfattar. En intervjuguide och en kvalitetshanteringsmodell har utarbetats på basis av litteraturdelen. I studien har man också undersökt hur projektledarna fastställer projektets framgång och hur projektets framgångsfaktorer förhåller sig till kvalitetshantering i projekten.

Genom intervjuerna har de kvalitetshanteringsprocesser som tillämpas i företaget kartlagts och fastställts i den modell för kvalitetshantering som forskaren föreslagit. Forskaren har identifierat framgångsfaktorer som fungerar som mått på projektets framgång för Vasa elnäts nätverksbyggnadsprojekt i allmänhet. Denna modell kan användas av Vasa elnät för att förstå deras kvalitetsledning och som en grund för vidareutveckling av den processen. Dessutom har detta examensarbete, baserat på intervjuerna, lyft fram flera aktiviteter som skulle kunna läggas till i projektplanen för att förbättra kvaliteten i projekten.

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# 1 INTRODUCTION

## 1.1 Background

As we become more reliant on electricity and it has become such an important part of everyday life, it is easy not to think about it. Until it becomes unavailable. A sudden loss of electricity, also known as a power cut, can negatively affect everything from working to cooking to being able to see when it is dark outside. The complex network of power plants, substations, transformers, and power lines that connect electricity to consumers usually works so well that we do not even think about it, but sometimes power cuts do happen. A power cut can happen for several reasons and the most vulnerable part of the electricity distribution system to severe weather conditions is overhead power lines. Storms, heavy rain and the accumulation of ice and snow can cause trees and tree branches to fall on power lines resulting in circuit breakers or other protective equipment to shut off the flow of power. Wildlife such as birds and squirrels can also cause power to fail when they come in contact with bare conductors.

To improve the resilience and the reliability of the distribution network, Vaasan sähköverkko began the process of replacing overhead lines with underground cables in 2013. This is an effective solution because underground cables are not affected by storms, snow loads or other extreme weather conditions and do not interfere with wildlife. Storms Aapeli in January 2019 and Aila in September 2020 are examples of why this upgrade is so important. During these storms there were thousands of disruptions in Vaasan sähköverkko's distribution network and as many as 14 000 households were without power.

Vaasan sähköverkko has set a goal to have 60 percent of the 20kV network and 80 percent of the 0,4kV network underground by year 2030. In recent years, Vaasan sähköverkko has invested 40 percent of its turnover in improving distribution security and as of November 2022, 50 percent of the 20kV network and 72 percent of the 0,4kV network are underground. That is about 1000 kilometers of

underground cable in total. To achieve this goal Vaasan sähköverkko carries out projects to replace the overhead power lines in its distribution area.

This Master's thesis project has been started based on the need to improve the quality management processes in Vaasan sähköverkko's underground cabling projects. Project managers have stated that it has been a challenge to keep the project quality consistent, which can affect the project performance. Examples of these challenges regarding quality management are that the project documentation is sometimes lacking or insufficient and that cables are buried too shallow or not according to regulation. This can cause extra costs and time when external contractors map and measure the underground cables to assure that the quality is up to standard. This thesis aims to find out how these types of challenges can be avoided in the future by improving the quality management processes.

## 1.2 Company Description: Vaasan Sähköverkko Oy

Vaasan Sähköverkko is an electricity distribution company that develops and maintains power networks in the Vaasa region. The distribution area covers about 3200 $km^2$ in seven different municipalities as shown in figure 1. Vaasan Sähköverkko is part of Vaasan Sähkö Group, which operates in electricity trading, district heating and electricity distribution. Vaasan Sähkö sells electricity all across mainland Finland, as well as selling district heat to homes in Vaasa and its immediate surroundings. Vaasan Sähköverkko is a subsidiary responsible for electricity distribution and the development of the power grid. In 2021, Vaasan Sähkö Group employed approximately 135 people, with a turnover of 209M€ (Vaasan Sähkö, 2022).

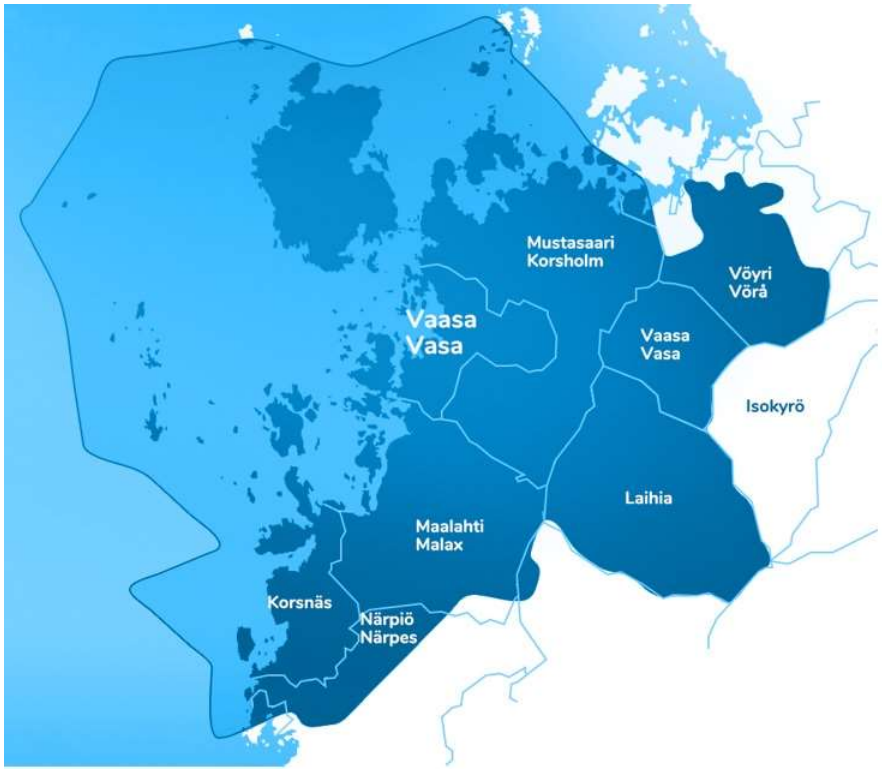


*Figure 1. The distribution area of Vaasan Sähköverkko (Vaasan Sähkö, 2022)*

## 1.3 Process Description for Power Network Construction Projects

Vaasan sähköverkko carries out projects to improve the resilience and the reliability of the power network. These projects include construction of new network, maintenance of existing network, substation and switching station projects. The planning of the projects is managed by Vaasan sähköverkko and different subcontractors. The work is carried out by subcontractors and Vaasan sähköverkko acts as a client with its own project managers.

The projects can be divided into three different categories:

- Annual contract jobs
- Turnkey contracts / design-bid-build contracts (DBB)
- Substation and 110kV power line projects

Annual contract jobs are for smaller projects, maintenance work and fault repairs. The distribution area of Vaasan Sähköverkko is divided into three smaller areas that go out to tender every three years. Different companies can then bid for these areas, and the company with the winning bid gets to take care of the annual contract jobs in the area. Larger network construction projects fall under the category turnkey projects or design-bid-build (DBB) contracts. Turnkey contracts are contracts in which a single company or contractor is responsible for the design, construction, and commissioning. Substation and 110kV network construction projects are also turnkey contracts because the knowledge or resources for these projects are not available internally in the company. DBB contracts are contracts where the network design is done by Vaasan sähköverkko or a subcontractor and then put out to tender for companies to bid for. The company with the winning bid constructs and commissions the project as a completed product for Vaasan sähköverkko. Underground cabling projects that this thesis deals with are either annual contract jobs or DBB contracts, depending on the size of the project.

Projects at Vaasan sähköverkko are established according to demand and at a rate so that the goals for the year 2030 are met. Underground cabling projects are prioritized in more populated areas, the archipelago and along the coast where extreme weather conditions are more common as the older existing overhead powerlines are exposed. In areas where electricity demand increases, the lines are strengthened and/or new lines built. Older overhead lines are gradually replaced with underground cable and lines where wildlife come into contact with bare conductors are also replaced. This work is done by special planners, whose task is to foresee work that needs to be done in the network and identify areas that need improving.

A steering committee then decides which projects will be carried out and when based on the work of the special planners. When a decision has been made that a project should be implemented, the project initiation process begins, and the preliminary project planning is commenced. The project manager establishes a

project in IFS and Headpower, which are the project management tools used at the company. In IFS, the financial follow-up is done, and the budgets are updated there. Headpower is for the practical aspects of the project where relevant documents and maps are shared between suppliers. Once the preliminary plan is completed, the project manager orders the the network design internally or purchases it as a service from a subcontractor. When the network design is completed, companies are invited to bid for the construction of the project if it is a DBB contract. The winning bid is announced, and a purchase order is placed. If the project is an annual contract job, the company that takes care of the contracts in the area gets the job. The order is then confirmed, and a kick-off meeting is arranged with key people involved in the project. The following step is terrain planning. Here, it is investigated whether it is practically possible to build the network as planned. Landowners are also consulted, and permission is sought to build on their land. When all land agreements are approved and the planning is approved, the construction phase begins. When the construction is complete, the commissioning is carried out. Before commissioning can take place, the necessary tests and protocols must be carried out. After that, Vaasan sähköverkko's network operation center makes a commissioning program, and the commissioning takes place with permission from the network operator. The last phase in the project is the approval of final documentation and the closure of the project. Figure 2 below describes the processes for managing the projects.

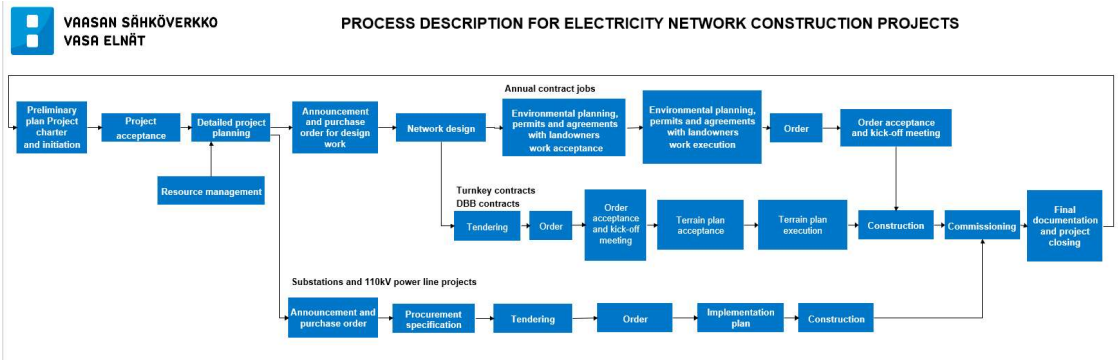


*Figure 2. Process description for power network construction projects at Vaasan sähköverkko*

## 1.4 Research problem and goal of the thesis

This thesis is commissioned by Vaasan sähköverkko. There is a gap in the knowledge on how to improve the quality management in projects, and this thesis aims to contribute to filling that gap. There is a lot of research on the subject of quality management in projects and this thesis will apply that to a real case study. The thesis is based on past and current literature and then go deeper into the company's specific problems and how they can be solved. The research method for this thesis is a qualitative interview-based case study with project managers who manage underground cabling projects. A quality management model based on the literature review will serve as a basis for the interview guide and the themes discussed in the interviews. The interviews in this study will be semi-structured, where the interviewees are given the opportunity to talk freely within the framework of the themes, topics and questions. The interviews will aim to find out what quality management practices are implemented in Vaasan sähköverkko's projects, what challenges the project managers have with quality management in their projects and what type of solutions they think should be found. The aim is also to improve these processes and the researcher provides suggestions for improvement in the discussion and conclusion chapter (Chapter 6). The study will also examine how the project managers determine project success and how project success factors relate to managing quality in projects.

## 1.5 Research questions

The purpose of this thesis is to conduct research about quality management in projects and provide answers to the following three research questions:

1) *What are the quality management practices implemented in Vaasan Sähköverkko's power network construction projects?*

2) *How can the quality management practices be improved?*

3) What are considered as success factors in Vaasan sähköverkko's power network construction projects and how do they relate to managing quality in projects?

## 1.6 Limitations of the thesis

Vaasan sähköverkko carries out various power network construction projects. These projects include construction of substations, switching stations, high voltage, medium voltage and low voltage networks. In addition to this, existing equipment and networks are also maintained. This thesis will be limited to medium and low voltage underground cabling projects only. As project management is a relatively wide research area, the topic of this thesis will be narrowed down to the knowledge area of quality management and focus on the quality management processes and the challenges these projects are facing. Risk management will also be briefly covered even though it is a separate knowledge area because literature suggests that it is an important subject to take into consideration when planning project quality.

