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Management and Development of DevOps and Traditional IT Project Paths

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<p>The objective of this thesis was to propose a way to manage and develop IT project paths that consist of both DevOps and Waterfall projects. To achieve this objective, this thesis aims to identify the key aspects for managing the IT project paths and build suitable proposal for the identified aspects.</p> <p>This thesis is based on interviews with the case company's ICT and business experts, the company's internal documents, benchmarking workshops with companies X and Y and industry best practices. Furthermore, the study is based on a structured approach starting with investigating the current state of the company's IT project management, then exploring available knowledge and best practices, and lastly building and validating the initial proposal.</p> <p>The key findings of this thesis revealed deficiencies and challenges in IT project prioritization, portfolio management and documentation. Moreover, roles and responsibilities for DevOps and Waterfall projects were found to be somewhat unclear to the personnel.</p> <p>The outcome of this thesis consists of three main proposals: a proposal for implementing the Two Project Paths Model, a proposal for managing the Two Project Paths Model and a proposal for developing the Two Project Paths Model. The proposal for managing the Two Project Paths Model includes propositions for a prioritization process, IT project portfolio and portfolio management, documentation and defined roles and responsibilities.</p>	
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<p>Tämän opinnäytetyön tavoitteena on esittää ehdotus kahden projektipolun (DevOps ja perinteinen vesiputous) hallintaan ja kehittämiseen. Opinnäytetyö pyrkii tunnistamaan IT-projektipolkujen kannalta oleelliset osa-alueet ja rakentamaan soveltuvan ehdotuksen tunnistetuille osa-alueille.</p> <p>Tämä opinnäytetyö perustuu yrityksen ICT:n ja liiketoiminnan asiantuntijoiden haastatteluihin, yrityksen sisäisiin dokumentteihin, vertailukehittämistyöpajoihin yhdessä yritysten X ja Y kanssa ja toimialan parhaisiin käytäntöihin. Tutkimus alkaa nykytila-analyysillä liittyen yrityksen IT-projektinhallintaan, minkä jälkeen käytettävissä olevaan teoriaan ja parhaisiin käytäntöihin tutustutaan. Näiden vaiheiden jälkeen ehdotus rakennetaan sekä validoidaan.</p> <p>Opinnäytetyössä tehdyt löydökset osoittavat, että IT-projektien priorisoinnissa, portfolion hallinnassa ja dokumentaatiossa on puutteita ja haasteita. Lisäksi roolit ja vastuut DevOps:ssa ja vesiputousprojekteissa ovat osittain epäselvät henkilöstölle.</p> <p>Tämän opinnäytetyön tuotos koostuu kolmesta osasta, jotka ovat ehdotus kahden projektipolun käyttöönottoon, ehdotus kahden projektipolun hallintaan ja ehdotus kahden projektipolun kehittämiseen. Ehdotus kahden projektipolun hallinnasta koostuu priorisointiprosessista, IT-projektiportfoliosta ja sen hallitsemisesta, dokumentaatiosta sekä määritellyistä rooleista ja vastuista.</p>	
Avainsanat	DevOps, ketterä, vesiputous

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List of Abbreviations

Agile	A flexible software development approach which advocates intensive and continuous teamwork.
APM	Agile Project Management. A project management model that utilizes the agile frameworks.
DevOps	Development and Operations. A set of combined practices from software development and IT operations.
RACI	Responsible, Accountable, Consulted and Informed. A responsibility assignment matrix which identifies the roles and responsibilities.
Waterfall	A sequential and straightforward process for delivering projects.

1 Introduction

Nowadays, the discussion of the new emerging technologies, such as Machine Learning, Internet of Things and Intelligent Process Automation, has spread out to every business and industry. These kinds of technologies offer new ways for companies to increase cost-effectiveness, innovativeness and reliability, but only if the implementation is carried out well. In addition, the digitalization within business processes increases the number of applications motivating to develop company's operations. In order to implement these technologies and develop operations, companies need to take an advantage of new type of project management methods, for instance agile project management.

Nevertheless, in some instances agile project management is not suitable for every project. Thus, some projects need to be delivered in ways that are more traditional, which leads to a new, particular situation. Therefore, the understanding of business' needs and ICT capabilities becomes considerably important, and coordination of these two project management models is desired.

1.1 Business Context

This study was carried out for Finland's transmission system operator called Fingrid. The company's responsibility is to plan and monitor the operation of the Finnish electricity transmission system and to maintain and develop the system. The transmission grid is connected to major power plants, industrial plants and regional electricity distribution networks, covering the entire country. (Fingrid delivers. Responsibly, Fingrid.)

The case company employs approximately 350 professionals, most of whom work at the headquarters in Helsinki. The yearly revenue of the company was around 850 million euros in 2018. (Fingrid Oyj toimintakertomus ja tilinpäätös, Fingrid.)

This study was conducted for the case company's ICT Business Services unit. The Unit is part of Information and Communication Technology (ICT) department and its main responsibilities are ICT project services, integration services and application services.

The ICT department employs approximately 40 experts, nine of whom work for ICT Business Services unit.

1.2 Business Challenge, Objective and Outcome

The case company seeks to improve its IT project management by dividing ICT project services into two categories: traditional IT projects and DevOps projects. For the case company, the DevOps model is an entirely new way of carrying out IT projects. Therefore, this new classification of ICT projects brings out many concepts that need to be considered when implementing a new project management model. Since the company is transitioning to a new project management model, to so called *Two Project Paths* model, organization culture and change management need to be taken into consideration. The company is pursuing to understand how the Project Paths should be observed in organization culture, and what type of changes need to be made.

The company is lacking information of what happens before, during and after transition. In addition, a comprehension of the biggest challenges in a new project management model and how to avoid difficulties are defective.

At the same time as this thesis was written, the company had an ongoing DevOps implementation project. Due to this, the focus of this study will be on understanding the full IT project management model and briefly covering DevOps and traditional IT projects. Furthermore, the roles and responsibilities are needed to be clarified for both DevOps projects and traditional projects.

The business challenge of this study lies thus in the management and usage of a new project management model. **The objective of this study is to propose a way to manage and develop IT project paths that consist of both DevOps and traditional models.**

The outcome of this thesis is a list of recommendations that should be considered when managing and developing two project paths. Since the company has a DevOps project in progress, it is crucial for this study to be completed on time in order to receive the maximum benefit.

1.3 Thesis Outline

The study was built in seven sections. The first section includes an introduction of the case company and the thesis itself. The second section gives an overview of the methods and materials used in the thesis. Analysis of the company's current way to carry out IT projects is discussed in section three. The thesis then continues with section four, introducing the conceptual framework and required literature of the study. Section five presents the conclusion of the thesis along with a description of how the proposal was built. In section six the proposal is validated, followed by the last section that consists of an evaluation of the project and a summary.

2 Method and Material

This chapter introduces the methods and materials utilized in this study. The section is divided into three components: research design, project plan and data collection and analysis. The purpose of the research design section is to explain how this study was carried out. The second part demonstrates the detailed planning and scheduling of the project. Lastly, the final part of this section discusses about the methods of data collection and analysis used to conduct this thesis.

2.1 Research Design

As seen in the diagram below, this thesis was carried out in 5 steps. The diagram presents the data sources that were used during this study, and the reached outcomes of each stage.



Figure 1. Research Design of the thesis

Figure 1 shows that the study starts by defining the objective for the identified business challenge. As determined earlier, the objective of this thesis is to *"Propose a way to Manage and Develop IT Project Paths that consist both DevOps and Traditional Models"*. After defining the objective, the thesis investigates the current state of the company's project management model. This phase includes exploring documents and materials provided by the company and having interviews with the internal professionals for Data 1.

After exploring the current state, the thesis carries on with the investigation of available knowledge and best practices. The focus was on the best practices of project management, covering Waterfall, Agile and DevOps methodologies. Based on the current state analysis, determined areas such as prioritization, portfolio management and documentation were investigated. In addition, the best practice for defining the roles and responsibilities of the Two Project Paths Model was explored. Lastly, the available knowledge of management and development of the Two Project Paths Model from the organization cultural point of view was investigated. The outcome of this step is conceptual framework.

The study then continues with proposal building phase, including benchmarking workshops with external professionals from companies Z and Y and with an internal ICT Expert (Data 2). The outcome of this phase is an initial proposal that is based on Data 1 and 2. The initial proposal was presented to ICT Business Services Head of Unit and ICT Expert, and based on the given feedback from the experts (Data 3), the changes were made and the proposal was validated. The outcome of this phase is the final proposal.

2.2 Project Plan and Schedule

This study was conducted as a Bachelor's Thesis by a student graduating from the study programme of Industrial Management at Helsinki Metropolia University of Applied Sciences. The study was carried out from the end of August 2019 until the beginning of December 2019. The detailed project plan shown in Figure 2, was created in order to deliver the proposal on time. However, finalization of the thesis was delayed by few weeks due to a large content.

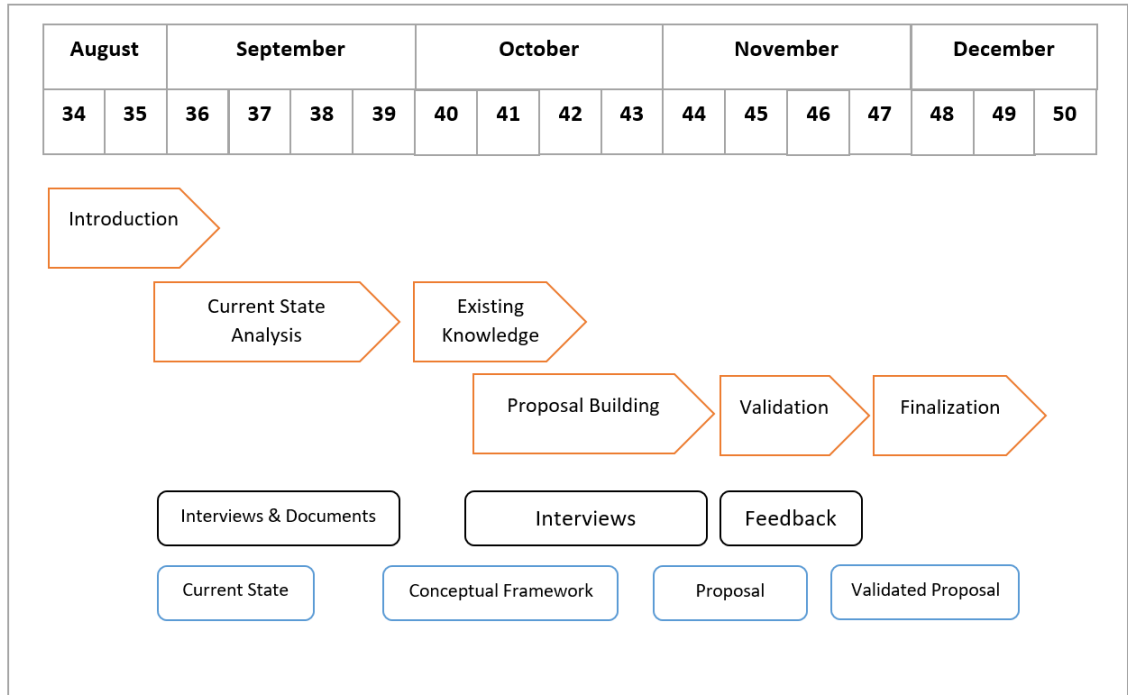


Figure 2. Timetable of the project

Figure 2 visualizes the weekly program of the project. As seen, the timetable contains three categories: thesis writing (orange), data collection (black) and proposal building (blue), which form the activities of the project.

2.3 Data Collection and Analysis

To assure the reliability of this study, the data used for this thesis was gathered from several sorts of data sources. As presented in the Table 1 and Table 2 below, the data was collected in three rounds: Data 1 for the Current State Analysis, Data 2 for Proposal Building and Data 3 for Validation.

Table 1. Details of interviews, workshops and discussions, in Data 1. (based on: Aittola 2015)

	Participants / Role	Data type	Topic, Description	Date, Length	Docu-mented as
Data 1, for the Current State Analysis					
1	ICT System Integration Expert	Face to face inter- view	IT projects, project management, develop- ment	Sep 11 1 hour	Field notes
2	ICT Planner	Face to face inter- view	IT projects, project management, develop- ment	Sep 12 1 hour	Field notes
3	Expert, ICT	Face to face inter- view	An ongoing DevOps project, objectives, benefits and chal- lenges	Sep 13 1 hour	Field notes
4	Chief Information Of- ficer	Face to face inter- view	Strengths, weaknesses and future outlook con- sidering IT projects	Sep 17 1 hour	Field notes
5	ICT Manager	Face to face inter- view	An ongoing DevOps project, objectives, benefits and chal- lenges	Sep 17 1 hour	Field notes
6	Senior Expert, ICT	Face to face inter- view	IT projects, project management, develop- ment	Sep 13 1 hour	Field notes
7	ICT Special Advisor, IPA	Face to face inter- view	IT projects, project management, develop- ment	Sep 19 1 hour	Field notes
8	Senior Vice President, Grid Services and Planning	Face to face inter- view	IT projects, project management, and de- velopment from the business point of view	Sep 19 1 hour	Field notes
9	Development Manager	Face to face inter- view	IT projects and project management from the business point of view	Sep 23 30 min	Field notes
10	Digitalization Manager, Asset Management	Face to face inter- view	IT projects and project management from the business point of view	Sep 23 30 min	Field notes
11	Development Manager	Face to face inter- view	IT projects and project management from the business point of view, ICT steering group	Sep 24 1 hour	Field notes
12	Manager, Energy Ac- counting Specialist, Energy Ac- counting	Face to face inter- view	Agile methodology	Sep 30 1 hour	Field notes

As seen in Table 1, Data 1 was used in the current state analysis. To obtain as wide understanding as possible of the company's current state, this data collection round included more interviews than the other rounds. Data 1 was gathered by interviewing the

company's professionals from ICT and Business departments. The interview questions were pre-defined and they are presented in appendix 1.