## 1.7 Structure of the thesis

The first chapter serves as an introduction to the thesis. The background to the thesis, research problem, research questions, goal of the thesis and limitations are described here. The company that served as a case in this case study and a description for how projects are handled at the company has also been presented here.

The second and the third chapters are the literature review chapters. Here the researcher has examined research work that has been previously conducted on project quality management. It provides an overview of what the research has so far concluded about the research area and lays the foundation for the research in this thesis. The literature review chapters are divided into sections according to subject area to make the theory more comprehensible for the reader. At the end of the third chapter is a short summary of the literature review and a model for project quality and project success is presented here. This model will serve as a foundation for the interview guide.

The fourth chapter is research methodology. Different research approaches and research methods are explained as an introduction to the chapter and thereafter

the choice to base the study on a qualitative approach is justified. At the end of the chapter, the implementation of the study is described in more detail as well as the data collection methods and how the data is analyzed.

The fifth chapter is empirical findings and analysis. Here the interviews are analyzed on the basis of the transcripts. The result of the interviews is summarized in a section after the analysis. The sixth and final chapter contains a conclusion with a discussion of the research questions. This is followed by a discussion on what benefit the study might have for the company, the reliability and validity of the study, limitations and suggestions for further research before concluding with some final words. Figure 3 below describes the structure of the thesis.


*Figure 3. Structure of the thesis*

# 2 MANAGING QUALITY IN PROJECTS

## 2.1 Project Management

To understand project management, one must begin with the definition of a project. A project is a temporary undertaking to create a defined outcome. This can be a product, service, or a result. (PMBOK, 2021, p. 4). Projects can be described as a series of activities and tasks that are planned from beginning to end and usually done sequentially. The objective of a project is to deliver an outcome that conforms to predefined requirements and constraints such as time, cost, and resources. Projects have defined start and end dates and require an investment in the form of capital resources and human resources. Projects bring together people who have diverse backgrounds and expertise and who have maybe not worked together before. (Nieto-Rodriguez, 2021, p. 40).

Projects also have stakeholders. These are the individuals, groups, organisations, or other entities that are affected positively or negatively by the project. Some elements of each project are unique; a project is something that has not been done before (Nieto-Rodriguez, 2021, pp. 40-41). Projects can stand alone or be part of a program or portfolio (PMBOK, 2021, p. 4).

A program is an entity formed by several projects and is often founded to implement a strategy. This could be, for example, starting a new business and launching products related to the new business. A program can take several years to implement and because of its duration and complexity, the objective may be defined only at the level of a general mission. The projects to be included in a program are not necessarily started or even known at the outset of the program. A program can be described as a temporary organisation that has been founded to act as a tool to manage a complex and large project entity. A program may consist of simultaneous and consecutive projects (Artto, Martinsuo, & Kujala, 2011, p. 314).

A portfolio is a set of projects and/or programs, which are not necessarily related, brought together to provide optimum use of the organisation’s resources and to

achieve the organisation's strategic goals while minimizing portfolio risk (IPMA, 2015, p. 27).

The international standard for project management has defined project management as "the application of methods, tools, techniques and competences to a project". (ISO 21500, 2012, p. 4). It is the application of management practices aimed at achieving the project goal and objectives (Artto, Martinsuo, & Kujala, 2011, p. 26).

A project manager is a professional in the field of project management with responsibilities focused on the managerial elements of a project. The project manager is the person responsible for the project, for achieving its objectives, and for managing its implementation (Artto, Martinsuo, & Kujala, 2011, p. 32). Project managers perform a variety of functions, such as facilitating the project team work to achieve the outcomes and managing the processes to deliver intended outcomes (PMBOK, 2021, p. 4). The knowledge, skills, and tools can be grouped into activities or processes. PMI's PMBOK Guide identifies five process groups in project management:

- Project initiation
- Project planning
- Project execution
- Project monitoring and control
- Project closure

(PMBOK, 2021, p. 171)

Project initiation is the first process group in managing a project. Some of the activities within this group include selecting the best project given resource limits, recognizing the benefits of the project, and assigning a project manager. The planning process group includes definition of the work requirements, definition of the scope and quality of the work and the resources needed. Scheduling of the

activities is also done, and the various risks are evaluated. Tasks included in the execution phase are directing and managing the work and working with the team members. Monitoring and control is about tracking progress, comparing actual outcome to predicted outcome, making adjustments, and analyzing variances and impacts. The final process group in a project is the closure. Activities within this group include verifying that all the work has been completed, closure of the contract and financial closure.

Successful project management can be defined as achieving a continuous flow of project objectives within cost and time, at the desired level of performance/technology, while using the allocated resources effectively and having the results accepted by the customer and/or stakeholders. Because each project is different and each customer can have different requirements, the activities included within the process groups can change from project to project. (Kerzner, 2017, pp. 2-3)

In addition to process groups, processes are also categorized by knowledge areas. PMI's PMBOK Guide describes a knowledge area as "an identified area of project management defined by its knowledge requirements and described in terms of its component processes, practices, inputs, outputs, tools, and techniques". The knowledge areas described in this guide are:

- Project integration management
- Project scope management
- Project time management
- Project cost management
- Project quality management
- Project resource management
- Project communications management

- Project risk management
- Project procurement management
- Project stakeholder management

(PMBOK, 2017, pp. 23-24)

This thesis focuses on the quality management aspects of projects. PMI's PMBOK Guide describes project quality management as "the processes for incorporating the organization's quality policy regarding planning, managing, and controlling project and product quality requirements, in order to meet stakeholders' expectations" (PMBOK, 2017, p. 24).

## 2.2 Project quality management

The benefits of quality in projects are undoubtedly many. IPMA (2015) points out that project quality management is a set of processes that considers how a project should proceed to achieve the desired quality for the project's deliverables and meet the stakeholder's objectives. These processes integrate the company's quality policy with regard to planning, managing, and controlling project and product quality requirements. The purpose of performing quality management is to continuously review the project and the project deliverables. Quality management encompasses all tools, procedures, processes, and resources that are needed in order to meet the quality of objectives of a project. (IPMA, 2015, p. 120)

The purpose of performing quality management is also to continuously improve activities and review the project and its deliverables (Kerzner, 2017, p. 699).

Previous literature on quality states that quality has continued to revolutionize in the last decades. Kerzner (2017, p.697) considers the push for higher levels of quality to be driven by the customers. They are demanding even higher performance, faster product development, better technology, higher quality materials and processes as well as fewer defects. This in turn demands even

better-quality management from an organisational perspective. Everyone in an organization plays an important role in quality management. In order for an organization to become a quality organization, all levels must actively participate (Kerzner, 2017, p. 724).

## 2.3 The wheel of quality

Rose (2014) has codified the basic principles of contemporary quality into one single graphic image called the wheel of quality. The figure below showcases the three elements of customer focus, variation, and continuous improvement while showing the relationships and interactions among them.

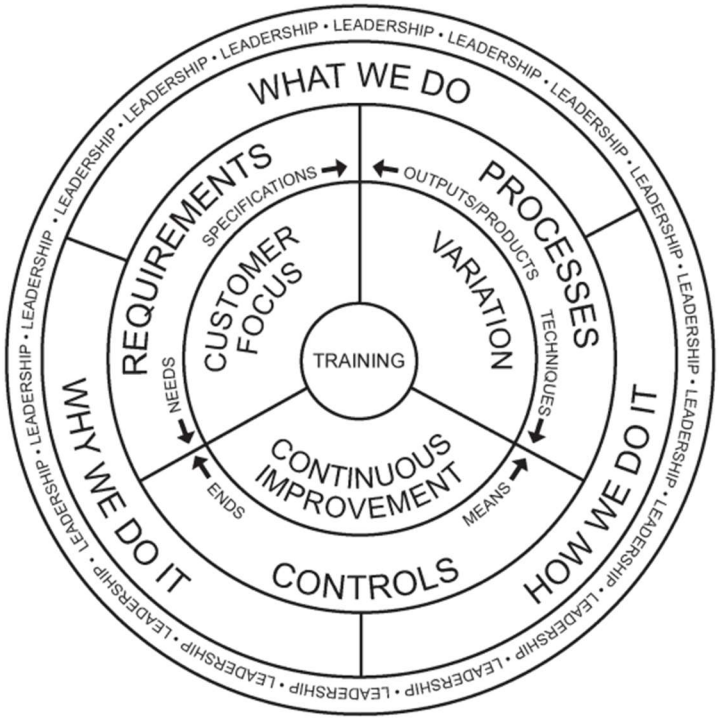


*Figure 4. The wheel of quality by Rose (2014, p.24)*

### 2.3.1 Customer focus

It is important to acknowledge the fact that a project might have several different customers. Rose (2014) distinguishes between external customers, internal customers and hidden customers. External customers are the obvious customers,

the ones paying the bill and receiving the project outcome. However, Rose (2014) also considers suppliers as external customers. The supplier is an external customer in that sense that they should be receiving clear requirements from the project team in order to be able to deliver supporting goods and services. Internal customers are the collaborators present within the project organisation. The different collaborating elements internally regard each other as suppliers and customers. The third group of customers is hidden customers. Rose (2014) describes hidden customers as stakeholders or organisations that do not participate directly in the project but have an interest in or concern about the project.

### 2.3.2 Variation

Rose (2014) states that variation must be understood and controlled in order to influence the results of a project. This is the case because variation can possibly cause defects. Understanding what part of the project may cause variation is an important step towards better quality. Rose (2014) writes: "*project managers must seek to understand the variation, why it occurs, and what its effects are. Then they must control the variation so the process involved performs consistently, producing predictable results. Improvement occurs when project managers or members of the project team analyse the process and take action to reduce the variation to some degree.*"

### 2.3.3 Continuous improvement

Continuous improvement is a debateable topic in that sense that many times, a project is simply trying to meet the specifications set for the project. However, Rose (2014, p.28) states that, although meeting the project specifications might lead to a satisfied customer, if you want to be sure to win the next contract you need to exceed the customer expectations. This is done by enabling continuous improvement in an organisation's project processes. This in turn involves effective communication both within the project and externally, identifying problems and taking corrective actions as well as identifying and acting on opportunities.

While these three elements listed above makes up the basis of the wheel of quality, there are also other important factors adding to project quality. Rose (2014) acknowledges that training is the core of quality. Meaning that the project members need to be trained in the skills needed for successful completion of the project. Leadership is the quality unifying all of the other elements. Each of the elements are then expressed through requirements, processes and controls.

## 2.4 Handling project quality

Project quality management involves approaches, processes and techniques to ensure and improve quality in a project. (Steyn, 2008) states that management in general to a large extent consist of planning and control and that project quality management therefore should address the same elements. PMI's PMBOK Guide (2017) summarizes the tools and techniques associated with quality management as planning quality management, managing quality and controlling quality. The process is illustrated in Figure 5.

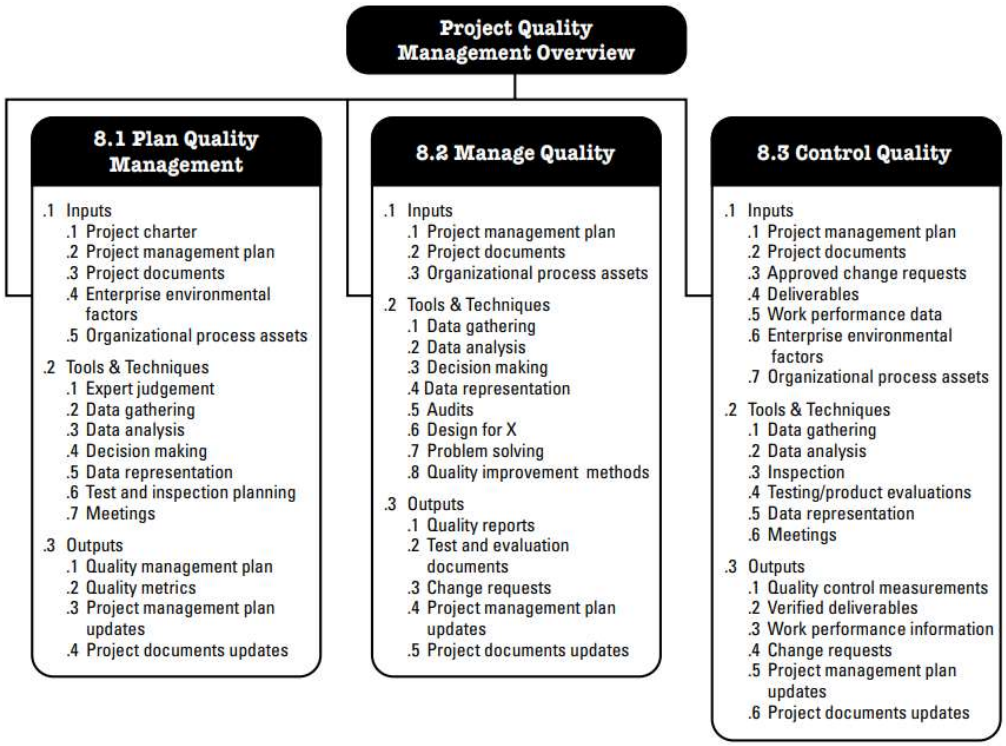


*Figure 5. Project quality management overview (PMBOK, 2017, p. 272)*

According to PMBOK (2017) the plan quality management process focuses on the quality that the work needs to have. It is the process of identifying quality requirements for the project and its deliverables and documenting how the project will comply with quality requirements. Manage quality is the process of translating the quality management plan into workable quality activities that include the organization's quality policies into the project. Manage quality focuses on managing the quality processes throughout the project. During the manage quality process, quality requirements identified during the plan quality management process are turned into test and evaluation instruments, which are then applied during the Control Quality process to verify these quality requirements are met by the project. Control quality is concerned with comparing the work results with the quality requirements to ensure the result is acceptable. (PMBOK, 2017, pp. 271-272)


*Figure 6. Quality management framework proposed by Steyn (Steyn, 2008, p. 1300)*

If we are building on to the processes set out by the PMBOK, there are literature suggesting frameworks similar to the processes set out. (Steyn, 2008) proposes a quality management framework described in Figure 6. The framework consists of planning for project quality, project quality assurance and project quality control. They are described in more detail below.