Table 2 below shows details of interviews and workshops for Data 2 and 3.

Table 2. Details of interviews, workshops and discussions, in Data 2-3. (*based on: Aittola 2015*)

	Participants / Role	Data type	Topic, Description	Date, Length	Docu-mented as
Data 2, for Proposal Building					
13	External DevOps Consultant, Expert, ICT	Face to face interview	An ongoing DevOps project	Sep 24 1 hour	Field notes
14	Company X, Head of Software Development	Benchmarking workshop	The DevOps journey of the Company X	Oct 25 2 hours	Field notes
15	Company Y, Head of Digital Solutions Development, Agile Program Manager, Lead Software Developer	Presentation	Presentation about DevOps and Agile given by the Company Y	Oct 30 2 hours	Field notes
Data 3, from Validation					
16	ICT Business Services Head of Unit, ICT Expert	Face to face meeting	Validation of the initial proposal and further improvements	Dec 4 1 hour	Field notes

Data collected from the second collection round was utilized in the proposal building phase. The round consisted of two benchmarking workshops with other companies and one workshop with an internal ICT expert. The purpose of these benchmarking workshops was to gather information how the DevOps and traditional IT project paths are utilized in different companies.

The last part of the data collection was Data 3, which was gathered to validate the built proposal. The proposal was presented in a meeting to the ICT Business Services Head of Unit and ICT Expert.

The detailed current state analysis of the case company's IT project management is introduced in the following chapter.

3 Current State Analysis

In this section, the findings from the current state analysis of IT project management and development are presented. The first part gives an overview of how the current state analysis was carried out. After this, implementation and management of IT projects, including project management, prioritization and portfolio management, project documentation and development, are introduced. The analysis then continues with demonstrating the roles in IT projects which is followed by a description of an ongoing DevOps project and its relation to project management. The last section of this chapter summarizes the strengths, weaknesses and future outlook of IT project management and development.

3.1 Overview of CSA Stage

In order to achieve a wide understanding of the company's current project management model, the current state analysis stage was conducted in three steps. As seen in Figure 3, the first step included internal interviews with professionals from ICT department. The interviews were face-to-face and arranged between the student writing this thesis and the appointed expert. One hour was reserved for each interview. The aim of these interviews was to understand what kind of IT projects the company deals with and how they are carried out from ICT point of view.



Figure 3. Overview of the Current State Analysis stage

As presented in Figure 3, the second step consisted of interviews with business professionals. These face-to-face meetings included experts from different business departments such as grid services and planning, energy accounting and asset management. Depending on the subject the interviews lasted from 30 minutes to one hour. The business department is an internal customer for ICT and therefore the interviews focused on gathering information about IT projects in general, e.g. the definition of a project, project ideas and so on. In addition, the information of how conceptions of IT projects differs in business departments compared to ICT department was obtained.

The last step included investigating the company's internal documents. The purpose of this step was to understand what the defined roles for IT projects are and how they are described.

3.2 Current Way to Carry Out and Manage IT Projects

According to the professionals interviewed, the case company has defined what a project is. However, some of the interviewees were not aware of where to find the definition of a project. During the meetings, professionals explained what a project is in their own words: *A project is one-off job that has a predefined beginning and an end date, a plan and a budget. In addition, the owner of the project is named, and this person is responsible for reporting to required personnel.*

Currently the company has one way to manage and deliver IT projects, waterfall model. In some cases agile methods have been used for carrying out IT projects but this is still rare and not standardized. Waterfall methodology is widely used in project management because it is systematic and easy to follow. The process includes several linear stages, and the previous stage needs to be completed before starting the next stage. (Waterfall Methodology in Project Management - Phases, Benefits, Medium)

3.2.1 The Definition of IT Project in the Case Company

The company delivers two types of IT projects, pure IT projects and IT associated projects. As seen in Figure 4, the definition of pure IT project is a project that includes experts only from ICT department and possibly service providers. The requirement for project comes from the ICT department, and these projects often cover updates for applications and softwares.

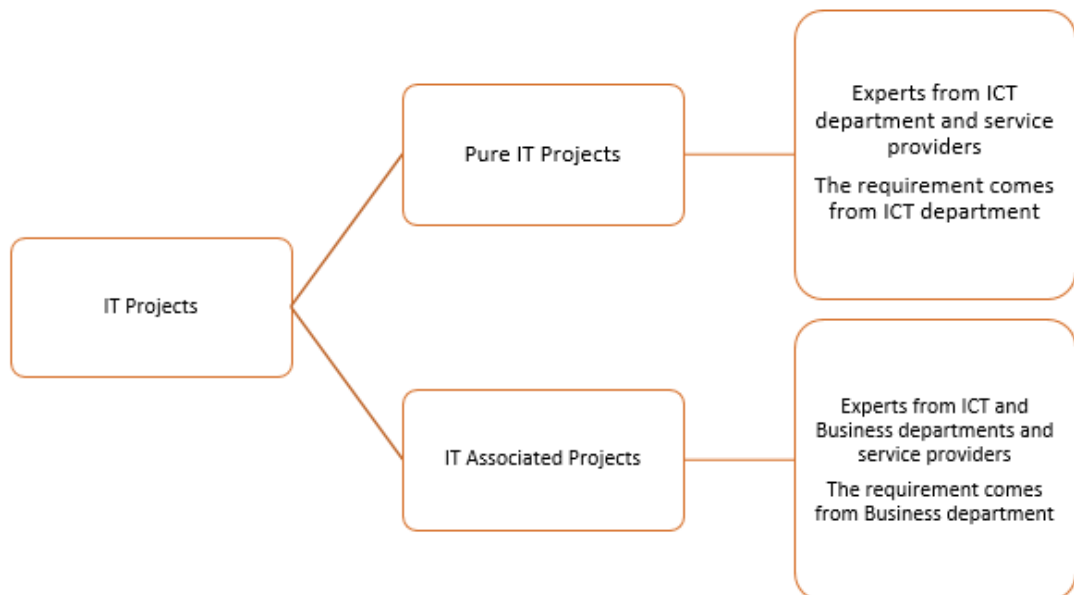


Figure 4. Definition of IT Projects

As shown in Figure 4, the requirements for IT associated projects are determined in business departments. IT associated projects are frequently initiated due to regulation changes or customers' demand. Therefore, the people working with these projects are from both business and ICT departments.

3.2.2 Project Management

As stated earlier, the company is developing its IT project management with a Two Project Paths Model. Figure 5 shows how the project paths divide IT project services into two categories, which are namely Traditional IT Projects and DevOps Projects. This section focuses on traditional IT projects, and DevOps Projects will be discussed in chapter 3.4.

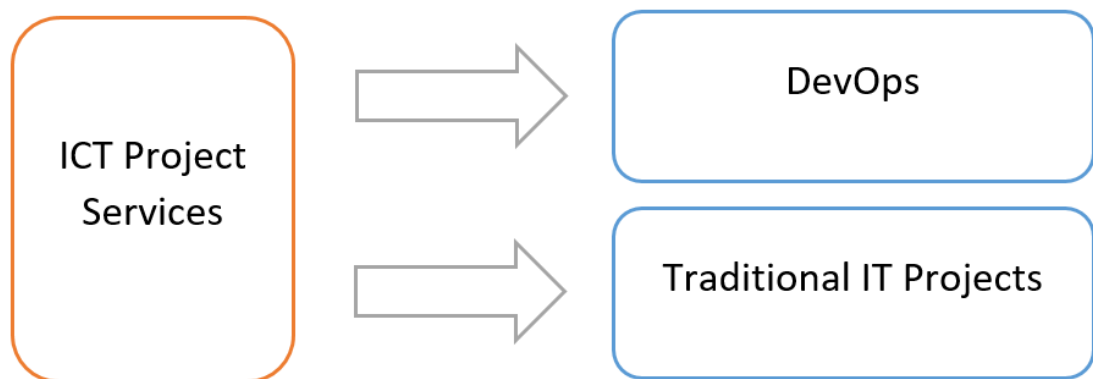


Figure 5. The Two Project Paths Model

As seen in Figure 5 above, IT projects can be carried out either through DevOps path or through traditional path. Recently, the amount of IT associated projects have increased significantly, and the demand for tailored solutions have multiplied. The ICT managers and experts of the case company have understood that in order to meet the business' needs and requirements in the future, the development of ICT project services is necessary. The whole industry is accessing to more digitalized operations, thereby a real-time data is putting pressure on improving company's digital services. Thus, the DevOps project was started. On the other hand, the professionals realized that not all of the IT projects can be delivered using DevOps, mainly because of the size of the project. Therefore, the ICT department decided to build the Two Project Paths Model.

According to the ICT experts, previously mentioned pure IT projects and IT associated projects can be executed through either of these paths. While writing this thesis, the DevOps project was in progress.

In the case company, projects are run by a project manager, who most of the time works for one of the business departments. The one, who is responsible for coordinating ICT's role and IT tasks, is called IT Lead. IT project roles are discussed further in chapter 3.3.

According to the business personnel, the idea for a project can come from various different sources e.g. from the daily need, a customer's demand, business' requirement, or due to a new technology.

Project implementation, schedule and resources are often agreed on a case-specific basis. Due to this, the project management methods within the company vary. Usually, projects start with a kick-off meeting, where the business department determines a schedule for the project. Needed resources for service providers are defined accurately, but regarding ICT personnel, this is rarely done. According to the ICT personnel interviewed, this is problematic in some instances, because the people working with projects are not aware of how much time do they have to spend with each project. This was expressed by many interviewees as follows: *Internal ICT resources are seldom defined, meaning it is difficult to plan one's own tasks and timetable.*

3.2.3 Project Prioritization and Portfolio Management

According to the professionals interviewed, projects are prioritized to key projects (earlier strategic projects) and to regular projects. Key projects are identified as strategic improvements and experts from different departments within the company carry out these projects. For regular projects, there is not an agreed way to prioritize projects, which tends to lead to a situation where the project that has gained the most attention will be executed.

The professionals pointed out that it would be beneficial to prioritize projects even more in the future. This would be helpful especially for the personnel who have many ongoing projects at the same time. In addition, prioritization might reduce simultaneous projects and perhaps decrease the duration of each project. The importance of prioritization was indicated as follows: *The prioritization would make it easier to see the most important projects and to focus on these projects.*

One way to prioritize projects is to manage the project portfolio. Project portfolio gives an overview of all projects including information about the project's status, resources, people involved, schedule, and budget. According to the experts interviewed, the project portfolio has been in use for a year, and in some projects, the portfolio is not updated often enough. Therefore, the portfolio is lacking information of for example the resources and budget.

3.2.4 Project Documentation

The interviews revealed that the project documentation within the company varies. This has been noticed especially in IT associated projects because those projects mix experts from many departments and everyone has their own way of documenting. Typically, the project manager is responsible for the general documentation and ICT expert is responsible for documenting the functionality of a service or an application.

Some experts pointed out that a defined documentation model would be useful in order to standardize practices. Experts suggested creating a commonly used template for project plans. By doing this, all the needed information would be included in a suitable format in the document.

3.2.5 Developing Project Management

According to the personnel interviewed, lessons learned workshops are rarely held. Experts emphasized that these kind of workshops would clearly close the projects, and pros and cons of each project would become visible. In addition, giving and receiving feedback would improve project management.

On the other hand, professionals pointed out that the company's atmosphere encourages developing one's own work. Managers support experts by giving them lots of responsibility and by organizing project management trainings. The experts are pleased that they can affect to one's own work and to company's operations.

3.3 IT Project Roles

As mentioned in section 3.2.2, the projects are managed by a project manager. Project manager is responsible for creating and managing a project plan and monitoring the progress. This person also takes care of the communication between the parties involved and defines the resources and budget. Lastly, project manager is responsible for the reporting and the documentation related to a project.

IT lead ensures that the current ICT project model will be used during the projects. The communication with a project manager and a supplier is under IT lead's responsibility. This person is also responsible for informing ICT personnel and ensuring that the ICT tasks are performed within the given time period. In collaboration with an application cooperator, IT lead is liable for an application to be cost effective and to meet the requirements. In addition, the management and coordination of a technical environment and the review of an application architecture are IT lead's tasks.

Application cooperator serves internal and possibly external customers with a customized usage of an application. This person is responsible for managing required changes and application's access rights. Updating documents, such as disaster recovery plan, are part of application cooperator's role. Application cooperator also ensures that the ICT personnel take part in an application's implementation in order to observe the architecture and IT security.

3.4 An Ongoing DevOps Project

At the time of writing this thesis (Autumn 2019), the case company consulted a DevOps expert in order to build a DevOps path. Consequently, the focus of this section is on understanding how the company sees DevOps now and in the future. Moreover, the desired benefits and the potential challenges will be looked into.

DevOps path is suitable for projects which are customized and rather small. As for the large, out-of-the-box solutions, such as ERP systems, the traditional path is better.

With the DevOps path, the ICT department expects to respond to the business' need for change faster and to deliver rapidly suitable solutions. The aim is to streamline the service in which the ICT department utilizes agile methodology to meet the business' needs. In addition, the project lead-time is expected to decrease. Lastly, closer cooperation between ICT and business departments is desired.

According to the ICT experts, the potential challenges lie in the DevOps path. It is quite clear, that the personnel is lacking information regarding which IT projects should utilize the DevOps path. Due to this, there is a possibility to block the entire DevOps path with IT projects that should be carried out through the traditional path.

3.5 Summary of CSA Stage

In order to obtain a reliable perception of IT project management, the experts from business and ICT departments were interviewed. The key findings gained from the interviews are presented as a matrix covering strengths, weaknesses and challenges in Figure 6 below. Lastly, the section discusses of the future outlook regarding the Two Project Paths Model.