### 2.4.1 Planning for project quality

Steyn´s (2008) framework starts with planning for project quality. The planning needs to contain requirements that need to be met, actions required to reach the specifications and metrics that will be used to decide if the project standards have been met. Steyn states that one should already in the planning phase decide on quality control and quality assurance principles. These elements therefore form a whole rather than separate elements.

### 2.4.2 Project quality assurance

According to Steyn (2008) quality assurance entails both assurance of a specific project´s quality as well as continuous improvement in quality as whole. Lessons learned from one project should be carried out as important improvement in a company´s project management practices. Tools for continuous improvement are, for example documented lessons learned from a project, reports from project close out meetings and reports on non-quality costs (for example lost liability, lost sales, and reputation damage). For a specific project, quality assurance methods include for example project kick-off meetings, audits, design reviews, checklists, and training of project members.

### 2.4.3 Project quality control

There are two facets of project quality control set out by Steyn (2008). These are planned quality control and ad-hoc quality control. Quality control involves inspections of the product and its components throughout the project as well as acceptance testing and final product inspection. Ad-hoc quality control entails handling all problems that occur during the project. These might be unforeseen setbacks, delays in the schedule and problems with the budget.

On top of the proposed framework, Steyn (2008, p.1301) also states that several principles of quality management are equally risk management. Therefore, although project quality management is a specialized field, it can be considered as a subset of project risk management. Therefore, it is important when planning a project, to also integrate with risk planning.

## 2.5 Project risk management

Although project risk management may be seen as a separate part of project planning, literature suggest that it is an important field to take into consideration when planning project quality (Steyn, 2008, p. 1301; Popescu & Dascalu, 2011). It is stated that risk and quality are the two sides of the same coin: Popescu & Dascalu (2011, p.50) states*:" The two dimensions are not mutually exclusive but complement each other, being components of the indicator system that measure the performance of the organization".*

Projects are by definition 'risky' undertakings as they aim to deliver an outcome that conforms to requirements, constraints and assumptions, while responding to stakeholder expectations that may change and conflict. Projects deal with unknown situations and as a consequence often resulting in changes to the project. In an effort to prevent projects becoming a 'game of chance', risk management can be done to control or mitigate the project risks. Project risks are future uncertainties that may affect project results in both directions, i.e., for the better or worse. (Zandhuis & Stellingwerf, 2013, pp. 71-72)**.**

The ISO guide to risk management vocabulary defines risk as "the combination of the probability of an event and its consequences". The definition covers both opportunities and threats. Opportunities are described as an upside risk and threats as downside risks. Risk management is the process of identifying, assessing and controlling the impact of both the positive and negative aspects of risk. (ISO, 2009). Project risk management aims to identify and manage risks that are not addressed by the other project management processes. When ignored or unmanaged, risks have the potential to cause a project to deviate from the plan

and fail to achieve the project goals. PMI's PMBOK Guide points out that because of this project risk management is directly related to project success and that organisations should decide to take project risk in a controlled and intentional manner in order to create value while balancing risk and reward. (PMBOK, 2017, p. 397)

Kerzner's book on project management (2017) states that because of the unique and temporary nature of projects we have developed a "live-with-it" attitude on risk and attribute it as part of doing business since projects can be something that we have not done previously and will not do again in the future. Risk management should be set up as a disciplined, continuous process of identifying, planning and analysing risks. Risk response strategies should be developed and the risks monitored and controlled. The risk management process should be designed to do more than just identify risks. The process should include a formal planning activity, analysis to estimate the probability and predict the impact on the project of identified risks, a risk response strategy for selected risks, and the ability to monitor and control the progress in reducing these selected risks to the preferred level**.** If this is done correctly the risk management process will supplement other processes such as planning, budgeting, cost control, quality, and scheduling.

The emphasis will now be on proactive management rather than reactive management as surprises that become problems will be reduced. Kerzner (2017, p.600) points out that risk management is justified on almost all projects and the implementation can vary from project to project, depending on the size of the project. Risk management is important when the stakes are high and/or a great deal of uncertainty exists. Instead of treating risk as "let's live with it", risk management should be a key part of overall project management and should be a conscious input to decision making.

The PMBOK (2017) sets out that risks exist at two different levels; individual risks that can affect the achievement of the project objective as well as riskiness of the overall project**.** Riskiness of the overall project arises from the combination of

individual project risks and other sources of uncertainty**.** The two different levels of risks are defined by the PMBOK as follows:

Individual project risk is an uncertain event or condition that, if it occurs, has a positive or negative effect on one or more project objectives.

Overall project risk is the effect of uncertainty on the project as a whole, arising from all sources of uncertainty including individual risks, representing the exposure of stakeholders to the implications of variations in project outcome, both positive and negative. (PMBOK, 2017, p. 397)

# 3 REACHING PROJECT SUCCESS

## 3.1 Project success

When studying project quality, one quickly stumbles upon the concept of project success. It is not an easy task to describe project success, and earlier literature pinpoints that there is no consensus on what defines project success (Dvir, Lipovetsky, Shenhar, & Tishler, 1998; Besteiro, 2015). Rather, there are several ways to describe project success**.** Defining success depends on the perspective of the stakeholder, the type of project, the temporal perspective, and the organization (Besteiro, 2015)

However, literature on project quality states that in order for a project to be successful, the elements of time, cost and scope are of utmost importance. These elements are in project literature referred to as the "triple constraint" (Rose, 2014, p. 7). In some studies, these elements are referred to as the iron triangle. According to Rose (2022) each one of the triple constraints affect project quality and therefore, project managers are faced with having to balance the three while often having to make trade-offs among the three to meet the customers objectives. Trade-offs are situations where one aspect of a project may be sacrificed to gain an advantage with another aspect**.** For example, sometimes a project might need to extend project cost in order to reach the scope and in that case a trade-off has been made on the cost. It does not necessarily mean that the project has not been successful, but that some adjustments had to be made along the way. Rose (2022, p.7) therefore suggests that many projects are completed successfully, at least in the eyes of the stakeholders, although the final criteria from which success is measured may be different from the initial criteria because of trade-offs.

For a long time, project managers have seen their job as successful when they are able to complete a project within the frames of the triple constraint (Shenhar & Dvir, 2007). However, other academic literature suggests that the triple constraint is far too narrow to describe the constraints a project might face (Frefer,

Mahmoud, Haleema, & Almamlook, 2018, Kerzner 2017, Shenhar & Dvir 2007). Kerzner (2017, p.7) states that there are multiple competing constraints on projects and that these constraints might be primary or secondary. Secondary factors are risk, customer relations, image, and reputation. These constraints might lead to a deviation from the original success criteria of time, cost and performance and might heavily influence the triple constraint (Kerzner, 2017, p.7). In order to successfully deliver a project literature suggests that some trade-offs most often have to be made in some of the project constraints. *"When managing a project according to the triple constraints of time, cost, and scope, we perform a juggling act and often find a way to meet all three constraints, each of which usually carries an equal degree of importance. When the number of constraints increases to five or six constraints, it may be difficult, if not impossible, to meet all of the constraints and a prioritization of constraints may be necessary".* (Kerzner, 2017, p. 7)

Recent literature also suggests that one should distinguish between project efficiency and overall project success where project efficiency refers to the things that needs to be done in order to complete a project while overall project success refers more to business-oriented results such as customer satisfaction. Shenhar & Dvir (2007, p.10) state that since one can no longer assume that the initial project plan will hold, changes will have to be made and the project will have to adjust. Therefore, they state that the classical drivers of project management are no longer sufficient in today´s business environment. They write *"In their struggle to keep projects on track, executives and teams get frustrated when they try to fulfill unrealistic expectations of stability. Worse, their effort to focus the project on the triple constraint, project teams often lose sight of the business rationale behind their projects: that they must satisfy a customer and achieve business results, and not just meet project requirements."*

Since literature refers to the triple constraint as non-successful in terms of measuring project success. The question of what makes a project successful stand.

## 3.2 Project success factors

Since project success is hard to define and fluctuates, it is difficult to know what makes a project flourish. In order to know if a project has been successful or unsuccessful, it is pivotal to know beforehand what to measure the success on. It is important to identify project success criteria and critical success factors already at the initial stage of a project (Frefer, Mahmoud, Haleema, & Almamlook, 2018, p. 6)**.** However, the academic discussion on the success factors is wide and several authors offer several conclusions on success factors. Besteiro et al. (2015, p.13) found four criteria to be critical when defining success;

1) Managerial Abilities: ability to communicate, defining the schedule, accepting the proposal of the project, indicating roles and responsibilities, defining realistic goals and objectives and team qualification.
2) Critical Success Factors: defining the scope of the project, the deadline of the project, the commitment, planning, ability to communicate and meeting the budget.
3) Monitoring and Control: monitoring meetings, deadline variation, benefit variation, control point, budget variation and identification of goal deviations.
4) Lessons Learned: deadline, budget, communication, project proposal, goals and project documentation (Besteiro, 2015, p. 13)**.**

However, the study of Besteiro et al. (2015) on success factors is far from the only one. Several different studies suggest different success factors. Dvir (2007, p.12) finds five criteria to be relevant for project success:

1) Project efficiency: meeting time and budget goals
2) Impact on the customer: meeting requirements and achieving customer satisfaction
3) Impact on the team: satisfaction, retention and personal growth
4) Business results: return on investment, market share and growth

5) Preparation for the future: new technologies, new markets and new capabilities

Another study, developed by Mishra et al. (2011) studied critical success factors in the Indian organizational setting and they heavily imply that there is a need to highlight soft criteria more in terms of project success. They in turn suggest that human aspects such as the importance of the project manager and the project team should be taken into consideration when listing success factors. Furthermore, the social and political environment was found to be important in Mishra et al.´s study on success factors. This leads us to acknowledge the fact that there seems to be many studies on success factors suggesting a variety of different results.

How is it then possible to clarify which the relevant success factors are since there are multiple studies suggesting varying success factors and success factors can vary a lot between different projects. Literature suggests that project success factors are contingent upon the specific type of project and that the list of project success factors is far from universal. The list of project success factors depends upon the project type. Consequently, project managers must identify those factors that are critical to their specific project. (Dvir, Lipovetsky, Shenhar, & Tishler, 1998, p. 931). In other words, a project needs to map which factors to review at the end of the project in order to be able to measure its success. Different projects might have different success factors and it is upon the specific project to define their success factors and rely on them to measure the project´s success.

As stated in this chapter, different projects can have different success criteria and these needs to be defined prior to starting the project. These success factors need to become an integrated part of the project planning process and they have to be monitored throughout the project. However, to ensure project success, Dvir (2007, p.35) states that apart from success factors, a project also needs to define its failure criteria. Failure criteria set the state for what can go wrong during the project and is important in order to create a successful risk management plan.

## 3.3 Summary and model for project quality and project success

As the literature review suggests, project quality management is a set of processes that examine how a project should proceed to achieve the desired quality for the project's deliverables and meet the stakeholder's objectives. It is to continuously improve activities and review the project and its deliverables.