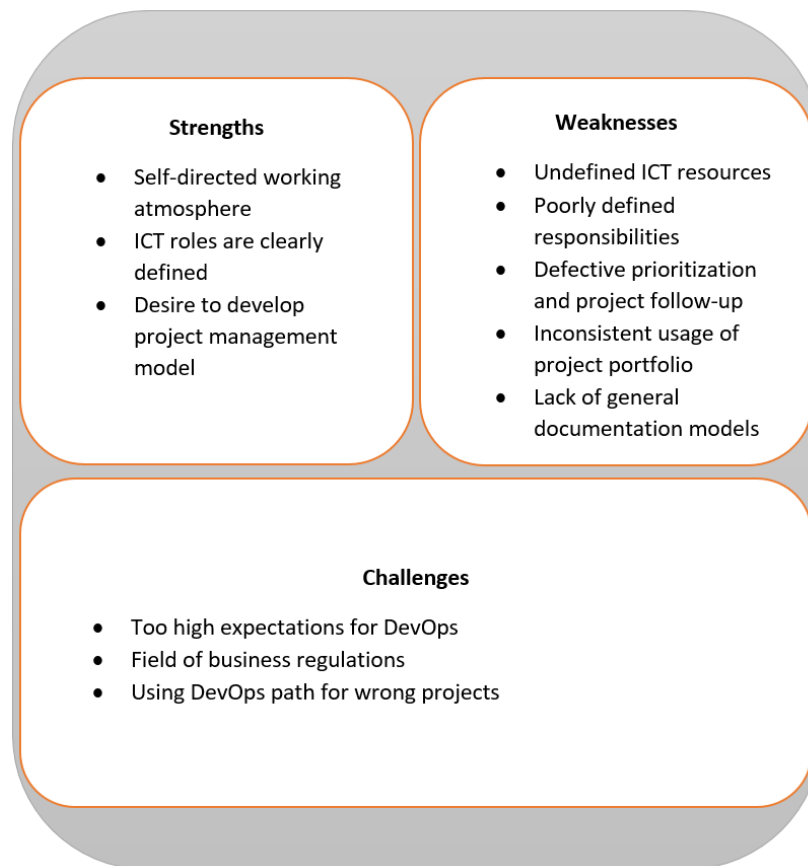


Figure 6. Strengths, Weaknesses and Challenges Matrix

Strengths

As seen in Figure 6, the strengths indicate that the ICT roles are defined and described properly. ICT roles consist of IT lead and Application coordinator, being commonly known within the ICT personnel. On the other hand, the lack of defining responsibilities is seen as a weakness and will be discussed later.

The personnel interviewed pointed out a noticeable change in the project management model. Nowadays, project managers take advantage of agile methodology in project management, and the ambition of developing the IT project management can be seen. Agile methodology enables to separate projects into sprints which leads to a more flexible and user-friendly outcome. The aim is to deliver projects that fulfill expectations and reduce project lead-time.

The new project portfolio is seen as a strength, but only if it is used correctly. According to ICT experts, the portfolio has worked in a desired manner for projects where the business personnel has not been involved.

The case company underlines one's self-direction in everyday work. The purpose of self-directed work is to entrust responsibility for the personnel who are experts in specific fields. Due to this, the innovativeness increases but the goal setting might be defective.

Weaknesses

The identified weaknesses lie within the lack of defining the ICT resources. According to the personnel interviewed, when the IT projects start the ICT resources are not defined and therefore, the ICT experts are not aware of the time they need for the project. The determined ICT resources would remove negative impacts, such as delays or budget exceeding in projects.

The interviews revealed that the ICT resources are a bottleneck for several projects. A possible reason for this might be the number of IT projects. According to both business and ICT personnel, the number of ongoing IT projects is too massive and therefore the duration of each project is too long. In addition, if the ICT experts are too busy at the moment, the courage to reject projects is lacking. Moreover, some projects do not bring value to the company and should not be started.

According to both business and ICT personnel, the roles are defined but sometimes the responsibilities are not clear. The experts interviewed from the business departments desire that the IT lead would take a greater ownership of the project. Poorly defined responsibilities also applies to continuous service and support, because the business personnel often think that IT lead is responsible for it.

The defective prioritization and project follow-up is seen as a weakness in the current project management model. Currently, the prioritization is not on the needed level, which leads to an unwanted situation regarding the number of projects in progress. The lack of project follow-up indicates that there is a shortage of records regarding ongoing projects, budgets and resources.

Moreover, the usage of project portfolio is defective. Interviews revealed that project transparency is rather small, however updating project portfolio regularly would solve this.

Lastly, the interviews revealed the lack of general documentation models. According to the professionals it would be beneficial to determine general documentation models for IT projects.

Challenges

The challenges that came up in the interviews consist of three factors: too high expectations regarding DevOps, specific business field regulations and using DevOps path for wrong projects. High expectations for DevOps can occur from both ICT and internal customer's side, meaning it is possible that the internal customers expect faster and better solutions. A potential expectation regarding ICT lies within the usage of DevOps, in other words DevOps is perhaps seen as a decisive answer to everything.

Since the field of business where the company operates is regulated by different parties, the chance to use new models and technologies might not always be possible.

The last challenge is the usage of DevOps for wrong projects, implicating that those projects should be carried out through the traditional IT projects path. As mentioned earlier, putting Waterfall projects to the DevOps path might block the entire DevOps path.

Future Outlook

According to the ICT professionals interviewed, more and more projects will utilize DevOps path in the future. Experts' opinions differ whether DevOps path could replace the traditional path. Some experts think that it is impossible to replace it entirely, but others think this might be possible in the next few years. Nevertheless, it is certain that the agile methodology will become commonly used around the company.

In section 5, the thesis concentrates on building a proposal based on the identified strengths, weaknesses, challenges and future outlook and on the best practices presented next in section 4. The aim is to create a list of recommendations regarding the Two Project Paths Model.

4 Best Practice and Available Knowledge of the Two Project Paths Model

This chapter discusses best practices and relevant theories regarding the Two Project Paths Model. The section aims to produce relevant knowledge about selected topics related to identified weaknesses, challenges and future outlook in the current state analysis. The topics covered in this chapter are change management, project management models including Agile and Waterfall models, DevOps, IT project portfolio management and prioritization, roles and responsibilities and documentation. In order to build a reliable literature study, several different sources were investigated.

4.1 Overview of Chapter 4

The purpose of this subsection is to present logically how chapter 4 was built. Figure 7 visualizes the topic areas and their relations that are discussed in this chapter.

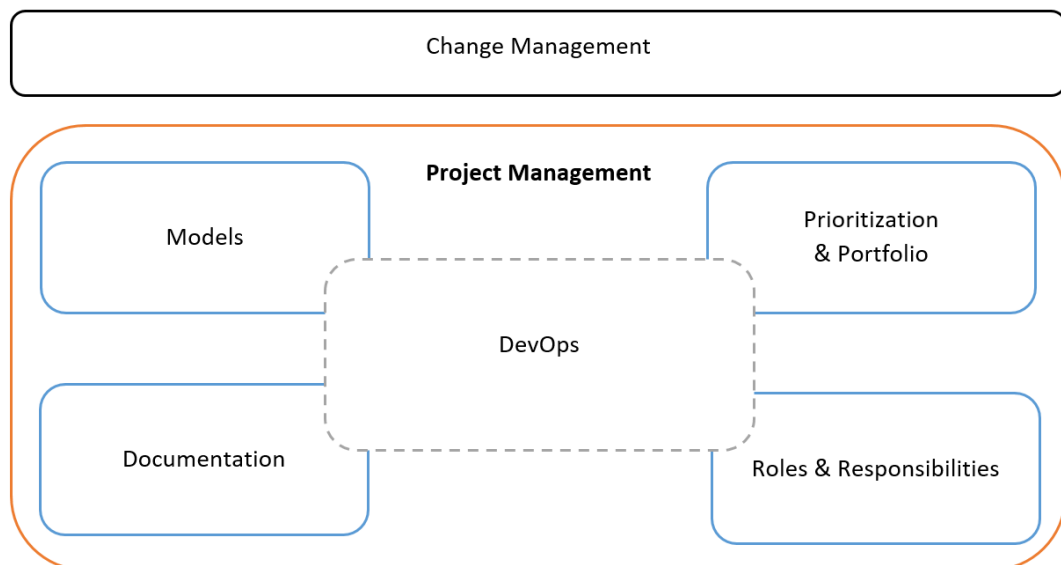


Figure 7. Overview of chapter 4

As shown in Figure 7, project management contains four components: models, prioritization and portfolio, roles and responsibilities and documentation. All of these components are affected by DevOps and therefore, a closer investigation of each component

is required. In addition, DevOps will be introduced and the comparison of the documentation and roles and responsibilities of the Waterfall, Agile and DevOps will be reviewed. Since, the DevOps is a cultural change, it is not comparable to Waterfall and Agile models. Therefore, DevOps is illustrated in the middle of Figure 7.

Change management is known to be an enabler of the change to be successfully implemented. Figure 7 shows that change management covers the entire project management area, due to the fact that the change affects to each project management component. The thesis firstly discusses about change management due to its importance in implementing a cultural change.

4.2 Change Management

Change management as a term is rather wide. Change management ensures that the changes are carefully implemented and the desired advantages are accomplished. The type of a change varies from a simple process change, to a major change in organization's strategy. Regardless of the type, the change affects the whole organization and the employees involved. (Change Management, MindTools.) There are numerous reasons that push organizations to change, e.g. people, technology, competition, communication, information processing and social trends. The aim of change management is to provide understanding of why and how change happens and what needs to be done for the change to be positively accepted among the organization. (Murthy 2007: 5, 22).

10 Steps to Successful Change Management written by George Vukotich (2011), divides change management in to 10 stages:

1. Understand Change
2. Assess the Impact of Change
3. Assemble a Change Management Team
4. Build a Vision for Change
5. Put a Change Strategy in Place
6. Win Support
7. Communicate Effectively
8. Overcome Challenges

9. Measure Success
10. Review Lessons Learned

The 10 steps are discussed and described below.

Understand Change

A change can be either continuous or discontinuous. A continuous change refers to an adjustment within a system or a process that is currently in use in the organization. This type of an adjustment does not require a major change in the system or the process and usually employees' reactions to change are positive. In discontinuous change, business, processes and people are changed significantly. Major changes often create both negative and positive emotions, such as excitement towards the new opportunities as well as frustration or fear to a new situation. (Vukotich 2011).

In order to understand change, the following things should be considered and identified:

- Reasons behind the change initiative
- The effects of change to organization's current operations
- Other alternatives, and the opportunities and consequences related to them
- Clearly determined goals for change initiative
- The roles, risks and rewards related to change are defined and understood
- Ways to communicate and inform about the change (Vukotich 2011).

Assess the Impact of Change

Evaluating and determining the impact of an organizational change is an important step of change management. This step enables to identify existing opportunities and potential threats. If the assessment is carried out, organization has the knowledge and information to deal with the change. (Vukotich 2011).

Organizations should be aware of the reasons that are driving the change. As discussed earlier, there are multiple reasons that push organizations to change, such as technology or competition. Furthermore, an important part of the impact of the change assessment

step is to understand the problems that occur. To gain the deepest knowledge of the issue, organizations should address the root cause of the problem. After identifying the root cause of a problem, the following step is to determine the internal factors, e.g. lack of money, lack of quality, lack of staff, lack of skills, lack of or incorrect technology. One of these factors may be the root cause of a problem and therefore it is worthwhile to recognize techniques to manage each factor. (Vukotich 2011).

In order to change to be implemented smoothly, the organization's readiness for change should be reviewed. This phase focuses especially on the individuals' motivation for making the change possible in the organization, and enables companies to understand how the individuals see the upcoming change. (Vukotich 2011).

Assemble a Change Management Team

The third step of successful change management process is to assemble a change management team. In order to put the team together, a few steps should be followed. The first step focuses on reviewing what sorts of goals the company is aiming to accomplish with the change. In the second step, these identified goals are analyzed and the needed tasks in order to achieve each of the goals are determined. After this, the third step evaluates the tasks and focuses on categorizing them to specific areas. This is followed by organizing meetings with the managers from the areas identified in step three. The meetings aim to provide information regarding the identified tasks that need to be carried out to achieve the change goals. The last step of assembling a change management team is to define how many and what type of individuals are required on the team. (Vukotich 2011).

Build a Vision for Change

The fourth step of successful change management is to build a vision for change. Vision for change enables organizations to understand how to handle surrounding changes. Creating a vision for change can be divided in to three stages: pre change, change and post change. Pre change accounts for the reasons behind the change and the expected

accomplishments. Change process focuses on informing the individuals who are affected by the change. Lastly, the post change stage ensures that questions and issues are covered and the new way of operating is understood. (Vukotich 2011).

Put a Change Strategy in Place

A change strategy combines the previous steps and addresses what the change will do for the organization with the limits of available resources. A comprehensive change strategy covers few key points: the organization's current abilities, the environment that organization functions in, alternatives, available resources, the future of the organization and the end results. Knowing these components enables companies to avoid and minimize issues. In addition to these components, the policies, rules and procedures related to the organization should be considered when putting a change strategy in place. (Vukotich 2011).

Win Support

The sixth step focuses on winning the support within the individuals involved. The step starts with defining the stakeholders and placing them into determined categories: supporters, detractors and undecided. Supporters are individuals and groups who approve the change and possibly encourage others to accept the change. Detractors are both individuals and groups who openly disapproves the change or the way it is being achieved. The last group, undecided, are individuals or groups without an opinion of the change. These people might also wait to receive more information about the change before making a decision. Identifying the levels of support and resistance is an important part of change management since it helps to create a strategy to affect or leverage each group. (Vukotich 2011).

Communicate Effectively

Communication is seen as a factor that can affect either positively or negatively to the success of a change initiative. Therefore, a successful change management includes

creating an overall communication strategy, which is based on the motivation and objectives behind the change initiative. In addition, all the significant stakeholders should be included. (Vukotich 2011).

Overcome Challenges

The eighth step focuses on overcoming the challenges related to the change. Often, the challenges relate to the people, nevertheless, they can occur in several different ways and from numerous different sources. A common challenge in change initiative is the change resistance. Organizations can address change resistance by going through the motivations and expected outcomes regarding the change with the people involved. Additionally, a two-way communication and consideration of potential challenges and creating a plan to handle them, can eliminate the risk of resistance. (Vukotich 2011).

Measure Success

A successful change management process measures and evaluates the success and the outcomes of the change initiative. Measurement for example allows to notify the level of progress, keeps the stakeholders informed, produces the return on investment for investors and enables to make adjustments or modifications to the plan. The following areas can be considered in measurement step: budget, other financials, time, people, recognition, quality, functionality, resources and competition. All of these areas can be measured in several different ways, thus the measurement system should provide relevant information for the organization in question. (Vukotich 2011).

Review Lessons Learned

The last step of successful change management is to review the lessons learned during a change process. The areas that should be covered during this step are process, technology, people as in employees and customers, competition and other possible areas that came up. (Vukotich 2011).

The 10 steps introduced above enable organizations to understand the critical phases in the change process, in this case the change in IT project paths. Therefore, the following

section discusses of project management methodologies which are used in the Two Project Paths Model.

4.3 Project Management Methodologies

Projects are challenging one-off jobs that combine experts and professionals from different departments as well as subcontractors and suppliers. Due to this, the need for project management methodologies have developed and generally approved methods have been created. Project management methodologies are commonly used techniques that provide information and guidance in project management. The most utilized methodologies are Waterfall, Agile, Critical Path Method, Six Sigma and Kanban. The thesis focuses on the Waterfall and Agile methodologies and considers how DevOps is linked to these methods. (Agendum, n.d.).

4.3.1 Waterfall

The Waterfall methodology is a straightforward project management model, which is utilized in various different industries. In this method, the goals and schedule are set at the beginning of the project and the phases are completed in a linear order. A previous phase needs to be fully completed in order to be able to move to the next phase. (ProjectManager, n.d.) As seen in Figure 8, the Waterfall model includes five phases that are: requirements, design, implementation, verification and maintenance. Occasionally, the model consists of six to seven phases, and the phase names might vary.

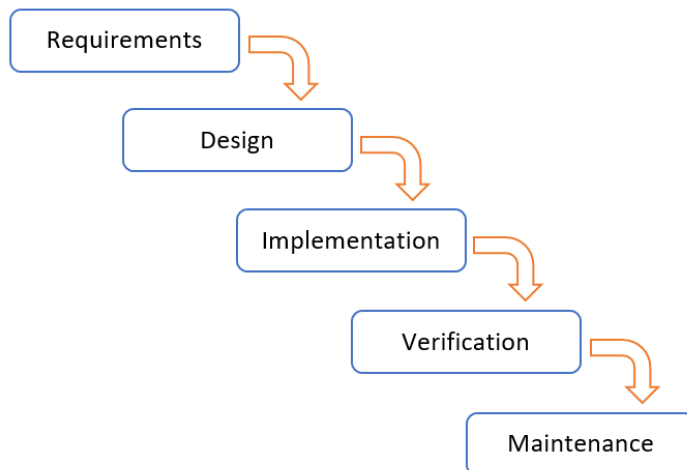


Figure 8. The phases of Waterfall Methodology

The first phase gathers customer's requirements and demands. The design phase includes two sub phases: logical and physical design. The logical design focuses on brainstorming and theorizing possible solutions and the physical design concretizes these theoretical ideas into specifications. The third phase, implementation, consists of building and creating the end product, i.e. the code for software, from the requirements and specifications from the previous steps. This is followed by a verification phase, in which the customer accepts or declines the product whether the product meets the defined requirements. Last phase of the Waterfall model is the maintenance. In this step, the customer uses and tests the product in order to discover errors, failures and bugs and the production team fixes and modifies these errors until the customer is satisfied. (ProjectManager, n.d.).

Table 3 below presents the advantages and disadvantages of Waterfall methodology.

Table 3. Advantages and Disadvantages of Waterfall model

Advantages	Disadvantages
Planning and scheduling are simple and clear	A linear project plan is inflexible
Accurate estimate of the project cost, resources and deadlines	Possibly, all of the customer's requirements are not defined at the beginning of the project
Easy to measure progress	Customer's dissatisfaction at the end of the project
New requirements are not added during the project	

As seen in Table 3, in the Waterfall model the requirements and needs are agreed in the first phase, therefore creating a plan and schedule for the project are clear and simple. Thanks to this, giving an accurate estimate for project cost, resources and deadlines is straightforward. In addition, progress measurement is easy as the project is carried out through the phases. The last advantage is that the customers are not able to add new requirements to the project. (ProjectManager, n.d.).

The disadvantages of the Waterfall model consist of three points. The Waterfall methodology is seen as a rigid and an inflexible in consequence of its linear project management approach. In addition, customers might forget some of their requirements in the first phase. Lastly, the customer might be dissatisfied with the product at the end of the project and therefore, the costs can increase. (ProjectManager, n.d.).

The following section introduces Agile due to its popularity in project management. Moreover, DevOps culture utilizes practices from Agile.

4.3.2 Agile

Fundamentally, Agile can be determined in two ways. Agile as its original meaning, is a flexible iterated **software development approach** where the key of the success is an intensive and a continuous teamwork between the team and the stakeholders in order to

make the right decisions. The aim is to deliver a higher-quality software faster and easier compared to the traditional models. On the other hand, Agile is a **project management model**, meaning Agile frameworks are used for managing a project. (DZone, n.d.).

Agile Project Management's roots are in the four values and twelve principles introduced in *Manifesto for Agile Software Development*. The manifesto was produced by 17 innovators who aimed to improve software development by making the software industry more productive, approachable and sustainable. The difference between the traditional project management models and the Agile Manifesto occurs in the core fundamentals. The traditional models underline rigid planning and hierarchal-based management that avoids change and documents everything, while the Manifesto emphasizes people, communications, the product and flexibility. (Layton 2012).

The four values of the Agile Manifesto are as follows:

- i. Individuals and interactions over processes and tools
- ii. Working software over comprehensive documentation
- iii. Customer collaboration over contract negotiation
- iv. Responding to change over following a plan

The twelve principles of the Agile Manifesto are as follows:

- i. Our highest priority is to satisfy the customer through early and continuous delivery of valuable software.
- ii. Welcome changing requirements, even late in development. Agile processes harness change for the customer's competitive advantage.
- iii. Deliver working software frequently, from a couple of weeks to a couple of months, with a preference to the shorter timescale.
- iv. Business people and developers must work together daily throughout the project.

- v. Build projects around motivated individuals. Give them the environment and support they need, and trust them to get the job done.
- vi. The most efficient and effective method of conveying information to and within a development team is face-to-face conversation.
- vii. Working software is the primary measure of progress.
- viii. Agile processes promote sustainable development. The sponsors, developers, and users should be able to maintain a constant pace indefinitely.
- ix. Continuous attention to technical excellence and good design enhances agility.
- x. Simplicity — the art of maximizing the amount of work not done — is essential.
- xi. The best architectures, requirements, and designs emerge from self-organizing teams.
- xii. At regular intervals, the team reflects on how to become more effective, then tunes and adjusts its behavior accordingly.

These values and principles were originally created for software development, however they have been modified in order to fit to APM. In APM the project is completed in short sections, called iterations. As seen in Figure 9, the APM process is a continuous, cyclical approach that starts from the requirements moving to a design phase and ends with deployment. These iterations typically lasts two to four weeks. (Pinkelephant, n.d.).

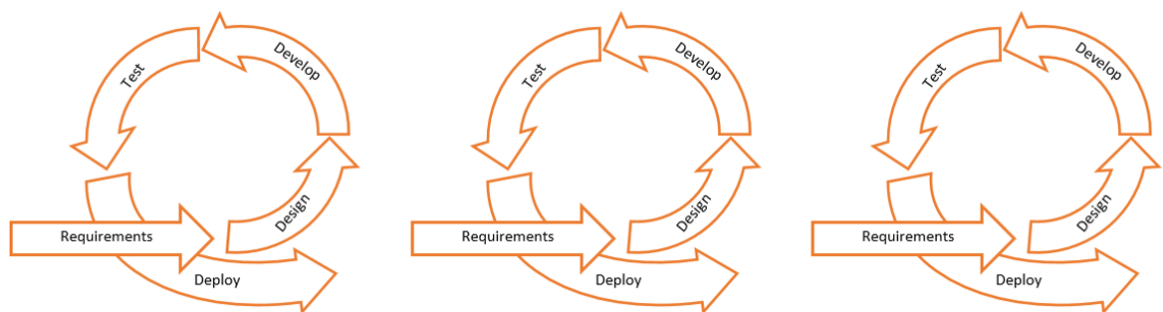


Figure 9. The iterations of Agile Project Management

As seen in Figure 9, every iteration has five steps: requirements, design, develop, test and deploy. Due to this, APM enables customer engagement and provides visibility and transparency of the project. Additionally, if the customer wants to change or add requirements, making changes to the product/service is easy. (Pinkelephant, n.d.).

Table 4 presents the advantages and disadvantages of Agile Project Management model.

Table 4. The Advantages and Disadvantages of Agile model

Advantages	Disadvantages
Empowers people	The lack of understanding the bigger picture
Allows decisions to be tested and rejected early	Resource cost can be high
Helps to deliver change when requirements are uncertain	A risk of losing the benefits due to the focusing on wrong things

As seen in Table 4, the advantages consist of three points. Agile model empowers people because it builds accountability, encourages diversity of ideas, allows the early release of benefits and promotes continuous improvement. Compared to the Waterfall model, Agile allows testing and rejecting decisions early with feedback loops. Lastly, Agile model enables to deliver change even though the requirements are not determined. This is because Agile builds customer engagement by focusing on the most beneficial improvements. (Association for Project Management, n.d.).

The disadvantages covers three topics. Firstly, since the Agile model focuses on iterations, the lack of understanding the whole picture increases leading to an uncertainty among the stakeholders. In addition, resource costs may increase due to the changes in teams' co-locating and needed investments in infrastructure. The third disadvantage is the possibility to lose the charge from the empowered end-user to the empowered project team. Thus, the project team may focus on the wrong things and therefore the benefits might be lost. (Association for Project Management, n.d.).

One of the most used agile framework is Scrum which aims to respond to change fast. Scrum splits the project into phases, referred as *sprints* which last two to four weeks. Such as Agile, Scrum was originally created for software development, but nowadays it is commonly used in all kinds of teamwork and projects. (Atlassian, n.d.).

At the time of writing this thesis, the case company was building the DevOps path. The DevOps path would be a combination of Agile and DevOps practices. Thus, the following section discusses of DevOps.

4.4 DevOps

DevOps, an acronym derived from development and operations, does not have an official definition and therefore, it can be determined in a few different ways. Davis et al. (2016) define DevOps as follows:

"DevOps is a cultural movement that changes how individuals think about their work, values the diversity of work done, supports intentional processes that accelerate the rate by which businesses realize value, and measures the effect of social and technical change. It is a way of thinking and a way of working that enables individuals and organizations to develop and maintain sustainable work practices. It is a cultural framework for sharing stories and developing empathy, enabling people and teams to practice their crafts in effective and lasting ways."

Atlassian defines DevOps as:

"DevOps is a set of practices that automates the processes between software development and IT teams, in order that they can build, test, and release software faster and more reliably."

DevOps is not a tool or a framework, it is an approach to change the culture of an organization. However, the DevOps tools can be utilized in order to make the process efficient and allowing teams to work effectively. (Medium, n.d.) Figure 10 illustrates the unified development and operations environments.

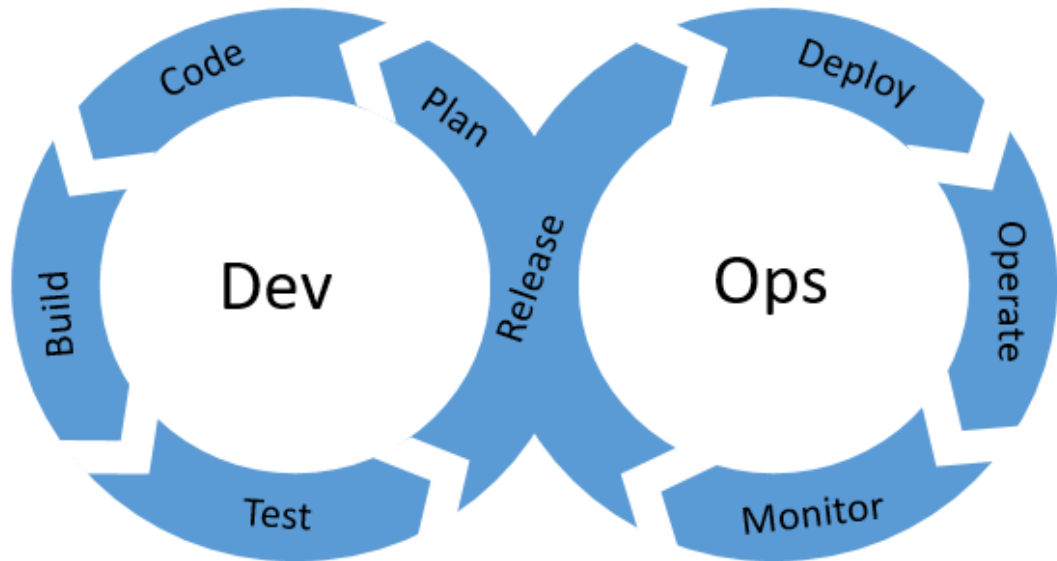


Figure 10. The DevOps process

As seen in Figure 10, DevOps enables better collaboration and tighter integration between the development and operations. It combines and takes advantage of agile, continuous delivery, continuous integration and automation, and consequently helps development and operations teams to efficiency, innovativeness and deliver greater value to businesses and customers. (Atlassian, n.d.) Continuous integration aims to detect and address errors and failures faster, improve software quality and shorten the validation and release phases of new software updates. Continuous delivery refers to a software development practice in which the focus is on preparing code changes to a testing or production environment. (Medium, n.d.).