The first step in project quality management is to plan quality management. This is done by identifying quality requirements for the project and its deliverables and documenting how the project will comply with quality requirements. Even though risk management may be seen as a separate part of project planning, literature suggest that it is an important field to consider when planning project quality management. Several principles of quality management can be seen as equally risk management. In the quality management plan risks and opportunities should be identified, assessed and response strategies developed. The emphasis should be on proactive management rather than reactive management as surprises that become problems will be reduced.

Quality control is done by reviewing the project continuously throughout its life cycle and comparing the work results with the quality requirements to ensure the result is acceptable. It involves effective communication both within the project and externally, identifying problems and taking corrective actions as well as identifying and acting on opportunities. Quality control also entails handling all problems that occur during the project. These can be unforeseen setbacks, delays in the schedule and problems with the budget.

Quality assurance entails both assurance of a specific project´s quality as well as continuous improvement in quality as whole. Lessons learned should be carried out after every project to improve the company's project management practices. Tools for continuous improvement are for example documented lessons learned from a project, reports from project close out meetings and reports on non-quality costs. Other quality assurance methods include kick-off meetings, audits, design reviews, checklists, and training of project members.

It is also important to keep the customer focus in mind throughout the quality management processes, since customers or key stakeholders can make or break a project's success. Identifying customers or stakeholders allows for clear communications during periodic updates or project progress meetings. Knowing who the stakeholders are and where they fit in the development and deployment phases of the project is vital to understanding and effectively addressing their expectations or concerns. As the literature suggested, projects can have several different customers or stakeholders. One can distinguish between external customers, internal customers and hidden customers. External customers are the ones paying the bill and receiving the project outcome. The supplier is also an external customer in that sense that they should be receiving clear requirements from the project team to be able to deliver supporting goods and services. Internal customers are the collaborators within the project organisation. The different collaborating elements internally regard each other as suppliers and customers. The third group of customers is the hidden customers. Hidden customers can be seen as stakeholders or organisations that do not participate directly in the project but have an interest in or concern about the project.

Project quality is closely linked to project success. In order to know if a project has been successful or unsuccessful, it is important to know beforehand what to measure the success on. It is important to identify project success criteria and critical success factors already at the initial stage of a project. If these success factors align with the quality requirements and are planned, controlled, and assured continuously throughout the project, it will lead to project success. Examples of quality requirements could be meeting time and budget goals, exceeding customer expectations or investing in team satisfaction and personal growth among project team members.

In other words, a project needs to map which factors to review at the end of the project in order to be able to measure its success. Different projects might have different success factors and it is upon the specific project to define their success factors and rely on them to measure the project´s success. In addition to success

factors, a project also needs to define its failure criteria. Failure criteria set the state for what can go wrong during the project and is important in order to create a successful risk management plan.

By having a project quality management system with these three processes in place: planning, assurance, and control, one can tackle problems before they cut into the budget and reach project success. Having set deadlines, meetings, and reports could influence the project team to hit targets early to keep the project on track. Tackling problems in real-time and communicating with the customer will ensure they're up to date and aware of any issues. Helping project team members with their personal growth would increase motivation, productivity, and boost collaboration between teams.

The following quality management model (Figure 7) has been developed based on the literature review including Steyn's (2008) and Rose's (Rose, 2014) quality management framework. It will serve as a basis for the interview guide and the themes discussed in the interviews. It includes the three processes of planning, controlling and assuring. Risk management is seen as a part of project quality planning and continuous improvement as assuring project quality. Customer focus is included in all the three processes and project success depends upon defining and measuring project quality.

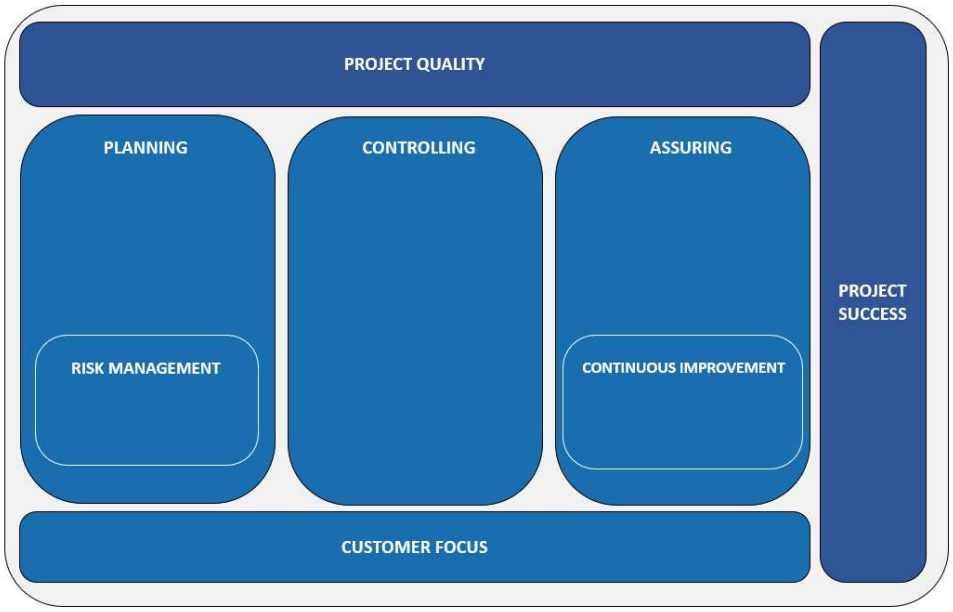


*Figure 7. Model for project quality and project success*

# 4 RESEARCH METHODOLOGY

In this chapter, the research methodology will be presented. Different research approaches and research methods will be explained as an introduction to the chapter and thereafter the choice to base the study on a qualitative approach will be justified. At the end of the chapter, the implementation of the study is described in more detail as well as the data collection methods and how the data is analyzed.

## 4.1 Research approach

Research approaches are a collection of procedures and plans that decide the overall process of research. Research approach decides the methods for data collection, analysis, and interpretation. They can be either to form or to test theories (Carson, Gilmore, Perry, & Gronhaug, 2001, p. 11). There are three approaches to theory development, inductive approach, deductive approach and abductive approach. An inductive approach (Table 1) is used when the researcher starts by collecting data to explore a phenomenon, identify themes and patterns and then forms theories in the form of conceptual work. (Saunders, Lewis, & Thronhill, 2016, pp. 144-145). The researcher studies the topic within its context, and uses an emerging design shaped by the researcher's experience in collecting and analysing the data. The research questions can change in the middle of the study to better reflect the types of questions needed to understand the research problem (Creswell, 2013, pp. 21-22).

A deductive approach (Table 1) is used when the researcher starts with theory, developed from reading academic literature and then designs a research strategy (hypothesis) to test the theory through a series of propositions (Saunders, Lewis, & Thronhill, 2016, pp. 145-146). Unlike the inductive approach that aims to create theories, the deductive approach uses existing theories and tests them (Carson, Gilmore, Perry, & Gronhaug, 2001, p. 11).

The third approach to theory development is abductive reasoning (Table 1). It is a combination of induction and deduction and is used when the researcher is

collecting data to explore a phenomenon, explain patterns and identify themes, to generate a new or modify an existing theory. This theory is tested through additional data collection. Abduction can begin with the observation of a surprising fact. It then works out a credible theory of how it may have occurred (Saunders, Lewis, & Thronhill, 2016, p. 146).

*Table 1. Approaches to theory development: deduction, induction, and abduction. (Saunders, Lewis, & Thronhill, 2016, p. 145)*

| | **Deduction** | **Induction** | **Abduction** |
|---|---|---|---|
| **Logic** | In a deductive inference, when the premises are true, the conclusion must also be true | In an inductive inference, known premises are used to generate untested conclusions | In an abductive inference, known premises are used to generate testable conclusions |
| **Generalisability** | Generalising from the general to the specific | Generalising from the specific to the general | Generalising from the interactions between the specific and the general |
| **Use of data** | Data collection is used to evaluate propositions or hypotheses related to an existing theory | Data collection is used to explore a phenomenon, identify themes and create a conceptual framework | Data collection is used to explore a phenomenon, identify themes and patterns, locate these in a conceptual framework and test this through subsequent data collection and so forth |
| **Theory** | Theory falsification or verification | Theory generation and building | Theory generation or modification; incorporating existing theory where appropriate, to build new theory or modify existing theory |

This thesis is not using an inductive approach since existing literature and theory is an important part of the thesis. It is also not using a deductive approach since no hypothesis or strategy is designed based on existing literature. The approach for this thesis therefore, is abductive because the aim of this work is to collect data

and explore a phenomenon (quality management processes) using existing literature and empiricism and then improve upon these processes. A suitable interview will be designed for the project managers based on the literature review (Chapters 2 and 3). The results of the empirical part (interviews) will then be analyzed in relation to the literature review. This thesis will be based both on existing theory and on empirical evidence.

## 4.2 Selection of research method

When conducting research, a decision needs to be made about what specific method to employ so that to collect the data required to answer the research question(s) or hypothesis**.** Based on the nature of the research the best research methodology is chosen for the research. The research can be based on qualitative research, quantitative research or mixed methods (Saunders, Lewis, & Thronhill, 2016, p. 164).

Qualitative research involves collecting and analyzing non-quantitative data to gather insights into a problem, understanding concepts, opinions and experiences. Qualitative research methodologies have roots in a several disciplines and traditions, including anthropology, sociology, psychology, linguistics, communication, economics, and semiotics (Cooper & Schindler, 2014, p. 144). The core qualitative research methods can be described as the following:

- In-depth interviewing of individuals and small groups
- Systematic observation of behaviour
- Analysis of documentary data

(Darlington & Scott, 2002, p. 2)

Creswell (2013) describes the common characteristics of qualitative research as natural setting, researcher as key instrument and multiple methods. Qualitative researchers tend to collect data in the field themselves, usually at the site of the problem or subject that they are studying. They gather up-close information by interviewing or talking directly to people and seeing them behave and act within

their context. In the natural setting, the researchers have face to face interaction over time. They may use an instrument, but it is one designed by the researcher using open-ended questions. They do not tend to use or rely on questionnaires or instruments developed by other researchers. In qualitative research, researchers gather multiple forms of data, such as documents, interviews and observations instead of relying on a single source of data. Then they review all of the data and make sense of it, organizing it into categories or themes that cut across all of the data sources. (Creswell, 2013, p. 45)

Hancock & Algozzine (2006, p.8) points out that the goal of qualitative research as *"to understand the situation under investigation primarily from the participants' and not the researcher's perspective".* This is called the insider's perspective (emic), as opposed to the outsider's perspective (etic).

Qualitative research is the opposite of quantitative research, which involves collecting and analysing quantitative data for statistical analysis (Darlington & Scott, 2002, p. 6). It involves instruments, such as tests and surveys, to measure specific variables from large groups of people. These instruments generate useful data in the form of series of statistical answers that can find patterns and averages, make predictions and test relationships (Hancock & Algozzine, 2006, pp. 7,8,10). Saunders, Lewis & Thornhill (2013) state that "Quantitative research often incorporates controls to ensure the validity of data, as in an experimental design. Because data are collected in a standard manner, it is important to ensure that questions are expressed clearly so they are understood in the same way by each participant".

In quantitative research the researcher is seen as independent from those being researched, who are usually called respondents. A quantitative research approach may use a single data collection technique, such as a questionnaire with a corresponding quantitative analytical procedure. Quantitative research is often associated with a deductive approach, where the aim is to use data to test theory.

However, it may also incorporate an inductive approach, where data are used to develop theory. (Saunders, Lewis, & Thronhill, 2016, p. 166)

Among the research methods, one can also distinguish between exploratory and descriptive studies. Exploratory studies are often qualitative in nature and useful when researchers lack a clear idea of the problems they will meet during the study. Through exploration researchers aim to seek new insights into phenomena, develop concepts, establish priorities, and improve the research design (Cooper & Schindler, 2014, p. 129).

Descriptive studies on the other hand attempts to describe or define a subject. It tries to discover answers to the questions who, what, when, where, and how. The researcher attempts to describe or define a subject, by creating a profile of a group of problems, people, or events (Cooper & Schindler, 2014, p. 21) . In a descriptive study, structured interviews can be used as a means to identify general patterns and to collect the necessary information (Saunders, Lewis, & Thronhill, 2016, p. 392).

This thesis is based on a qualitative approach since the aim is to conduct research on quality management in projects and through interviews identify the quality management processes in Vaasan sähköverkko's projects and improve them. It can be described as both descriptive and exploratory in nature. Descriptive when describing the theory and the quality management processes and explorative when the researcher analyses the results from the interviews and gives possible explanations for why the results appear in a certain way.