As seen in Table 5 below, the key benefits of DevOps are speed, quick delivery, reliability, culture and improved security. DevOps enables organizations to innovate, respond to customers' changing needs faster and efficiently reach the business results. Due to the continuous integration and delivery, the release cycle has become shorten. As a result of the continuous integration and continuous delivery and monitoring practices, DevOps enables organizations to become more reliable. In addition, DevOps focuses on

building more effective and more collaborated teams, who understand their accountability and take ownership of the work. Lastly, security is more effectively controlled due to the usage of infrastructure as code and policy as code. (Medium, n.d.).

Table 5. Benefits and Challenges of DevOps

Benefits	Challenges
Speed	Dev vs. Ops attitude
Quick delivery	Conflict of Dev and Ops toolset
Reliability	
Culture	
Improved security	

The challenges presented in Table 4 discuss cultural issues related to DevOps. The common perspective of development and operations teams working separately created different ways of thinking and acting. Developers focused on innovating and making rapid changes while operations team was trying to maintain high service levels. In order to DevOps to work in an organization, integration between these two teams is desired. In addition, both teams have different toolsets due to diverse objectives and measuring, therefore collaboration and integration of the tools are required. (Medium n.d.).

As discussed in the current state analysis, the identified weaknesses contained points of IT project portfolio management and prioritization. Therefore, the next section discusses about the best practices of IT project portfolio management and prioritization.

4.5 IT Project Portfolio Management and Prioritization

Project Portfolio Management (PPM) is a project selection process in which the resource allocation and project portfolio are managed and overseen. PPM provides a perspective for managing project types and risks, aligning projects with strategy and assuring that resource capabilities are compatible with the project portfolio. The goal of PPM is to allocate resources more effectively in order to improve the success of organizational projects. Additionally, the objective is to monitor and modify the project portfolio and re-

sources allocations when needed. (Hunt et al. 2008: 5.) IT projects differ from other projects since the objectives are not as clear as in non-IT projects. In addition, the expected outcomes vary due to the fact that IT-projects are designed to satisfy business unit needs rather than increase profits. Therefore, the IT project portfolio management covers slightly different subjects than the project portfolio management. (Bonham 2005).

In IT PPM, the size of the project portfolio is limited by the resource balancing. For prioritizing the projects, three criteria should be utilized. The first criterion is maximization, referring to a situation in which the project maximizes its value by meeting or exceeding the stakeholders' expectations. In order to show the maximum value, measurement methods should be carefully chosen. The measurement results are likely to be successful if the project metrics are minimized in scope, used effectively and released carefully. The metrics should provide small but proper reports in order to keep the ongoing project momentum. Releasing carefully refers to introducing metrics in phases in order to project managers to adjust and embrace measurement methods. The second criterion is the strategic alignment, meaning that the goals of the corporate strategy are advanced by the IT projects. The last criterion discusses of the portfolio balance. The objective is to create and manage the balanced portfolio by determining organization's requirements and capabilities and later on enabling organization to pick the suitable projects. To balance the portfolio, IT projects should be separated in to projects that improve the efficiency and to projects that support the change in business strategy. Subsequently, the projects in improve the efficiency category can be split in to three sub-categories: utilities, incremental upgrades and strategic investments. (Bonham 2005: 16-19, 205, 211).

4.6 Roles and Responsibilities in Waterfall, Agile and DevOps

As a result of building the Two Project Paths Model, the roles and responsibilities are required to be discussed and clarified. As reviewed in section 4.3, Waterfall and Agile methods vary and therefore, the roles descriptions for both of them will be looked into. In addition, the implementation of DevOps culture brings out new roles which are discussed in this section.

4.6.1 Roles and Responsibilities in Waterfall Model

As introduced in section 4.3.1, the Waterfall model consists of five phases: requirements, design, implementation, verification and maintenance. Each of these phases require different people with different knowledge including roles such as project manager, business analyst, systems analyst, systems analyst, technical architect, developer, tester and helpdesk and support. (Linkedin, n.d.).

Starting from the customer requirements, often the business analyst is responsible for understanding customer's needs. As shown in Figure 11, the business analyst focuses on speaking to the customer or user and documents the findings and requirements in a document referred to the *user requirements documents* (URD). All the requirements for the end product will be listed in the URD. Next, the systems analyst creates a technical functional specification in order to define the problem from a technical aspect. (Linkedin, n.d.).

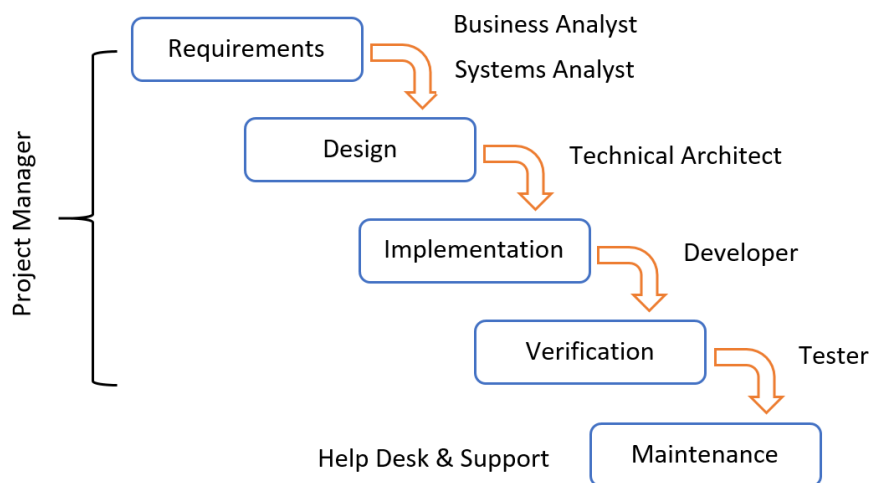


Figure 11. The roles in the Waterfall model

As seen in Figure 11, the technical architect is responsible for the design phase. Technical architect considers the technologies that can be utilized to build the product and strives to create the most cost effective solutions for the issue. In the implementation phase, the product is built by the developers. Developers are classified into three groups:

front-end developers, back-end developers and database developers. Front-end developers are responsible for the look, feel and user-friendliness of the product. Back-end developers focus on building the business logic behind the product and database developers manage the data. After the implementation phase, the testers test and verify the product. (Linkedin, n.d.).

Figure 11 shows that the project manager is involved in almost every phase of the project. The main tasks of the project manager are monitoring the costs, time and human resources. Project manager ensures that the tasks and roles are clear to everyone to complete the project on time. Lastly, the help desk and support is responsible for the maintenance. Generally, IT support is separated into three levels, first level, second level and third level support. (Linkedin, n.d.).

4.6.2 Roles and Responsibilities in Agile Model

As discussed in section 4.3.2, the most utilized agile method is Scrum, and therefore the roles and responsibilities of Scrum are introduced. The Scrum team is comprised of scrum master, product owner and development team. The responsibilities of the scrum master consist of ensuring that everything function smoothly and the project is completed successfully. Scrum master for instance, assists the product owner to define value, pushes the development team to accomplish the value and supports the scrum team to evolve. Four aspects can be seen as scrum master's main themes: transparency, empiricism, self-organization and values. Transparency refers to a stage where the stakeholders are able to observe the project status. The scrum master ensures that the team is working transparently. Empiricism refers to a procedure that begins with doing the work and then learning from it. The process might be difficult and therefore, the scrum master needs to encourage the team to divide the work and describe and review the outcomes. By self-organization, the team makes an effort to step out of their comfort zone and try different things. Often, self-organization does not happen without the help of scrum master. The last aspect of the scrum master's main themes is the values. Five values are defined in the scum method: courage, focus, commitment, respect and openness. The scrum master encourages and reminds of the importance of those five values. (Atlassian, n.d.).

The product owner is responsible for expressing the customer's requirements and ensuring that the highest value is delivered. Understanding the value that the scrum team is delivering to the customer is important for the product owner. In addition, balancing the requirements of other stakeholders in the organization is seen as relevant work of the product owner. The most important responsibility of the product owner is to collect all of these inputs and prioritize the tasks. Three responsibility aspects of the product owner are: managing the scrum backlog, release management and stakeholder management. The scrum backlog management refers to a product owner's awareness of everything that is in the backlog and that the communication about the backlog is effective. Responsibility of the release management means that the product owner is aware of the best timing for release. Stakeholder management covers the work and communication between all the stakeholders, such as users, customers and leadership involved. (Atlassian, n.d.).

Lastly, the development team refers to the actual people that build the product. The development team can include designers, programmers, writers and so forth. The team is responsible for carrying out the product by the sprints and ensuring the transparency during the project. In order to get the work done, the development team should self-organize. (Atlassian, n.d.).

4.6.3 Roles and Responsibilities in DevOps

The DevOps culture emphasizes the collaboration between the development and operations. Therefore, the roles and responsibilities for DevOps are needed to be explored and defined. The six key roles are listed below:

- The DevOps Evangelist
- The Release Manager
- The Automation Architect
- The Software Developer/Tester
- The Experience Assurance Professional

- The Security Engineer

The DevOps evangelist is seen as the leader for implementing the DevOps culture. This person is responsible for encouraging the organization to take advantage of DevOps. The DevOps evangelist focuses on addressing the challenges between the development and operations teams. The release manager is responsible for managing and coordinating the product during the entire DevOps cycle. The automation architect is seen as one of the most important roles in DevOps culture. This person is responsible for continuous deployments by analyzing, designing and implementing strategies for automation. The software developer/tester's responsibilities include coding, unit testing, deployment and ongoing monitoring. The experience assurance professional is responsible for ensuring the user experience aspect in the releasement of new features and functions. The last key role in the DevOps culture is the security engineer. In the DevOps culture, the security engineer is working closely with the developers in order to build the security into the product. (TechBeacon, n.d.).

4.7 Documentation in Waterfall, Agile and DevOps

The documentation between the Waterfall and Agile models varies, therefore this section introduces how the documentations are built in both models. Additionally, the documentation for DevOps will be looked into. IT project documentation includes two different types, user documentation and internal documentation. User documentation is provided to the customer and it describes how to use the product. Internal documentation describes the reasons why and how the product was built. The thesis will cover the internal documentation, since the user documentation is nearly similar in both Waterfall and Agile models. (Extreme Uncertainty, n.d.).

The traditional Waterfall method includes various different documentations e.g. business case, business solutions requirements, project plan, solution delivery plan, infrastructure design, functional and technical specifications. Often, these documents are part of the Waterfall phases, and therefore the project is unable to proceed until the documents are created, evaluated and accepted. The primary reasons for such a wide documentation are to prevent change and reduce ambiguity. (Extreme Uncertainty, n.d.).

In the Agile methodology the documentation is not seen as important as in the Waterfall methodology. In the Scrum framework, the documentation consists of the product backlog, sprint backlog and sprint/product burndown chart. The product backlog includes the tasks that are intended to be completed during a project. The prioritization for the product backlog is done regarding the customer's and technical requirements. The sprint backlog lists the tasks that are required to be executed for a sprint. The tasks are often divided into sections such as *in planning*, *in progress* and *done*. The sprint burndown chart visualizes the work for the team and the product burndown chart shows the monthly sprint progress. (StepShot, n.d.).

In DevOps the documentation is almost fully automated. Thus, the DevOps team is able to focus on more effective tasks. Compared to the Waterfall model, the documentation in DevOps is in different forms providing as much information as the documentation in the Waterfall. The sources of DevOps documentation are e.g. the log analysis platform, the DevOps processes scripts and the testing scripts. The data from the driving and controlling the DevOps generate logs and the application performance monitoring system is transmitted to the log analysis platform. (DevOps, n.d.).

The information about the system, server and software configuration are subsumed in the scripts which control the automated DevOps processes. Lastly, the testing also provides documentation which can be used whether an issue occurs. (DevOps, n.d.).

4.8 Conceptual Framework

In Section 3 the current state analysis of Management and Development of DevOps and the Traditional IT Project Paths was introduced. Section 4 presented the available knowledge and best practices of Management and Development of the Two IT Project Paths. The readings in Section 4 are based on the findings in the current state analysis. The outcome of this study is a conceptual framework which is presented in Table 6 below.

Table 6. Conceptual Framework.

Key Findings and Challenges	Related Theory
Poorly defined responsibilities and unde- fined ICT resources	4.6 The Roles and Responsibilities in the Waterfall, Agile and DevOps
The lack of prioritization	4.5 IT Project Portfolio Management and Prioritization
Inconsistent usage of project portfolio	4.5 IT Project Portfolio Management and Prioritization
Various documentation types	4.7 Documentation in the Waterfall, Agile and DevOps
Using DevOps path for wrong projects	4.3 Project Management Methodologies 4.4 DevOps

Additionally, Change Management was covered in Section 4 presenting the relevant topics to smoothly implement the Two Project Paths Model. Next, the outcomes of Section 3 and Section 4 are used to build the proposal of this thesis.

5 Building the Proposal

This chapter discusses the proposal building of implementing, managing and developing the Two Project Paths Model. The proposal building was based on the key findings from the Current State Analysis, the available literature discussed in this thesis and the data collected from the benchmarking workshops. The chapter starts with an overview of building the proposal. The chapter then continues with the propositions of implementing, managing and developing the Two Project Paths Model. The built proposal is summarized in the last subsection of this chapter.

5.1 Overview of Proposal Building Phase

The objective of this thesis was to propose a way to manage and develop IT project paths that consist of both DevOps and traditional models. During the time of writing this thesis, the organization's DevOps project was in progress and therefore, the proposal is based on the prevailing knowledge available.

At first, the investigation of the current state of IT project management in the case company was conducted. The findings obtained from the current state provided to identify the relevant topics in literature. After the literature review was completed, two benchmarking workshops with companies X and Y were held. In addition, a few extra internal interviews were arranged to re-examine the scope of the ongoing DevOps project. Thus, the proposal building of this thesis would not overlap with the DevOps project. The information gained from the benchmarking workshops and internal interviews discuss Data 2 of this study. Figure 12 illustrates the logic behind the proposal building.



Figure 12. The Logic of Proposal Building

The following chapters introduce the initial proposals for implementing, managing and developing the Two Project Paths Model.

5.2 The Proposal for Implementing the Two Project Paths Model

The proposal for implementing the Two Project Paths Model discusses the management of the organization's cultural change. The section focuses on three topics in the change management process: understanding the change, the impact of a change and communication in organizational change.

The first topic of the successful change management process is understanding the change. In order to successfully implement the Two Project Paths Model, understanding the change is crucial. As discussed in section 4.2, several aspects need to be covered to understand the change. The first aspect to cover is the awareness of why the change is desired. In the Two Project Paths Model, the reasons behind the change are e.g. to decrease the lead-time, deliver projects faster and deliver better and more suitable solutions. Therefore, the need to change the model of doing IT projects has emerged.

The second aspect to be considered to understand the change is how the upcoming change affects to organization's current operations. This thesis answers some of these questions in areas such as prioritization and management of IT project portfolio, roles and responsibilities and documentation. Furthermore, other operations, i.e. information security are desired to be taken into consideration.

The third aspect covers the other alternatives and opportunities. Identifying other alternatives can be attained in various ways, for example organizing benchmarking workshops or participating to appropriate events. Additionally, becoming acquainted with best practices of the change in question might offer other alternatives. Lastly, the goals for the change initiative should be clearly defined. The goals relate closely to the reasons behind the change and, therefore the goals of implementing the Two Project Paths Model can be seen as the same.

The second topic of the change management process is assessing the impact of change. This step focuses on identifying the potential threats. In implementing the Two Project

Paths Model, the potential threats and issues lie in the experience and skills of the personnel. DevOps is an entirely new way of doing IT projects and therefore the change affects most of all the personnel. DevOps trainings need to be organized in order to improve the skills of the personnel. The themes to introduce in trainings could be e.g. comparison between DevOps and traditional IT projects and close cooperation and teamwork in DevOps projects. The target group of these trainings are the personnel who work in both traditional and DevOps projects. In addition, the project owners are desired to attend the trainings.

The third and the last topic of the change management process is communication. Effective communication affects positively the success of the change management. An overall communication strategy should be created to inform all the important stakeholders. In the Two Project Paths Model the communication should be repetitious, e.g. once a week communication between the key personnel and once a month communication with the other significant stakeholders. Table 7 summarizes the proposal for implementing the Two Project Paths Model.

Table 7. Summary of Implementing the Two Project Paths Model.

Topics	Understanding the Change	The Impact of a Change	Communication in Organizational Change
Definition	Understanding why the change is desired, how it effects to organization's current operations and other alternatives	Identifying the potential threats and issues	Creating an effective communication strategy
What it means to the case company	Why? - To decrease the lead time, deliver projects faster and deliver better solutions, strategically important How? - Prioritization, portfolio management, roles & responsibilities, documentation, information security etc. Other alternatives	- The experience and skills of the personnel - Solution is to organize trainings	- Once a week communication between the key personnel - Once a month communication with the other significant stakeholders

The next subsection introduces the proposition for managing the Two Project Paths Model.

5.3 The Proposal for Managing the Two Project Paths Model

The initial proposal for managing the Two Project Paths Model consists of three sections: prioritizing and managing IT project portfolio, roles and responsibilities and documentation. The topics discussed in this section are based on the areas covered in the current state analysis and best practices.

5.3.1 Prioritizing and Managing IT Project Portfolio

The initial proposal for prioritizing and managing IT project portfolio was created by combining the explored knowledge, best practices and information received from the benchmarking workshops. Moreover, the key people working with the ongoing DevOps project were consulted to perceive the understanding of the progress.

To manage and control the IT project portfolio, the case company had decided to utilize two separate portfolios. As discussed in chapter 3, the case company has a project portfolio for the traditional IT projects. The portfolio has been in use for a year and thus, the usage is still deficient. Due to that, the inadequate usage of the portfolio decreases the possible benefits that could be achieved with the portfolio. Therefore, the preferable usage of the portfolio is important. The portfolio for the DevOps projects was built by the key personnel working with the DevOps. Figure 13 presents the portfolios.

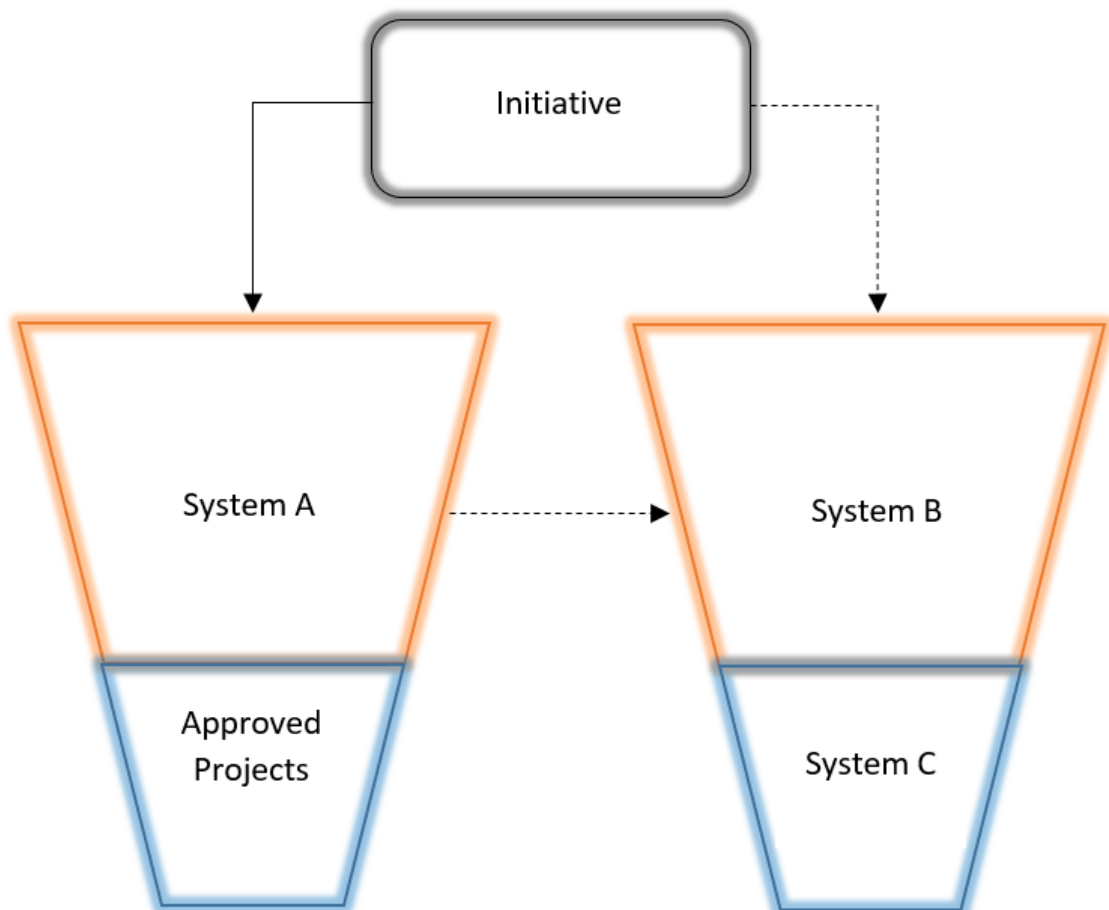


Figure 13. The IT Project Portfolios for Traditional and DevOps projects

As shown in Figure 13 above, the portfolios are similar but separated. As discussed earlier in section 3.2.3, the Waterfall projects utilize System A as a portfolio in which the initiatives are collected. System A portfolio contains both IT projects and other projects. According to the professionals interviewed, the initiatives are studied by the key professionals from the ICT and business departments and the suitable projects are approved. As shown in Figure 13, the Approved Projects are part of System A but smaller, indicating that all initiatives should not be approved. As discussed in section 3.2.3, the professionals pointed out that the amount of simultaneous ongoing projects is too high. Based on the literature, the idea of a project portfolio is to narrow down the amount of approved and ongoing projects. Therefore, a more rigorous screening of the initiatives and utilizing project portfolio is required.

As seen in Figure 13, the second portfolio is designed for DevOps projects. According to the key DevOps personnel, the ideas and initiatives for the DevOps path are collected to System B. Subsequently, the ideas that are approved and will be executed, move to System C.

The challenge lies in the understanding of which initiatives and projects should be collected and put to System A and which to System B. The proposition for the challenge is shown by the arrows in Figure 13. The continuous arrow on left demonstrates that all the initiatives should generally be listed to System A. The portfolio would include an inquiry of whether the project should be carried out through the DevOps path. If the project meets the demands of DevOps path, the portfolio would send an alert to the key DevOps personnel and the project would transfer from System A to System B. However, in some instances the project might remain in System A although the work is done using DevOps path.

The dash line arrow on the right side of the Figure 13 illustrates that the initiatives can also be directly listed to System B. Nevertheless, collecting projects directly to System B should be limited to new features in products which have utilized the DevOps path earlier. Thus, the DevOps path will not be blocked by the traditional projects and the case company's professionals would clearly know where to propose the initiatives. Once the

awareness of both portfolios and the usage of DevOps path increase, it may be possible to utilize System B as an equal project portfolio with System A.

Moreover, some parts of the traditional Waterfall project might be carried out through the DevOps path. Therefore, managing both portfolios becomes important in order for the Two Project Paths Model to function and to avoid undesirable situations, such as blocking the DevOps path.

In order to portfolios to function effectively, the case company is proposed to improve the prioritization of the IT projects. In the current state analysis stage, the ICT experts pointed out that the amount of ongoing IT projects is too high. According to companies X and Y, the effective usage of DevOps requires fewer simultaneous projects.

As discussed in section 4.5, three criteria (maximization, strategic alignment and portfolio balance) should be covered when prioritizing IT projects. The first criterion, maximization means that the delivered IT project should meet or possibly exceed the expectations of the stakeholders. Thus, the ICT personnel would concentrate on the beneficial projects. The second criterion discusses the strategic alignment. IT projects should be aligned with the business strategy. Hence, the solutions delivered in IT projects would support and help to change the business strategy. The third criterion covers the portfolio balance, referring to a classification of IT projects based on two things: efficiency and the support in business strategy. Figure 14 presents the prioritization process.

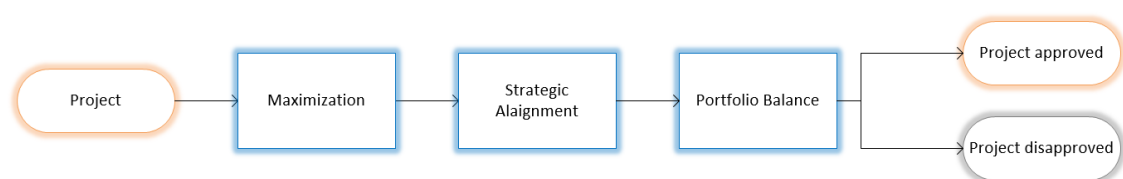


Figure 14. The Prioritization Process

As shown in Figure 14 above, the prioritization process starts when a project or initiative occurs. The next step covers the maximization in which the key personnel examines whether the project will meet the customer's expectations even if the expectations change during the project. To observe the level of maximization, a suitable metrics

should be created and applied. This study does not take a stand on the type of metrics the case company should use. The next step, strategic alignment, determines if the project is strategically important. If the project is seen important and/or it maximizes the value, the process continues with balancing the portfolio. On the other hand, if the project is not strategically important or it does not maximize the value, the project should be disapproved and possibly carried out later.

Each of these steps mentioned above, include ratings of different factors, such as costs vs. savings, schedule and process complexity. Based on the ratings, the projects which gained the most points should be highly prioritized. Moreover, a waiting time for lower rated projects is important to be defined.

The next section introduces the proposed roles and responsibilities in the Two Project Paths Model.

5.3.2 Roles and Responsibilities

The initial proposal for the roles and responsibilities in the Two Project Paths Model is based on the information received from the current state analysis. The literature review described the different roles in Waterfall, Agile and DevOps models. The identified challenges of the roles and responsibilities in the Two Project Paths Model are:

- the responsibilities in IT projects are sometimes unclear
- the new forthcoming roles by DevOps
- understanding the different roles in DevOps and Waterfall projects

The first two challenges are proposed to be solved with RACI (responsible, accountable, consulted and informed) table. RACI table describes the roles, responsibilities and tasks in IT projects. The tasks listed on the tables are based on the company documents. Both Waterfall and DevOps paths have different roles and therefore, two RACI tables are introduced. Moreover, the section compares the difference between insourced and outsourced DevOps paths regarding the personnel, roles and responsibilities.

Table 8 below presents the RACI table for the traditional IT projects. This table covers only IT associated projects not pure IT projects.

Table 8. RACI Table for the Traditional IT Projects.

Task / Role	Project Manager	IT Lead	Application Coordinator	Owner
Define & manage budget	R/A			I
Create & manage a project plan	R/A	C	I	I
Manage the timetable of the project	R/A	I	I	I
Inform ICT steering group about the project	R/A			
Ensure effective communication	R/A	I	I	
Create reports & documentation	R/A	C	C	
Acquire resources for development	R/A	C	C	I
Inform ICT personnel & ensure ICT tasks are performed on time	I	R/A	C	
Ensure application is cost-effective & meets the requirements	I	A	R	
Manage and coordinate technical environments	I	R/A		
Manage the required changes & application's access rights	A	C	R	
Update documents	I	C	R/A	
Ensure ICT personnel take part in application's implementation	I	C	R/A	

As seen in Table 8 above, the listed tasks are typical for the traditional IT projects. Project manager is responsible for managerial tasks of the IT project. However, project manager should inform IT lead, application coordinator and owner about the tasks at issue and consult them when needed. The main tasks of IT lead and application coordinator include building the required application on time. IT lead and application coordinator both inform and consult others when required.

The nature of IT projects affects the roles and responsibilities and therefore the tasks and roles might vary in different IT projects. Occasionally, the role of application coordinator is not a part of the project or the application coordinator is project manager and thus, the tasks are performed by the project manager.

Table 9 presents the RACI table for DevOps projects.

Table 9. RACI Table for DevOps Projects.