## 4.3 Case study

This study is implemented as a single case study. A case study is an in-depth contextual analysis of a naturalistic phenomenon, such as a person, an organization, a program, an event, a geographical location, or a decision (Tracy, 2020, p. 61). It is a qualitative research approach in which the researcher studies a real-life, contemporary bounded system (a case) or several bounded systems (cases). Case studies are done by collecting data in-depth involving multiple

sources of information, such as interviews, observations, documents and reports (Creswell, 2013, p. 97) . Case studies are suitable for studies that are explorative or descriptive in nature (Cooper & Schindler, 2014, p. 256).

A single case study approach is best when a need exists to study a unique or a revelatory case (Creswell, 2013, p. 237). It offers an opportunity to undertake a deep, but narrow exploration of a particular phenomenon. The focus is on small numbers which are investigated in-depth at a single point in time or over a longer period. It is the most practical approach for this study and is also of intrinsic interest and value since the researcher works at the company and has access to the company's data (Daymon & Holloway, 2011, pp. 119,121).

## 4.4 Data collection methods

The purpose of this thesis is to qualitatively and in-depth describe the quality management practices at the company and, on the basis of the literature review, propose improvements to these practices. Since it is specifically the project managers who are the focus of the thesis, in-depth interviews are well suited as a research method for the study. Interviews of individuals or groups allow the researcher to attain personalized and rich information and are especially helpful for acquiring information that is left out of formal documents. They create the opportunity for the researcher to test hunches and interpretations about the case**.** When conversing with interviewees, the researcher has the opportunity to bring up observations, and to ask interviewees to verify, refute, defend, or expand (Tracy, 2020, p. 79). Participants may be interviewed individually or in groups. Individual interviews yield considerable amounts of information from an individual's perspective, but can be quite time-consuming. Group interviews on the other hand take advantage of the sharing and creation of new ideas that sometimes would not occur if the participants were interviewed individually. One downside to group interviews is that they run the risk of not fully capturing all participants' viewpoints (Hancock & Algozzine, 2006, p. 39). In this study, individual, qualitative interviews are used as a method to collect data. It suits the

study best because individual interviews are are flexible and allows the researcher to develop an understanding of the perspectives of interviewees. Also, because the ideas of interviewees have priority, participants are able to explore their own thoughts more deeply or exert more control over the interview if they prefer. This means they can either react spontaneously and honestly to the researcher's questions or they may spend time reflecting on their answers and articulating their ideas slowly. Another benefit of interviews is that the data collected is situated within its own social context. That is, the responses obtained from interviews are the subjective views of the interviewees. The evidence, therefore, is based on participants' interpretations of their experiences and is expressed in their own words, and speech styles that are meaningful to them. (Daymon & Holloway, 2011, p. 221)

There are also different ways in which interviews can be conducted in qualitative research: structured, semi-structured and unstructured. In an unstructured interview (Table 2), the interviewer engages in informal conversation with the respondent about a particular subject. The interviewer may steer the conversation a little, by picking up on the cues and themes raised by the respondent, but mainly the respondent leads the direction of the interview (Fisher, 2010, p. 175). Structured interviews or pre-coded interviews (Table 2) are the opposite of unstructured interviews and controlled by the researcher. In these interviews the interviewer mainly reads from a prepared script and is expected not to diverge from it. The questions asked are organised into a logical sequence, and for most questions the respondent is given a series of options and asked to choose a given number of them (Fisher, 2010, p. 175). In between structured and unstructured interviews are semi-structured interviews. This thesis uses this approach, and it is particularly well-suited for case study research. In semi-structured interviews, the researcher asks predetermined but flexibly worded questions**.** The researcher has a schedule to remind the interviewees of the main issues and topics that need to be covered. The researcher can also ask follow-up questions designed to explore more deeply issues of interest to interviewees. In this way, semi-structured

interviews invite interviewees to express themselves openly and freely and to define the world from their own perspectives, not solely from the perspective of the researcher**.** When using a semi-structured approach, the researcher should develop an interview guide. This guide will help identify appropriate open-ended questions that the researcher will ask each interviewee. (Hancock & Algozzine, 2006, pp. 36, 40)

*Table 2. Unstructured and structured approaches to the main research methods (Fisher, 2010, p. 175)*

| | **Exploratory research Unstructured** | ←——→ | **Survey research Structured** |
|---|---|---|---|
| **Interviews** | In-depth and open | Critical incidents | Interviewer keeps to a script and there are answer options |
| **Panels** | Focus groups | | Delphi technique |
| **Questionnaire** | Lots of white space on the page | | Tick boxes |
| **Observation** | Keeping a research diary | Checklists and categories | Completing an observation schedule Activity sampling |
| **Documentary** | Rhetorical analysis | | Statistical analysis of themes |

A critical step in interviewing is to identify and gain access to relevant interviewees. Selection of interviewees directly influences the quality of the information attained. Hancock & Algozzine (2006) point out that *"The most important consideration is to identify those persons in the research setting who may have the best information with which to address the study's research questions."* In this study that would be project managers who manage underground cabling projects. At Vaasan sähköverkko, there are currently four

project managers who manage these types of projects. The aim was to interview all these people.

The potential interviewees must be willing to participate in an interview. The researcher should clarify issues of anonymity and confidentiality, review with the purpose of the interview with the interviewees and the approximate amount of time needed. The researcher should also clarify how and when the interviewee may receive results of the research of which this interview is a part. (Hancock & Algozzine, 2006, pp. 40-41)

An interview guide has been prepared for this thesis based on the literature review (Chapters 2 and 3). During the interviews, the researcher made sure that all themes, topics and key questions were discussed, but the questions and follow-up questions could differ depending on what the researcher found of value in what the interviewees were saying. The order of questions may also be varied depending on the flow of the conversation to make the interview freer and more natural for the interviewee.

## 4.5 Interview guide

The interviews in this study were semi-structured, with a list of themes, topics and predetermined questions to be covered, based on the literature review (chapters 2 and 3). The interviewees were given the opportunity to talk freely within the framework of the themes, topics and questions. The language in which the interviews were conducted was Swedish and Finnish to keep the situation more relaxed and, so that the interviewees could answer in their native tongue. The order of questions did not always follow the sequence of the interview guide. All interviews were audio- or video-recorded while notes were taken. Using both audio-recording and notetaking minimizes the risk of information being lost (Saunders, Lewis, & Thronhill, 2016, p. 411). The interviews were transcribed to assist the analysis and to ensure both reliability and validity. The transcripts were written in the language in which the interviews were conducted in.

This interview guide consisted of the following themes:

Theme 1 Project stakeholders

Theme 2 Planning project quality

Theme 3 Controlling project quality

Theme 4 Ensuring project quality

Theme 5 Project success and success factors

These themes were based on the literature review and the model made for project quality and project success in chapter four (Figure 7). The following four people chosen for the interviews are presented in Table 3.

*Table 3. Summary of interviewees*

| Work position | Interviewee | Work experience | Date of interview | Length of interview |
|---|---|---|---|---|
| Project manager | 1 | 15 years | 31.3.2023 | 1h 48min |
| Head of project management | 2 | 11 years | 5.4.2023 | 59 min |
| Project manager | 3 | 12 years | 3.4.2023 | 1h 23min |
| Project manager | 4 | 9 years | 3.5.2023 | 1h 3min |

The selection was made on the basis of their work as project managers or work in project management processes. It would have been beneficial to the study if more people were interviewed, but this is all who work with cabling projects or project management processes at the company.

## 4.6 Data analysis

Data analysis in qualitative research consists of preparing and organizing the data (i.e., text in transcripts, or photographs) for analysis, then grouping the data into themes, and representing the data in figures, tables, or a discussion (Creswell, 2013, p. 180). Darlington & Scott (2002) describe some of the key stages of

qualitative data analysis as transcribing, becoming familiar with the data and coding. Audio-recorded data that is to be systematically analysed needs to be transcribed. For most qualitative research, transcription at a general level of detail would be enough. This includes identification of long pauses, bracketed indications of emotional content such as laughing, crying or sighing. Inevitably some contextual and non-verbal aspects of the interview will not be recorded. The researcher can take notes to provide some perspective on these issues that may have a bearing on the research. When the transcript has been checked for accuracy, listening to the audio-recording again, with the transcript in hand, can be a valuable way to get a better sense of what the text is about. When the data has been thoroughly reviewed one can begin the process of coding. Coding is creating categories and assigning them to selected data. Coding is an integral part of the analysis, involving sifting through the data, making sense of it, and categorising it in different ways. Qualitative analysis is generally concerned with identifying patterns in the data—different ways in which the data relate to each other. (Darlington & Scott, 2002, pp. 143-145)

In this study, all interviews were recorded on Microsoft Teams. The files were saved in a folder and named according to the interviewee's numbers. The interviews were listened to several times before being transcribed in the language in which the interviews were conducted in. Parts that the interviewees asked to be left out were left out in the transcript. This is because some information may be sensitive. Notes were also taken during the interview. A separate document was created to categorize the interviewees' responses according to the themes of the interview guide. This made it more comprehensible to identify patterns when the different interviewees discussed the same topics.

# 5 EMPIRICAL FINDINGS AND ANALYSIS

In this chapter, the interviews will be analyzed on the basis of the transcripts and the categorized interviewee responses. The analysis is divided into sections according to the themes that were discussed in the interviews. The result of the study is summarized at the end of the chapter. The interviewees are stated as numbers in the analysis based on the table of interviewees (Table 3).

## 5.1 Project stakeholders

The literature review states that a project might have several different customers. These can be external customers, internal customers or hidden customers (Rose 2014). These are important to keep in mind throughout the quality management processes, since these customers or stakeholders can make or break a project's success.

Identifying these customers or stakeholders allows for clear communications during periodic updates or project progress meetings. Knowing who the stakeholders are and where they fit in the development and deployment phases of the project is vital to understanding and effectively addressing their expectations or concerns. This is an important part of achieving overall project success where business-oriented results such as customer satisfaction can play a large role unlike project efficiency that only refers to the things that needs to be done to complete a project.

The interviewees described the projects' external customers as follows:

*"Everything with an electricity connection. It can be households, factories or hospitals for example."* (Interviewee 1)

*"It is the end-user or the consumer that is our external customers"* (Interviewee 3)

All interviewees described the electricity consumers as the external customers of their projects. Other external stakeholders mentioned were landowners, municipalities, subcontractors, telecommunications companies, water supply and wastewater companies.

*"Landowners can also be considered as external stakeholders as the result of our projects are on their land"* (Interviewee 2)

*"Telecommunications or water companies are also stakeholders because there is a law on joint excavation, and we are required to coordinate the work with these companies when we bury cable to avoid unnecessary excavation of land"* (Interviewee 1)

To ensure that these external stakeholders receive relevant information about the project, the interviewees described that dialogue between the customers/landowners as important. Information letters are sent out and discussions with landowners or for example, telecommunications companies are held on the best possible solution for the cable route. Clear construction site signs are also important with contact details of all key people involved in the project.

*"I listen to problems or requests that customers may have. There is usually an answer to the problem if you cooperate or are willing to cooperate."* (Interviewee 1)

*"In order to take customers into account during the project, customers living in the area where the project is carried out are notified that work will be carried out with the aim of improving the reliability and the resilience of the network."* (Interviewee 3)

In the literature review, internal customers were mentioned. These are collaborators present within the project organisation (Rose, 2014). The internal stakeholders were described by the interviewees as the network operations and control centre, network planning department, communications department and the economic department.

*"Since network operations and control centre are the end users of our projects, it is important to take their wishes into account and to ensure that the project works smoothly in practice and is easy to use once it is commissioned."* (Interviewee 2)

In order to take the internal stakeholders into account during the project, the network operations and control centre and the network planning department are invited for example to kick-off, commissioning and regular meetings. Project managers co-operate with the communication department to best reach out to customers. The economic department is also involved. They make sure that invoices go to the right place and are defined correctly in IFS (a project management tool).

For the planning department it is also important that the project is well documented in the system that Vaasan sähköverkko uses. Well-documented means that the maps correspond to reality and all relevant commissioning and testing protocols are done.

The third customer group that was brought up in the literature review was hidden customers. Hidden customers are stakeholders or organisations that do not directly participate in the project but have an interest in or concern about it (Rose 2014). Hidden customers or other stakeholders were trickier to define. From the interviews it appeared that these could be authorities, local village associations or customers in general in a larger area (not only in the project area).

*"If our projects are located in a groundwater area, it is important that the authorisation procedure is carried out correctly via AVI or ELY-keskus."* (Interviewee 1)

*"For example, if we build a new substation in Malax, this also affects customers in a larger area and not only those living in Malax because the project increases the reliability of the entire network. So, these customers could perhaps be counted as hidden stakeholders."* (Interviewee 2)

Based on the interviewees' answers, the external and internal customers of their projects are clear. The one clear external customer mentioned were the electricity user. There were also several other external customers mentioned that in one way or another have an interest in the project and need to receive some kind of

communication of its progress. Hidden customers were not as clear and based on the interviewees' answers some of the external customers mentioned, could perhaps actually be seen as hidden customers.

The difference between an external and a hidden customer could be described as that the external customers are the ones that need to receive something from the project on a regular basis. However, the difference between these customers and the hidden customers might not be obvious in all cases. Rose (2014) refers to the external customers as the obvious customers, the one receiving the bill, but on the other hand also mentions suppliers as external customers since they should be receiving clear requirements from the project. For Vaasan sähköverkko´s projects this division amongst the customers is not the best since they also have many stakeholders that are not in a sense the final customers of the project, but that still need to receive something from the project. However, it might not be on a regular basis in the same way that a clear external customer needs information. With this said, it could be beneficial for Vaasan sähköverkko to map their customers and divide them into stakeholder groups based on the level of communication and information that is needed from the project to the customer group. This way, they could already in the beginning of their projects have a clear understanding of their customers, the level of communication needed to them at different stages and a plan on how to put the plan into action.

## 5.2 Planning project quality

Planning quality management is the process of identifying quality requirements and the required standards for the project and its deliverables (Steyn, 2008).

During the interviews, the interviewees were asked to define what quality is in their projects. Several interviewees emphasised that quality is when the project plan is followed.

*"Quality in a project is where potential risks have been identified, the project is progressing according to the project plan and the end result meets expectations."* (Interviewee 2)

*"*Quality is when the project stays on schedule and progresses according to the project plan.*"* (Interviewee 3)

Multiple interviewees also mentioned that quality is met when construction standards are met. However, one of the interviewees notifies that this is to some extent also the responsibility of the contractor.

*"Quality can be mechanical or cosmetic. Mechanical quality is defined in standards that the construction must meet. Cosmetic quality is a tidy site area with surfaces that landowners are happy with after we have buried cable."* (Interviewee 1)

*"Quality is that it is built according to the standard i.e., it should last for 50 years."* (Interviewee 3)

*"Much of the quality is the responsibility of the contractor. Construction quality should be good. Transformers, foundations, electrical cabinets, cables buried correctly, etc. should last for about 40 years or their expected lifetime."* (Interviewee 1)

Another thing that the interviewees described as quality is when there are as few dissatisfied landowners as possible in the project. This is directly linked to what the literature reviewed as customer focus. When the stakeholders are happy, quality standards have been met.

*"One sign of success is when few customers contact you about the project. It's going well when nothing is heard (from the customers)."* (Interviewee 3)

One of the interviewees mentions an interesting fact that quality can also be what Vaasan sähköverkko want to get out of the project because they use the project themselves when it is finished. This means that it should be easy to use and reliable. This is interesting in the sense that Vaasan sähköverkko as an organisation could perhaps also be seen as a customer of the project themselves.

*"The project should be in good operational condition when it is completed.* The network operations and control centre *want it to work well in practice and the*

*network planning department want it to be well documented in the system."* (Interviewee 2)

With reference to the interviews conducted, there seems to be no specific quality management plan for the projects. For project management in general, the projects are managed using the phase gate process, which means that the projects are divided into four gates. G1 is the project initiation phase where planning decisions are made. It is followed by the electrical planning and network design. G2 is the terrain planning phase and G3 is the commissioning. G4 is the project closing phase. In difficult projects additional risk assessments are carried out, and major decisions and gate completions are made by the CEO or a steering group.

Even if a separate quality management plan is not made, some quality criteria are measured. Deadlines, budgets, resources are measured and to ensure that the construction meets the quality standards, site visits are carried out. The progress of the project is measured in Power BI (project management software) where deadlines are set and subcontractors report, for example, how many metres of cable have been buried, or transformers built. One can see the project's progress in per cent and payments that have been made.

*"We do not make separate quality management plans, but the progress of the project is measured in Power BI. This shows the start and end date of the project and the subcontractors report, for example, how many metres of cable have been buried or how many transformers have been built. Basic things like schedules and budgets are measured here."* (Interviewee 1)

The lack of a separate quality management plan in Vaasan sähköverkko´s network construction projects seem to be a decision made by the organisation due to the nature of the projects. More complex projects use more complex project management frameworks.

*"Vaasan sähköverkko uses the Vaasan sähkö project management framework. This is based on PMBOK and IPMA standards. The framework is scalable and if a*

*project is familiar to us (lower risk), we can scale down the project management requirements. In an A-class project, project management is more complex and requires, for example, quality plans and communication plans. Simpler projects do not necessarily require a separate quality management plan." (Interviewee 4)*

Since Vaasan sähköverkko´s network construction projects are usually not classed as complex, a separate quality management plan is not made. However, based on the conducted interviews, there are activities that are done in order to plan the quality in these projects as well. The activities done for planning quality in Vaasan sähköverkko´s network construction projects are, based on the interviews in this study, the following:

- A clear project charter
- A project management plan
- Criteria for authorizing project phases (based on the gate model)
- Setting quality standards and specifications that need to be met (standards)
- Identifying possible risks

In reference to the last chapter about project stakeholder, a possible activity that could add to project quality already in the planning quality phase would be to survey the customers in the project and plan the amount and timing of communication towards them. In the planning phase, activities that could be added are therefore:

- Stakeholder mapping/stakeholder register
- Planning stakeholder communication

### 5.2.1 Risk management

Although project risk management may be seen as a separate part of project planning, literature suggests that it is an important field to take into consideration when planning project quality (Steyn, 2008, p. 1301). Risk management is integrated in the project planning of Vaasan sähköverkko´s projects.

*"In our system we do risk assessments. No matrices but more general risk assessment. At kick-off meetings or project start-up meetings, important factors and risks are highlighted. Subcontractors also carry out risk analyses on their work."* (Interviewee 2)

At Vaasan sähköverkko, projects are also categorised into different categories depending on the difficulty or risk of the project. They can be:

A = very complex and high-risk project

B = typical, so-called normal project

C = Simple and straightforward project

*"To decide what type of class the project is, Vaasan sähkö's project framework has a form that can be used as a guideline. The questions concerning timetables, project size, costs, stakeholders, project participants and strategic value for the company help to determine the class."* (Interviewee 4)

Vaasan sähköverkko´s network construction projects are usually classed as B-class or C-class in complexity. A-class projects do occur, but they are not too frequent. Therefore, the project quality management and the project risk management plan are not seen as just as crucial as in an A-class project. However, risk management is always conducted for each and every project to some extent. This is also the case for the network construction projects where risks are mapped throughout the project and marked in a specific project management tool.

*"In IWM (project management tool) there is a section where you can add risks. An example could be utility pole construction. Here you can add explanations or guides on how the job should be done that the subcontractors can see. This is also reviewed at kick-off meetings. We add new risks as we identify them."* (Interviewee 1)

*"We carry out a separate risk analysis for each project. We try to minimise individual project risks such as schedule risk or cost risk. Other risks that we are*

*aware of are considered. Risks are also discussed with the steering group, especially for projects where costs may rise significantly or where delivery times are long. To minimise delivery risks, we order components as soon as planning is complete."* (Interviewee 3)

*"As a client, we can do our part to create the best possible conditions for the success of the projects and minimise the risks. We try to do archipelago projects in the winter when the ice is thick. If it's a warm winter, we can even try to postpone a project to the next winter in order for the project to be more successful."* (Interviewee 1)

One of the interviewees also mentions the advantage of what the ISO guide sets out as upside risks, so called opportunities.

*"You have to turn everything in your favour when working around problems. In our projects, it is often the weather that can be a risk or an opportunity. As previously mentioned, it is a WIN-WIN situation for both us and subcontractors if the job is done when there is frost in the ground compared to wet and muddy. In these situations, it pays to start projects early if possible."* (Interviewee 1)

All interviewees said that they try to recognize risks before they happen. At the beginning of the projects, unit prices for different works are made to predict costs. A typical risk is rock blasting because no soil survey has been done before the project and if there is a lot of blasting, costs rise quickly. Rock blasting was mentioned by several interviewees as a typical reactive risk management. Fuel prices and component prices have also increased significantly in recent years, which also poses some risk to projects. However, most felt that risk management is more proactive than reactive in their projects and that risks are properly surveyed and taken into account already in the beginning of the projects.

Since risk management is closely related to quality management and the fact that one interviewee mentioned that quality is when possible risks has been identified, the following activities could be added to the planning quality list:

- Mapping possible risks
- Making response strategies

## 5.3 Controlling project quality

Quality control is done by reviewing the project continuously throughout its life cycle and comparing the work results with the quality requirements to ensure the result is acceptable. (PMBOK, 2021, pp. 271-272). This is according to (Steyn, 2008) planned quality control. Planned quality control at Vaasan sähköverkko´s network construction projects involve site visits.

*"I do site visits at least twice a month but aim to do it once a week. This way, the contractor "feels" our presence. It is important to be critical but not too critical when making visits."* (Interviewee 1)

The frequency of site visits varies between interviewees. Some aim for once a week while others do site visits about once a month. It is up to the project manager to decide.

*"*During site visits we inspect the quality. The goal is to conduct site visits at least once a month.*"* (Interviewee 2)

*"*For larger projects, I try to make site visits once a month.*"* (Interviewee 3)

Furthermore, Vaasan sähköverkko uses the Gate model as their project management approach. The gate model further enhances the controlling of the project quality since the project needs to be checked and accepted at each gate in order to proceed.

*"We follow up the projects using the gate model. The project is divided into four gates and different milestones mark the end of a gate. G1 is when a decision has been taken to carry out power network planning. G2 marks the start of network planning and terrain planning. When both of these are finalized, the construction phase begins. G3 is achieved when the construction phase is completed. G4 is*

*completed when all work on the project is done, and all bills have been paid."* (Interviewee 1)

*"One could say that the gate model is a way to measure and ensure the quality of a project."* (Interviewee 2)

Quality control also involves ad-hoc quality control that is handling all problems that occur during the project. (Steyn, 2008). For Vaasan sähköverkko´s projects it was already earlier mentioned that rock blasting is a typical risk that occurs in projects. This is mostly ad-hoc problem solving.

*"To solve such a problem, we calculate whether it is worthwhile to blast the rock or to dig around it. The cable can also be laid on top of the rock if it is protected by an additional cable protection. The cable must then be deep enough in the ground but shallower than 70 cm (the requirement in the standard) to need extra protection."* (Interviewee 2)

Other possible problems mentioned by the interviewees, that possibly demands ad-hoc quality control, are for example landowners that have not always fully understood the implications of the contracts or how the cabling on their land is planned to be carried out. Some landowners can also be more challenging to work with than others, so it is important to try to listen to them and be diplomatic. These problems are partly something that can be anticipated and therefore minimized through good communication, but at the same time, the problems are always ad-hoc when they appear due to the human factor.

*"It is important to be clear in your communication with landowners. Effective communication usually reduces the number of "challenging" landowners."* (Interviewee 1)

*"A frequent problem we encounter with projects completed in late autumn or winter is lawn damage. The damage is not visible until spring when the snow melts and then there are usually some calls from landowners/customers. These calls can*

*be avoided by letting customers know in advance that this will be fixed."* (Interviewee 3)

Another possible ad-hoc problem that sometimes occur, is when a plan looks good on paper but is hard to implement in reality.

*"Another problem we encounter sometimes is when a network design looks good on paper but is difficult to implement in reality."* (Interviewee 3)

The interviewees were further asked about the handling of nonconformities or investigations used in ad-hoc quality control. They responded that it is usually done only in case of major problems or deviations in planned jobs. An example mentioned was a subcontractor that blasts much more rock than planned and sends an invoice for the job that is considerably more expensive.

Based on the interviews, the activities Vaasan sähköverkko does in their network construction projects in order to control the quality, are:

- Project documents
- Follow-up meetings
- Regular site visits
- Reporting of defects
- Gate model controls
- Ad-hoq quality control
- Handling of nonconformities if major problems occur

## 5.4 Ensuring project quality

Quality assurance entails both assurance of a specific project´s quality as well as continuous improvement in quality as whole. Tools for continuous improvement are for example, documented lessons learned from a project, reports from project close out meetings and reports on non-quality costs (cost of poor quality). Quality assurance methods include kick-off meetings, audits, design reviews, checklists, training of project members etc. (Steyn, 2008).