Task / Role	DevOps Owner	Scrum Master	Agile Coach	Product Owner	Team Member	Technology Lead
Define & manage budget	I	I		R/A		
Ensure DevOps Path's functioning	R/A	C	C			C
Ensure that product owners are active	R/A		C	I		
Ensure daily operations	A	R	C	I	I	
Support teams & provide needed expertise	C	R/A	C	I	I	
Ensure required resources	C	R/A	C	I	I	
Manage the timetable of the project	I	A	C	C	R	
Offer support for Product Owners & Scrum Masters	A	I	R	I	I	
Train the business departments in Agile/DevOps	A		R			
Explore development opportunities for the current operations model	A	C	R	C	C	I
Prioritize the team's work & tasks		C		R/A	C	
Develop the service (which the team is responsible for) based on the processes and prioritization	I	I	C	R/A	R	
Ensure that the technology is updated & update when needed	A	I	I	I	I	R

As shown in Table 9 above, DevOps requires more roles compared to the traditional model. The consulted DevOps expert is building a customized DevOps path for the case company and therefore, the roles in the DevOps path are a mix of DevOps and Agile methodologies.

As seen in Table 9, the tasks are different and include closer cooperation between the personnel working in a DevOps project. In DevOps projects, the closer cooperation refers to fulfilling one's own responsibilities, informing other DevOps members and asking and offering help when needed. As shown in Table 9, an intensive cooperation is seen especially between the DevOps owner, agile coach and scrum master.

The third challenge, *understanding the different roles in DevOps and Waterfall projects*, is proposed to be taken into consideration when implementing the DevOps path. As discussed, the DevOps path brings new roles and a new way of doing IT projects. Due to this, the knowledge of DevOps between the personnel varies and the level of motivation differs. The personnel should understand how to work in both IT project paths, since the same expert might be working as a scrum master in a DevOps project and as a project manager in a traditional project. As discussed earlier, this challenge can be solved for example by organizing trainings and workshops. Moreover, the managers should lead by example and encourage personnel to comply with DevOps principals.

Insourced vs. Outsourced DevOps path

This section focuses on comparing the advantages and disadvantages of insourced vs. outsourced DevOps path. The benchmarking workshops with companies X and Y revealed valuable information about the difference in insourced and outsourced DevOps paths.

The case company should consider whether the personnel should focus only on one type of projects. The information received from the benchmarking workshops revealed that the companies X and Y have different people working in different types of projects. Thus, the potential challenge in understanding how to work in both DevOps and traditional projects would disappear. However, the costs might increase since new employees are hired or present employees are needed to be trained.

Alternatively, the costs also increase if the DevOps path is mainly outsourced. Consequently, the DevOps team can be entirely or partly outsourced. Entirely outsourced DevOps path means that all the DevOps team members work for other companies. Partly outsourced DevOps path refers to a situation in which some of the DevOps team members are working for the company in question, such as scrum masters and some are outsourced, i.e. developers. According to company Y, the costs decreased by 40 per cent when the company decided to mainly insource the DevOps path. Table 10 shows the pros and cons of both insourced and outsourced DevOps path.

Table 10. Pros and cons of insourced and outsourced DevOps path.

	Insourced DevOps path	Outsourced DevOps path
Pros	<ul style="list-style-type: none"> - The knowledge and expertise would be inside the company - The motivation and ownership of the experts would possibly be higher - Better understanding of the company, its operations and the field the company operates in - The personnel with higher motivation produce code which is easier to maintain 	<ul style="list-style-type: none"> - Easier to find skillful experts - Due to the skillful experts, the quality and the service of the DevOps path would probably be better - The internal personnel can learn from the external experts - The case company can focus on its core business
Cons	<ul style="list-style-type: none"> - The increased costs from hiring or training employees - Possibly difficult to find skillful experts - The expertise might be lower 	<ul style="list-style-type: none"> - The increased costs from outsourcing - The motivation and ownership of the experts might not be high

As seen in Table 9, the advantages of insourced DevOps path consist of four factors. The first advantage, the knowledge and expertise would be inside the company, refers to utilizing the expertise of the internal personnel. The second advantage is the motivation and ownership of the experts would possibly be higher. According to company Y, the motivation and taking ownership is higher when the DevOps path is insourced. The third advantage of the insourced DevOps path is that the personnel have better understanding of the company, its operations and the field the company operates in. The last advantage indicates that in the insourced DevOps path, the personnel has higher motivation to produce codes with high quality because they are the ones that have to maintain it.

The disadvantages of the insourced DevOps path are the increased costs of training or hiring employees, difficulty to find skillful experts and the expertise might be lower. The last two disadvantages bring out the fact that the DevOps experts are extremely sought after in the labor market at the moment.

As shown in Table 10, the advantages of outsourced DevOps path consist of four factors and the disadvantages consist of two factors. If the DevOps path is outsourced, finding skillful and experienced experts is easier. However, the costs of outsourcing might be quite high. On the other hand, skillful experts usually deliver higher quality and better service since they have the expertise and the knowledge needed. Moreover, the internal

personnel can learn from the external experts. Although, the motivation and taking ownership of the external experts might not be as high as the internal experts. Lastly, the case company can focus on its core business if the DevOps path is outsourced.

The conclusion is that the outsourced DevOps path is less risky for the case company. Subsequently, the case company can consider if some parts of the DevOps team could be insourced. However, this should be useful and working in insourced DevOps path should be fluent with a long future ahead. Whether the DevOps path is insourced or outsourced, the main aspect is to ensure the personnel's satisfaction with the operations model, tools and projects. Thus, the personnel would continue working with the company and the level of motivation of the personnel would remain high to maintain the codes. Moreover, it is worthwhile to rotate personnel to draw new skills.

The next section introduces the proposition for documentation in the Two Project Paths Model.

5.3.3 Documentation

In the current state analysis and in the literature review one of the key topics was documentation. According to the professionals interviewed, the documentation in traditional IT associated projects varies and therefore a general model for the documentation is proposed to be created. Based on the literature, the documentation in the traditional Waterfall projects is created phase by phase, including documents such as business solutions requirements, project plan, solution delivery plan, infrastructure design and functional and technical specifications. However, the documentation in Waterfall projects might sometimes be time consuming and impractical. Thus, creating a template which includes all the necessary and important documents is proposed.

The proposed template should include a project plan, solution delivery plan, infrastructure design, recovery plan and functional and technical specifications. As one identified weakness was undefined IT resources, a project plan should include a more specific information of the needed IT resources. The case company has had some troubles in implementing the products and ending the projects therefore, the template should include a more informative solution delivery plan.

The proposal for the DevOps documentation is based on the literature and the information received from the key DevOps personnel. According to the key DevOps personnel, the documentation model for the DevOps path is a mix of DevOps and Agile methodologies. The documentation in DevOps path should be as automated as possible. However, the documentation principles, such as product backlog, sprint backlog and sprint/product burndown chart from Agile should be utilized to visualize the progress of each project. The administrator of the DevOps project is not always the scrum team, and therefore the documentation should support the maintenance.

The next section introduces a proposition for developing the Two Project Paths Model.

5.4 The Proposal for Developing the Two Project Paths Model

The proposal for developing the Two Project Paths Model covers two topics of the change management process, success measurement and reviewing lessons learned. Based on the literature, a change management process should include success measurement. In the Two Project Paths Model, the measuring methods should focus on five areas: functionality, productivity, customers' satisfaction, reliability and effectiveness. By utilizing these measuring methods, the company would gain the knowledge whether the Two Project Paths Model has been successful.

In order to develop the Two Project Paths Model, the case company should organize a lessons learned meeting in which the process, technology, people and other important areas would be discussed. The process should be reviewed and changed if needed. The technology should be suitable for the purpose and updated when required. The people, both personnel and customers' opinions of the Two Project Paths Model should be taken into consideration.

The next section summarizes building the proposal stage.

5.5 Summary of Proposal

This section summarizes the proposal created for implementing, managing and developing the Two Project Paths Model. Figure 15 illustrates the summarized proposal.

Section	Theory	Proposal
5.2 The Proposal for Implementing the Two Project Paths Model	Change Management	<ul style="list-style-type: none"> - Understanding the change - The Impact of a change - Communication in organizational change
5.3 The Proposal for Managing the Two Project Paths Model	Prioritizing & Managing IT Project Portfolio	<ul style="list-style-type: none"> - Portfolios for traditional and DevOps projects - Prioritization process
5.3 The Proposal for Managing the Two Project Paths Model	Roles & Responsibilities	<ul style="list-style-type: none"> - RACI table for the traditional IT projects - RACI table for DevOps projects - Insourced vs. outsourced DevOps path
5.3 The Proposal for Managing the Two Project Paths Model	Documentation	<ul style="list-style-type: none"> - Documentation table
5.4 The Proposal for Developing the Two Project Paths Model	Change Management	<ul style="list-style-type: none"> - Success measurement - Reviewing lessons learned

Figure 15. The Summary of Chapter 5

As shown in Figure 15, Chapter 5 consisted of three subsections which aimed to build the proposal for identified challenges: 5.2 The Proposal for Implementing the Two Project Paths Model, 5.3 The Proposal for Managing the Two Project Paths Model and 5.4 The Proposal for Developing the Two Project Paths Model. Subchapters 5.2 and 5.4 focused on the change management process by understanding the change and its impacts, taking communication into consideration, measuring success of the change and reviewing lessons learned.

The proposal for Managing the Two Project Paths Model included three sub subsections: 5.3.1 IT project portfolio management and prioritization, 5.3.2 roles and responsibilities

and 5.3.3 documentation. The main outputs of the IT project portfolio management and prioritization are IT project portfolios for the traditional and DevOps paths and a prioritizing process. The RACI tables for the traditional and DevOps paths and a comparison of insourced vs. outsourced DevOps path are the main outcomes for clarifying the roles and responsibilities. Lastly, a general documentation table is proposed to be created.

In the following section, the built proposal is validated.

6 Validation

This chapter validates the initial proposal built in Section 5. The chapter starts with an overview of the validation stage. The section then continues with introducing the key findings received from a validation meeting with ICT Business Services Head of Unit and ICT Expert. The chapter ends with the final proposal in which the key findings of validation are applied and expected benefits are introduced.

6.1 Overview of the Validation Stage

To ensure that the solution presented meets the company's requirements, a validation of the proposal was conducted. The objective of the validation was to confirm the appropriateness of the proposal for managing the IT project paths. The steps of the validation stage are presented in Figure 16 below.



Figure 16. The Overview of Chapter 6

As seen in Figure 16, the validation was conducted in four steps. First, the proposal for managing and developing the Two Project Paths Model was presented to the ICT Business Services Head of Unit and ICT Expert. Data 3 collected for this study included the feedback and improvement ideas suggested by the experts. Based on the feedback, the minor changes and improvements proposed were implemented. Lastly, the final proposal was produced and expected benefits were introduced.

6.2 Key Findings of Validation and Final Proposal

In the validation of the proposal the proposed concepts were verified to be aligned with the company's expectations. It was noticed that the created RACI tables provide clarification to the roles and responsibilities. In addition, it was stated that the portfolios will enable improved management of IT projects. Primarily, the case company considered the presented proposal valid and only minor changes were suggested. The key findings of the validation stage consist of minor insertions to both RACI tables and adding one more aspect to Table 10, *Pros and cons of insourced and outsourced DevOps path*. The modified tables are introduced below in Table 11.

Table 11. Final RACI Table for the Traditional IT Projects.

Task / Role	Project Manager	IT Lead	Application Coordinator	Owner
Define & manage budget	R/A			I
Create & manage a project plan	R/A	R	I	I
Manage the timetable of the project	R/A	I	I	I
Inform ICT steering group about the project	R/A			
Ensure effective communication	R/A	I	I	
Create reports & documentation	R/A	R	C	
Acquire resources for development	R/A	C	C	I
Inform ICT personnel & ensure ICT tasks are performed on time	R	R/A	C	
Ensure application is cost-effective & meets the requirements	R/A	R	R	
Manage and coordinate technical environments	I	R/A		
Manage the required changes & application's access rights	A	C	R	
Update documents	A	C	R	
Ensure ICT personnel take part in application's implementation	R/A	R		

The minor changes to the traditional RACI table are shown in Table 11. According to the ICT Business Services Head of Unit, the project manager should be accountable or responsible for all of the tasks listed except managing and coordinating technical environments. Moreover, the role of IT lead includes more responsibilities, such as creating and managing a project plan, creating reports and documents and ensuring ICT personnel take part in application's implementation.

The feedback received from ICT Business Services Head of Unit and ICT Expert covered one minor change to the DevOps RACI table. As seen in Table 12 below, technology lead is consulted when supporting teams and providing needed expertise.

Table 12. Final RACI Table for the DevOps Projects.

Task / Role	DevOps Owner	Scrum Master	Agile Coach	Product Owner	Team Member	Technology Lead
Define & manage budget	I	I		R/A		
Ensure DevOps Path's functioning	R/A	C	C			C
Ensure that product owners are active	R/A		C	I		
Ensure daily operations	A	R	C	I	I	
Support teams & provide needed expertise	C	R/A	C	I	I	C
Ensure required resources	C	R/A	C	I	I	
Manage the timetable of the project	I	A	C	C	R	
Offer support for Product Owners & Scrum Masters	A	I	R	I	I	
Train the business departments in Agile/DevOps	A		R			
Explore development opportunities for the current operations model	A	C	R	C	C	I
Prioritize the team's work & tasks		C		R/A	C	
Develop the service (which the team is responsible for) based on the processes and prioritization	I	I	C	R/A	R	
Ensure that the technology is updated & update when needed	A	I	I	I	I	R

One change related to the pros and cons of insourced and outsourced DevOps path was identified based on the feedback. As shown in Table 13 below, the added advantage of outsourced DevOps path discusses the resource flexibility. According to the ICT Business Services Head of Unit and ICT Expert, the outsourced DevOps path enables utilizing the human resources more flexibly.

Table 13. The Final Table of Pros and Cons of Insourced and Outsourced DevOps Path.