There is a lot done in order to ensure the quality of Vaasan sähköverkko´s network construction projects. Kick-off meetings are organised before the construction phase of each project. Those who attend the meeting are the key people involved in the project. They are usually:

- The project manager from the client's side (Vaasan sähköverkko)
- The project manager from the contractor
- The excavation contractor
- Terrain planner
- The network designer
- Network operations and control (Network operator)

At kick-off meetings it is decided who is responsible for what. The network design and terrain plan are reviewed, and it is ensured that everyone has access to the right planning tools (for example, NIS, M-Files, Headpower) so that they can find the relevant documents or maps. Permits are discussed and checked that all those needed are approved. Then it is also discussed how and when the old electricity line will be demolished. Joint excavation is discussed as well, and contact is made with telecommunication companies. Risks and uncertainties are reviewed and how to react to them. Timetables are discussed and the progress of the project. A channel on Microsoft Teams is also created as a medium for project communication.

Before the commissioning of a project, the necessary acceptance tests and test protocols must be carried out. A final inspection of the project is also carried out by visiting the site and reviewing the final results of the project.

*“To ensure quality, we do site quality control. For example, we check the electrical installations, occupational safety, fire risks and noise levels. We can also check things like whether the concrete meets the standard.”* (Interviewee 4)

*“When we are in the field during the final inspection, we look at all transformers and major components. We don't usually go through all components such as low*

*voltage cabinets, but we do spot checks on them to ensure quality."* (Interviewee 1)

*"During final inspection, we check that cable depths are correct (GPS measured documentation) and that technical components are correctly installed. We also review test protocols, and check that they are filled in correctly."* (Interviewee 3)

Another way of ensuring the quality is factory acceptance tests. Since Vaasan sähköverkko is the one to order products for their projects, the ensuring entails being present during the tests and making sure that everything meets the set standards in terms of quality.

*"When we order larger components (such as large-scale industrial heat pumps or transformers), we are invited to factory acceptance tests where we review the quality documentation with the project team before it is sent to us."* (Interviewee 4)

To some extent, ensuring quality also means making sure that the personnels is properly resourced and distributed amongst the ongoing projects.

*"From a portfolio management point of view, it is important not to overburden project members. If a project member is working on too many projects at the same time, the quality of their work drops. It is important that projects are adequately resourced."* (Interviewee 4)

The process of ensuring quality of the specific projects can at Vaasan sähköverkko´s projects be reviewed as good. There is a good plan set up for ensuring the quality and the project managers are on the whole satisfied with how it is working at the moment. However, ensuring project quality also entails continuous improvement. Lessons learned are an important tool for continuous improvement. Doing this after every project helps the company develop its project management practices. (Steyn, 2008)

This is something Vaasan sähköverkko wishes to improve in their project quality management process. At the moment, lessons learned are not documented.

*"It has been discussed that this should be done (lessons learned), but it is not done at the moment. It would be good to do this with the subcontractors."* (Interviewee 2)

*"Lessons learned are not currently done or part of the project closure process, but it is sometimes discussed during the final inspection of a project with the subcontractors."* (Interviewee 1)

*"Lessons learned is an area of development for us. It should be done, and it is important to do it in a sensible way. We must not end up "dumping" a lot of lessons learnt documents in a place that no one reads. If you could develop it so that you can search for different knowledge areas on M-files. This could be, for example, whether various risks occurred and how they were reacted to, or in the case of automation/electrical planning, various topics that should be paid attention to so that mistakes are not repeated."* (Interviewee 4)

Costs of poor quality could also be measured to better monitor the impact on the project.

*"The cost of poor quality is not measured, but if we end up double checking cables (mapping and measuring depth) to make sure that they are buried according to standard, it is an external contractor who does this. We are invoiced for this extra work, so it appears in the project's budget. But we do not compile a separate report for the cost of poor quality."* (Interviewee 1)

Another possible issue regarding the assurance of quality is the warranty period. As Vaasan sähköverkko is, to some extent, the customer of their power network construction projects, all faults should be reported before the warranty period is due.

*"The warranty period for the project is two years. Since network control and operations and other subcontractors use the project once it is completed, it is important that they pay attention to and report faults if they find any within the warranty period. If something is built incorrectly, it will be fixed after the warranty period has expired."* (Interviewee 2)

Based on the interviews the following activities are done in order to assure quality in Vaasan sähköverkko´s network construction projects:

- Kick-off meetings
- Final site visits
- Dividing responsibilities
- Checking tool access
- Project communication tool
- Acceptance tests and protocols
- Properly resourced personnel

In addition to this, possible activities that could be added in order to improve quality are:

- Documenting lessons learned
- Joint post project review
- Reports on non-quality costs

## 5.5 Project success factors

One of the questions in this paper is whether the quality management principles in Vaasan sähköverkko´s network construction projects lead to project success. According to the literature review, project success is hard to describe and depends on the type of project and the organization (Besteiro, 2015). It is pivotal for the project to beforehand know what to measure the success on and set out the success factors already prior to starting the project (Frefer, Mahmoud, Haleema, & Almamlook, 2018, p. 6)

Specific success factors are not put on paper in Vaasan sähköverkko´s projects. Although, the interviewees described a successful project as one that is on time and on budget and where the project has progressed according to the project plan and the quality of the construction is good (meets the standard).

*"A successful project is one that is delivered within budget, on time and according to the project plan. It is important that the stakeholders are satisfied with the project (municipalities, customers, consumers, Vaasan sähkö and Vaasan sähköverkko etc.)."* (Interviewee 4)

The literature describes these success factors as the "triple constraint" or the "iron triangle" (Rose, 2014, p. 7). It is described that the elements of time, cost and scope are of utmost importance and that they directly affect the quality of a project. Therefore, these criteria are important for Vaasan sähköverkko to keep in mind throughout the project. However, another part of the literature discusses how the iron triangle is too narrow and does not take into account possible fluctuations (Frefer, Mahmoud, Haleema, & Almamlook, 2018; Kerzner, 2017; Shenhar & Dvir, 2007). Therefore, there is a need to specify more detailed successful criteria for the specific projects. However, as opposite to the literature review, one of the interviewees specifies that these factors work well as success factors within their projects.

*"Our projects (power network construction) rarely deviate from standard procedure, so typical measurements of success such as schedule, budget and cost work well to define the success of our projects."* (Interviewee 1)

Although, there were a few other factors mentioned that could be reviewed as a metric for success in the projects. For Vaasan sähköverkko proper documentation of the project was mentioned as important along with positive feedback from landowners or other stakeholders (operations). It was also a good sign if as few customers or landowners as possible got in touch. From a long-term perspective, success in the projects was also defined as when the projects create value for Vaasan sähköverkko long-term.

*"If I were to rank, I would say that proper documentation is most important. The whole project will be miserable if documentation is poor. But just as important is the quality of construction and installation. Then comes positive feedback from customers and stakeholders followed by smooth invoicing." (Interviewee 1)*

*"From a strategic point of view, a successful project is one that brings value to the company. Was the project profitable to do? It could be the construction of power plants, improvements to the electricity grid or major system updates. This may not be apparent until years after the project has been completed."* (Interviewee 4)

On the other hand, a non-successful project is by one of the interviewees described as a project that fluctuates.

*"The opposite of a successful project is when there are a lot of surprises and changes in the project plan. such projects can burden our organisation and our stakeholders." (Interviewee 3)*

However, the literature discusses that one can no longer on today´s business environment assume that the initial project plan will hold and that the project will have to adjust to fluctuations. This is the exact reason why the triple constraint is no longer working as a single measure of project success. (Shenhar & Dvir, 2007, p. 10). Therefore, the failure criteria of fluctuations should perhaps, instead of being regarded directly as a failure criteria, be turned into a success factor in terms of how well the project can respond to fluctuations. All in all, the success criteria listed by the interviewees and set out in this chapter could be divided into the following categories:

- Critical success factors: Keeping the project on time and budget and following the set project plan.
- Project managerial factors: Project documentation, smooth invoicing
- Customer success factors: Positive feedback from customers
- Responsiveness factors: How well the project is able to react to fluctuations
- Value: Brings strategic value to the company

# 6 DISCUSSION AND CONCLUSION

The results from the analysis in the last chapter provide an insight into the quality management process in Vaasan sähköverkko's network construction projects. In this chapter, the result of the analysis are discussed, and the conclusions of the study are presented in regards to the research questions stated at the beginning of this thesis.

The first research question was what the quality management practices implemented in Vaasan sähköverkko´s network constructions are. From the interviews, one clear fact set out was that Vaasan sähköverkko does not make a separate quality management plan for their network construction projects. This is an active choice made by the organisation due to the low level of complexity on project management level in these projects. The researcher in this thesis has, based on previous literature, surveyed a quality management framework that acted as basis for the interviews conducted. Based on the interviews, several quality management activities were recognized that are already done in the network construction projects. The current quality management activities in Vaasan sähköverkko´s network construction projects are presented in Figure 8. These activities are marked with blue. This figure represents the quality management framework used in Vaasan sähköverkko´s network construction projects today.

The second research question in this thesis was how the quality management practices in Vaasan sähköverkko´s network construction projects can be improved. During the interviews, several quality management activities were also recognized as activities that could be added in order to enhance the quality of the projects. In Figure 8, the possible activities that could be added to the current quality management framework have been marked with red.

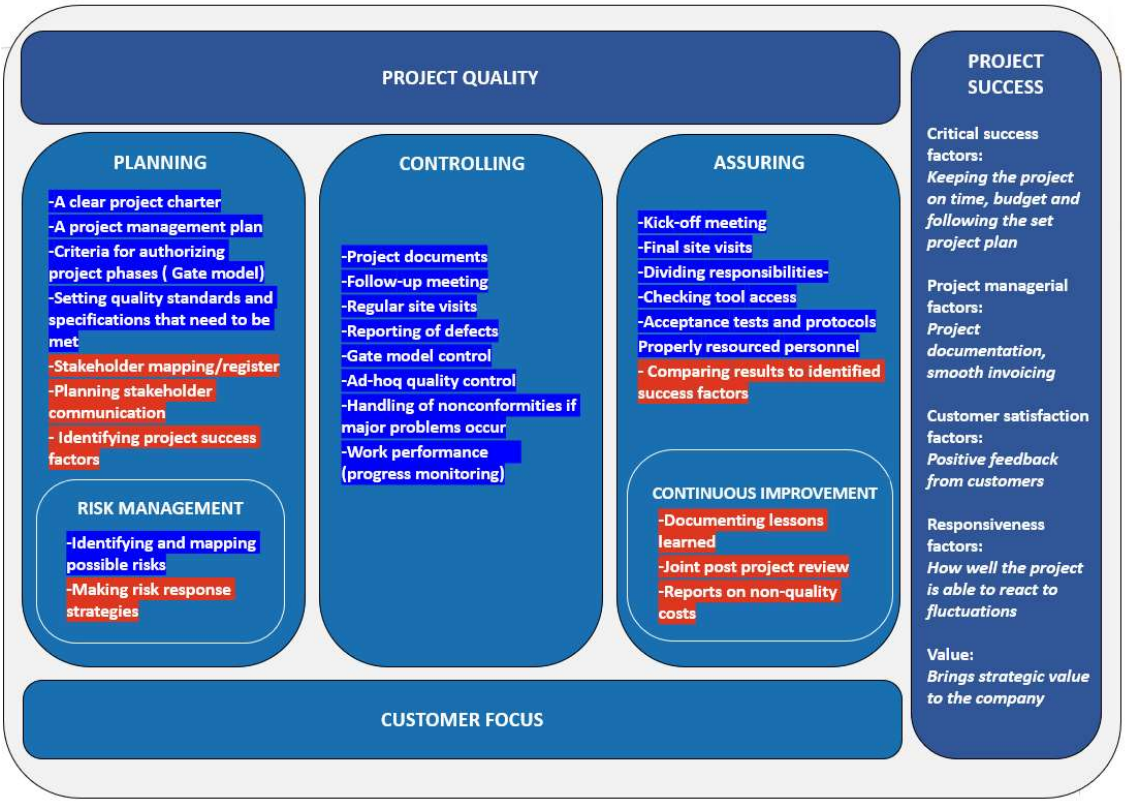


*Figure 8. Model for project quality and project success containing identified quality management processes (blue text), suggestions (red text) and success factors*

However, since Vaasan sähköverkko does not make a separate quality management plan for their network construction projects, the second research question has to be answered by adapting the proposed quality management activities to their project management plan. For this reason, the process description for power network construction projects will serve as foundation for answering the research question and improvement suggestions will be added to the description.

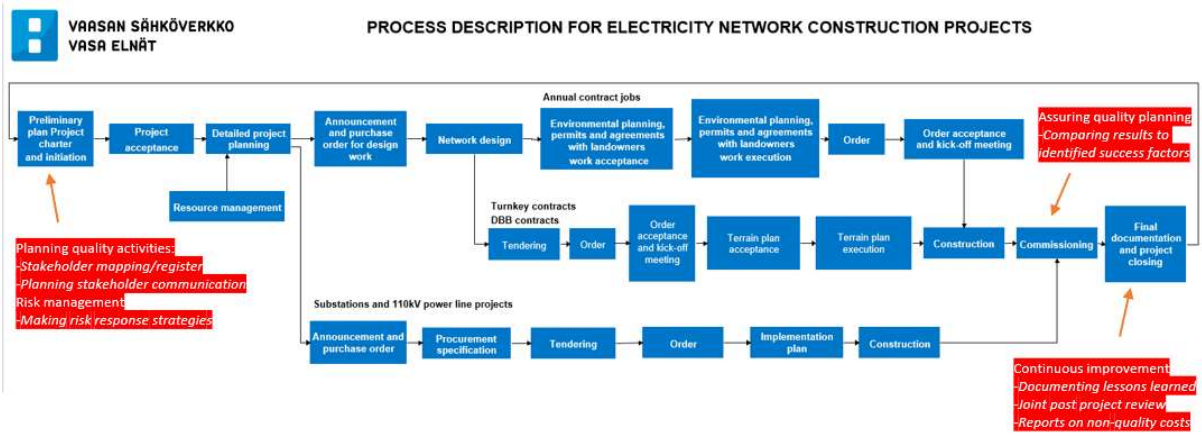


*Figure 9. Process description with improvement suggestions*

In Figure 9, the improvement suggestion has been adapted to Vaasan sähköverkko´s process description of their power network construction projects. In the preliminary plan step, the activities of stakeholder mapping and communication as well as risk management and response strategies has been added as activities that would be beneficial to add to this stage of the plan. To the commissioning step, the activities of comparing the results to the success factors has been added and to the step of final documentation and project closing, continuous improvement entailing documenting lessons learned, joint post project review and reports on non-quality costs has been added.

Since several literature on quality management dealt with the concept of project success, the researcher in this thesis made the decision to involve success factors into this thesis. Success in projects is an indicator of high quality and the mapping of success factors therefore, acts as a possibility to measure project success and by this also the level of quality in projects. The third research question, what are considered success factors in Vaasan sähköverkko's projects and how do they relate to managing quality in projects, where therefore added to this thesis.

From the interviews, it pretty soon became clear that Vaasan sähköverkko does not set out the success factors their projects separately. However, the interviewees were all of the same opinion on the success factors what literature

calls the triple constraint; time, cost and scope. These were mentioned as clear indicators of a successful project in reference to their network construction projects. The literature review critiqued the triple constraint of being an old-fashioned way of mapping success, but with reference to the results from this study, the triple constraint seems to be working quite well for Vaasan sähköverkko´s network construction projects. However, based on the interviews, the researcher did identify more success factors that works as measurement of project success for Vaasan sähköverkko´s network construction projects in general. These involved furthermore the factors of project management, customer satisfaction, responsiveness and value creation. The success factors proposed for the projects in general are therefore the following:

- Critical success factors: Keeping the project on time and budget and following the set project plan.
- Project managerial factors: Project documentation, smooth invoicing
- Customer satisfaction factors: Positive feedback from customers
- Responsiveness factors: How well the project is able to react to fluctuations
- Value: Brings strategic value to the company

However, the literature discusses how success factors can differ between different projects and that it is important to set out the specific success factors in the beginning of each project. Therefore, the activity “identifying project success factors” was added as a proposal to Vaasan sähköverkko´s project management plan. The activity “comparing results to identified success factors” was also added as an activity.

The success factors listed above are the success factors the researcher in this thesis proposes for the network construction projects. However, the researcher does acknowledge that the projects might differ and that the success factors therefore need to be mapped separately in each project. The proposed success factors can, however, act as a starting point for Vaasan sähköverkko when

mapping the specific success factors in their network construction projects. These success factors then relate to the quality management in the projects by giving clear metrics to measure the success of the projects on.

## 6.1 Theoretical and practical implications

This thesis has in the literature review touched upon the subjects of managing quality in projects by presenting the wheel of quality by Rose (2014) and two different models for planning quality suggested by PMBOK (2017) and Steyn (2008). It has furthermore touched upon the subject of project success and presented the ongoing theoretical discussion on specifying project success factors. The researcher has used this theory in order to build a new project quality management framework that has been used for the case study presented in this thesis. The project quality management framework has combined the models of quality, planning quality and project success. This has not been done in theory before and this model served very well for the purpose of mapping a company´s current quality management activities while clarifying their success factors. Therefore, the theoretical implications of this study are a new quality management framework that can be tested and used in further research about the same topics.

The practical implications of this study are the knowledge this brings to the case company Vaasan sähköverkko. Vaasan sähköverkko did not have a clear project quality plan for their network construction project and therefore no clear picture of their current quality management. This thesis has surveyed their quality management activities and put them into a quality management framework. This framework can be used by Vaasan sähköverkko in order to understand their quality management and as a basis for developing their quality management further. In addition, this thesis has, based on the interviews, highlighted several activities that could be added to the project in order to enhance the quality. Furthermore, the thesis has surveyed what the factors are making the projects

successful and by that, given Vaasan sähköverkko a clearer understanding of how to plan for success and how to measure the success and quality of their projects.

## 6.2 Evaluation criteria of reliability and validity

Reliability and validity are concepts used to evaluate the quality of research. Reliability means how consistently a method measures something. It means that if a survey was to be repeated using the same methods under the same circumstances it would produce the same result (Cooper & Schindler, 2014, pp. 259-260). However, Daymon & Holloway (2011, pp,78.79) point out that "In qualitative research, the idea of replicability and reliability is rarely used because of the subjective nature of qualitative research. The researcher him- or herself is the research tool, the research is context specific and therefore the research would be difficult to replicate."

This applies to this study as it is a case study that is tied to its context and would be difficult to replicate. Creswell (2013) mentions that the reliability of a study can be enhanced if the researcher obtains detailed field notes by employing a good-quality tape for recording and by transcribing the tape (Creswell, 2013, p. 253). This has been done in this study. The methodology chosen for the study has also been justified and the steps of the study have been described as thoroughly as possible to give the reader a clear picture of how the study was realised.

Validity in qualitative research refers to the extent that a test measures what the researcher actually wishes to measure (Cooper & Schindler, 2014, p. 668). It means that a test measures what it is supposed to measure and that the study accurately assesses the phenomenon that the researcher intends to assess. Internal validity is the extent to which the findings and the research account accurately reflect the social world of those participating in the study and also the phenomenon which you are investigating. To an extent, one can establish this by showing the findings of the study to the participants (interviewees) and ask for their comments. This makes it possible to compare the researcher's interpretation with the perceptions of the people involved and note whether or not they are compatible. Only the

participants themselves can judge this internal validity. (Daymon & Holloway, 2011, p. 79). The participants in this study have been shown the results and read through their quotes in the empirical findings and analysis chapter to make sure the researcher understood them correctly.

## 6.3 Limitations and further research

This study has been affected to some extent by limitations. One limitation that might have affected the study is the number of interviews. It might have been beneficial for the study if more people had been interviewed to get a broader perspective, but on the other hand, these were all the people who work with underground cabling projects at the company. No sampling was necessary as everyone relevant to the study was interviewed.

The study has also been affected to some extent by time constraints. The interviews took place during the interviewees' working hours and time was limited. Most had just over an hour for the interviews, and some interviews had to be adapted to their schedule. The time frame for the researcher has also been quite tight to get the work done in time, which may have affected the study somewhat.

This study has furthermore focused specifically on Vaasan sähköverkkos´network construction projects. The study is therefore a single case study, and the results of the study cannot directly be amplified on projects in a general context. Within Vaasan sähköverkko there are also larger projects that the network construction projects and it should be noted that this study does not cover the larger projects of the organization. However, the study aims to add to the knowledge of quality management and success factors. In order to make the results of this study more generable, further research could focus on replicating a qualitative study on this same subject in other organisations.

## 6.4 Conclusion

This thesis was started because there was a need to improve the quality management processes in network construction projects at Vaasan sähköverkko. The literature review provides an insight into what quality management is and what it encompasses. Through the interviews, the quality management processes that are implemented in the company were surveyed and set out in a quality management framework proposed by the researcher. This framework answers the question what of what the quality management practices implemented in Vaasan Sähköverkko's power network construction projects are.

The quality management activities the researcher proposes that Vaasan sähköverkko add to their activities were added to Vaasan sähköverkko´s project management plan for the network construction projects. This enhanced project management plan aims to answer the research question on how the quality management practices in their projects can be improved.

The third research question was what are considered as success factors in Vaasan sähköverkko's power network construction projects and how do they relate to managing quality in projects.

The answers to this emerged from the interviews, and the researcher identified several possible success factors that the projects teams could be utilizing in their network construction projects. Based on this, a proposal of how they could be implemented in the project management plan was made. As success in projects is an indicator of high quality, the surveying of success factors acts as a possibility to measure project success and by this also the level of quality in projects.

This thesis has answered all the three research questions set out in the beginning of the thesis. By this, the researcher has surveyed the current use of project quality management activities in Vaasan sähköverkko´s network construction projects and suggested how they can enhance the quality in their projects.

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# APPENDIX 1 INTERVIEW GUIDE

## THEME 1 project stakeholders

External customers / stakeholders

- *Who are the end customers of the project?*
- *How is the end-customer present/taken into consideration throughout the project?*
- *What other stakeholders does the project have outside the organisation that needs to receive information about the projects? (Ex. Suppliers)*
- *How are these stakeholders taken into consideration throughout the project?*

Internal customers / stakeholders

- *Is there internally anyone/another function you collaborate with during the project?*
- *How do you make sure that these function(s) receive all the information that they need throughout the project?*

Hidden customers

- *Is there anyone else who has an interest in the project that don´t directly participate?*
- *Do you take these into consideration during the project somehow?*

## THEME 2 planning project quality

Planning quality management is the process of identifying quality requirements and the required standards for the project and its deliverables.

- What is quality?
- What customers and stakeholders need from the project

Quality management plan

- *Is a quality management plan made for each project?*

*- is it included in the Project charter or Project management plan?*

- *Are quality requirements identified for the project and its deliverables? (specifications/deadlines or budgets that needs to be met)*
- *Are these requirements measured?*
- *How are they measured?*

Risk and opportunity

- *Are risks and/or opportunities identified in the beginning of each project? (Special risk factors, probability/impact)*
- *Risk register? Where risks are analyzed, prioritized and responsibility assigned.*

*Examples: cost risk, schedule risk, performance risk*

- *Are response strategies made for risks and opportunities?*
- *Is risk management typically proactive or reactive in projects?*
- *Are opportunities exploited? Trying to increase the likelihood.*

## THEME 3 controlling project quality

Quality control is done by reviewing the project continuously throughout its life cycle and comparing the work results with the quality requirements to ensure the result is acceptable. It is the process of translating the quality management plan into executable quality activities.

- *Involves inspection of products/deliverables throughout the project. Is this done and how?*

- *Ad-hoc quality control is handling all problems that occur during the project. What are the most typical problems, and can they be avoided through planning?*
- *Are investigations/handling of nonconformities used in ad-hoc quality control?*
- *Acceptance tests and final inspections*
- *Defect reporting?*

## THEME 4 ensuring project quality

Quality assurance entails both assurance of a specific project´s quality as well as continuous improvement in quality as whole. Lessons learned should be carried out after every project to improve the company's project management practices. Tools for continuous improvement are for example documented lessons learned from a project, reports from project close out meetings and reports on non-quality costs (cost of poor quality).

quality assurance methods include kick-off meetings, audits, design reviews, checklists, training of project members etc.

Project kick-off meeting

- *Who usually attends the kick-off meetings?*
- *What is involved in a kick-off meeting (Statement of work, project scope, timetable deliverables)*
- *Tools of communication (streamlined? Shared documents etc.)*

Training of project team members

- Are project members trained/educated continuously for their tasks?
- PM qualifications?

Lessons learned and project closeout meeting

-What went right, wrong and what needs to be improved.

- Are lessons learned a part of the project closure process?
- Are reports made for lessons learned? What is included in these reports?
- Cost of poor quality documented?

**THEME 5 project success factors**

- What is a successful project?
- Describe the most critical success factors/what needs to be in place for a project to be successful?
- What is a failed project? Are failure criteria considered when planning a project or considering success factors?

**Do you have anything to add in terms of quality management perspective that has not yet been discussed?**

# APPENDIX 2 PROCESS DESCRIPTION FOR POWER NETWORK CONSTRUCTION PROJECTS