	Insourced DevOps path	Outsourced DevOps path
Pros	<ul style="list-style-type: none"> - The knowledge and expertise would be inside the company - The motivation and ownership of the experts would possibly be higher - Better understanding of the company, its operations and the field the company operates in - The personnel with higher motivation produce code which is easier to maintain 	<ul style="list-style-type: none"> - Easier to find skillful experts - Due to the skillful experts, the quality and the service of the DevOps path would probably be better - The internal personnel can learn from the external experts - The case company can focus on its core business - Resource flexibility
Cons	<ul style="list-style-type: none"> - The increased costs from hiring or training employees - Possibly difficult to find skillful experts - The expertise might be lower 	<ul style="list-style-type: none"> - The increased costs from outsourcing - The motivation and ownership of the experts might not be high

The following subchapter introduces the summary of the final proposal based on the initial proposal and validation results. Moreover, the expected benefits of implementing the proposal are reviewed.

6.3 Summary of Validation and Expected Results

The objective of this thesis was to propose a way to manage and develop IT project paths that consist of both DevOps and traditional models. The thesis concentrated on preconceived aspects that were considered important. The built proposal forms the results of the thesis and fulfills the expected outcome by proposing aspects to manage and develop the Two Project Paths Model. A summary of the identified findings and challenges, proposal and expected benefits are presented in Figure 17 below.

Findings & Challenges	Proposal	Expected Benefits
<ul style="list-style-type: none"> - Defective prioritization - Inconsistent usage of project portfolio 	<ul style="list-style-type: none"> - Prioritization process - Portfolios for traditional and DevOps projects 	<ul style="list-style-type: none"> - The focus is on the highly prioritized projects - The amount of on-going IT projects decreases - Blocking the DevOps portfolio/path is avoided - The transparency of the projects and status
<ul style="list-style-type: none"> - Undefined ICT resources - Poorly defined responsibilities 	<ul style="list-style-type: none"> - RACI tables - Insourced vs. outsourced DevOps path 	<ul style="list-style-type: none"> - Clarity to roles and responsibilities - Comprehension of the roles in DevOps - Understanding the pros and cons of insourced vs. outsourced DevOps path
<ul style="list-style-type: none"> - Lack of general documentation model 	<ul style="list-style-type: none"> - General documentation instructions for both IT project paths 	<ul style="list-style-type: none"> - Precise and improved documentation
<ul style="list-style-type: none"> - The importance of change management 	<ul style="list-style-type: none"> - Guidelines for change management 	<ul style="list-style-type: none"> - Better communication about the change - The understanding of why the change is desired

Figure 17. The Summary of Findings and Expected Benefits

The prioritization process shown in Figure 17 enables the personnel to focus on the highly prioritized projects. The understanding of the most important projects increases and due to that, the amount of on-going IT projects decreases. Moreover, the projects are delivered faster with a higher quality since fewer simultaneous projects allow personnel to expend more time on each project.

The portfolios for traditional IT projects and DevOps projects provide an overall picture and transparency to the projects and their status. The proposal presented in Section 5.3.1 suggested using System A for all projects. The DevOps projects would then move from System A to System B and the traditional projects would remain in System A. Thus, blocking the DevOps path with traditional projects is avoided. Additionally, using one portfolio for projects is straightforward for the personnel in a new situation.

RACI tables for traditional IT projects and DevOps projects enable observing the different roles in the Two Project Paths Model. RACI tables are expected to bring clarity to the responsibilities and tasks in both IT project paths. Consequently, the understanding of

the roles in DevOps path and how they differ compared to the traditional model is expected to increase.

The comparison between insourced and outsourced DevOps path produces understanding of the advantages and disadvantages related to DevOps. Thus, the case company can consider whether the insourced or outsourced is the most suitable option for them.

General documentation instructions and documentation tables for the traditional and DevOps paths provide precise and improved documentation. The general documentation models could save the project managers' time. It is recommended that the case company creates general documentation tables for traditional and DevOps projects.

Lastly, the guidelines for change management enables the case company to communicate better about the up-coming change. In addition, the personnel will be able to understand why the change is desired and how it affects their work.

The following chapter introduces the summary and conclusions of this thesis.

7 Summary

This section provides the summary and the conclusions of the thesis. The chapter consists of four different sections which are executive summary, next steps of the proposal, thesis evaluation and final words.

7.1 Executive Summary

The objective of this thesis was to propose a way to manage and develop IT project paths that consist of both DevOps and traditional models. At the time of writing this thesis, the case company was building the DevOps path and therefore, this thesis concentrated on management of DevOps and traditional paths. The outcome of this thesis comprised five key sections: (1) recommendations for implementing the Two Project Paths Model, (2) a proposal for prioritizing and managing IT project portfolios, (3) a proposal for roles and responsibilities in DevOps and traditional projects, (4) a suggestion to create a general documentation model, and (5) recommendations for developing the Two Project Paths Model.

The thesis was carried out in seven stages. The thesis started by introducing the business challenge and determining the objective for this study. The expected outcomes as well as the thesis outline were defined in the first stage.

In the second stage, the research design was introduced and the project plan and schedule were set. Additionally, the methods of data collection and analysis used in the thesis were presented.

The third stage, current state analysis, was conducted to explore the current state of the company's IT project management. The stage included interviews with the key ICT personnel and experts from the business departments in order to achieve as wide perception of the current state as possible. In addition, the company's internal documentation were investigated. The key areas investigated were IT project management, IT project prioritization and portfolio management, documentation, IT project roles and developing project management. The key findings from the analysis were presented as a strengths, weaknesses and challenges matrix. The identified weaknesses consisted of five aspects:

(1) undefined ICT resources, (2) poorly defined responsibilities, (3) defective prioritization and project follow-up, (4) inconsistent usage of project portfolio, and (5) lack of general documentation models.

In the fourth stage, best practices and available knowledge were explored. The theory was based on the key areas investigated in the current state analysis. The investigation of the literature covered areas such as change management, Waterfall, Agile, DevOps, IT project portfolio management and prioritization. In addition, documentation and roles and responsibilities in Waterfall, Agile and DevOps were explored.

The fifth stage concentrated on building the initial proposal which combined the information received from the current state analysis, best practices, discussions and benchmarking workshops. The proposals consisted of guidelines for change management, portfolio model for traditional and DevOps projects, prioritization process, RACI tables for defining roles and responsibilities in traditional and DevOps models and highlighting the importance of documentation.

In the sixth stage, the initial proposal was introduced to the IT Business Service Head of Unit and ICT Expert. Based on the validation results the initial proposal was polished which led to the final proposal.

7.2 Next Steps of the Proposal

The next steps recommended for implementing the proposal are based on two aspects. The first aspect focuses on the next steps in the topics discussed in this thesis. The second aspect covers the topics that should be considered in the case company at some point in the future.

The next steps:

- Implementation of the proposed prioritization process and defining ratings for the agreed factors.

- Implementation of the project portfolios.
- Introducing the RACI tables for all the key stakeholders and organizing trainings about DevOps.
- Creating general and standardized documentation models for traditional and DevOps projects.
- Taking other aspects of management and development of the Two Project Paths Model, such as information security and communication, into consideration.
- Creating measurement methods for the Two Project Paths Model.

This thesis concentrated on specific topics of IT project management and development. Some of these topics were only briefly introduced, such as documentation. The proposed next step is to create general documentation instructions or models, since documentation was one of the weaknesses identified in this thesis. General documentation instructions would be easy to follow by the project personnel, and all the required information would be in exact format.

Moreover, the management and development of DevOps and traditional IT project paths consist of aspects that were not discussed in this thesis. Therefore, the second step to be proposed is taking into consideration other aspects of management and development of the Two Project Paths model, e.g. information security and communication.

The last step to be proposed is to measure the Two Project Paths Model. Measurement methods should include areas such as the number of projects delivered through the DevOps path, the number of projects delivered through the traditional path, how fast the projects are delivered, the satisfaction of the customers and the personnel as well as resource allocation.

7.3 Thesis Evaluation: Objective vs. Results

This thesis aimed to give guidance on managing and developing the traditional and DevOps paths. As noticed, the focus for the thesis was wide and due to that the specific areas were agreed in collaboration with the ICT Business Services Head of Unit and ICT Expert. The agreed areas were change management, documentation, roles and responsibilities, prioritization and portfolio management. A continuous and close collaboration with the company's stakeholders enabled building a solid proposal. Thus, it can be stated that the outcomes meet the expectations of this thesis when comparing the objectives to the proposal created.

The section for roles and responsibilities can be considered a success due to the fact that it gives a rigorous description of the roles, responsibilities and tasks in both traditional and DevOps projects. The RACI tables provide straightforward information about the differences in roles in the traditional and DevOps projects and thus, going through the tables by the personnel is desired.

On the other hand, the section for documentation remained relatively short. Documentation models and general instructions were desired to be created. However, the scope of this thesis was narrowed down while writing the study and therefore, the documentation models and general instructions were not created. As discussed earlier, the proposed next step is to create documentation models for both paths.

In the beginning of the study, a research design was created which provided guidelines for the thesis. Various professionals and experts from ICT and business departments were interviewed for the data collection. In addition, external experts from different companies were consulted for the proposal building. The literature exploited in this thesis was relevant for building the proposal. Lastly, the objective determined in the beginning corresponds to the outcome of this thesis. Therefore, the reliability of the study can be stated as good.

7.4 Final Words

Conducting this thesis has been a valuable learning experience. A unique subject that combines Waterfall, Agile and DevOps all together provide valuable knowledge about all of these topics. From a personal point of view my professional skills have developed during this project, and will be put to good use in my future career.

References

Agendum. (n.d.) *Agile, Waterfall, Kanban ja muut: 6 yleistä menetelmää projektityöhön - ja miksi sinun kannattaa valita omasi?*

Available: <https://www.agendum.com/projektinhallinta/metodit-projektityohon> (Accessed 22 October 2019).

Association for Project Management. (n.d.) *Why do you need agile for project management?* Available: <https://www.apm.org.uk/resources/find-a-resource/agile-project-management/why-do-you-need-agile-in-project-management/> (Accessed 24 October 2019).

Atlassian. (n.d.) *DevOps*. Available: <https://www.atlassian.com/devops> (Accessed 28 October 2019).

Atlassian. (n.d.) *Scrum*. Available: <https://www.atlassian.com/agile/scrum> (Accessed 4 November 2019).

Atlassian. (n.d.) *Scrum roles and the truth about job titles in scrum*. Available: <https://www.atlassian.com/agile/scrum/roles> (Accessed 29 October 2019).

Bonham, S. (2005). *IT Project Portfolio Management*. Available: <https://www.proquest.com/products-services/ebooks/ebooks-main.html> (Accessed 31 October 2019).

Davis, J. et al. (2016). *Effective DevOps : Building a Culture of Collaboration, Affinity, and Tooling at Scale*. Available: <https://learning.oreilly.com/library/view/effective-devops/9781491926291/> (Accessed 4 November 2019).

DevOps. (2015). *Continuous Documentation*. Available: <https://devops.com/continuous-documentation/> (Accessed 4 November 2019).

DZone. (2018). *The Difference Between Agile Programming vs. Agile Project Management*. Available: <https://dzone.com/articles/the-difference-between-agile-programming-vs-agile> (Accessed 24 September 2019).

Extreme Uncertainty. (2016). *Myths of agile "there's no documentation in Agile"*. Available: <https://www.extremeuncertainty.com/myths-agile-no-documentation-agile/> (Accessed 2 November 2019)

Fingrid. (n.d.) *Fingrid Delivers. Responsibly*. Available: <https://www.fingrid.fi/en/pages/company/in-brief/> (Accessed 2 September 2019).

Fingrid. (2019). *Fingrid Oyj Toimintakertomus ja Tilinpäätös*. Available: https://www.fingrid.fi/globalassets/dokumentit/fi/sijoittajat/taloudelliset-julkaisut/2018/fingrid_oyj_tilinpaaatos_-ja_toimintakertomus_2018.pdf (Accessed 2 September 2019).

Hunt, R. et al. (2008). *International Journal of Quality and Reliability Management: Best practice portfolio management*. Available: <https://www.proquest.com/products-services/ebooks/ebooks-main.html> (Accessed 31 October 2019).

Layton, M. (2012). *Agile Project Management for Dummies*. Available: <https://learning.oreilly.com/library/view/agile-project-management/9781118235850/?ar> (Accessed 24 September 2019).

Linkedin. (2017). *An Overview of IT Roles, Waterfall and Agile*. Available: <https://www.linkedin.com/pulse/department-ayub-shaikh/> (Accessed 29 October 2019).

Medium. (2019). *All About DevOps Fundamentals You Ever Wanted to Know*. Available: <https://medium.com/faun/all-about-devops-fundamentalsyou-ever-wanted-to-know-2333328a2b40> (Accessed: 28 October 2019).

Medium. (2019). *Waterfall Methodology in Project Management - Phases, Benefits*. Available: <https://medium.com/@sudarhtc/waterfall-methodology-in-project-management-phases-benefits-85393be2f1d> (Accessed 24 September 2019).

MindTools. (n.d.) *Change Management*. Available: https://www.mindtools.com/pages/article/newPPM_87.htm (Accessed 10 October 2019).

Murthy, C.S.V. (2007). *Change Management*. Available: <https://ebookcentral.proquest.com/lib/metropolia-ebooks/reader.action?docID=588098> (Accessed 11 October 2019).

Pinkelephant. (2018). *Agile Project Management Benefits*. Available: <https://pinkelephant.co.uk/agile-project-management-benefits/> (Accessed 24 October 2019).

ProjectManager. (n.d.) *Waterfall Methodology in Project Management*. Available: <https://www.projectmanager.com/software/use-cases/waterfall-methodology> (Accessed 23 October 2019).

ProjectManager. (2016). *What Is Agile?* Available: <https://www.projectmanager.com/blog/what-is-agile> (Accessed 23 October 2019).

StepShot. (n.d.) *Documentation in the Scrum Agile Development Methodology*. Available: <https://stepshot.net/documentation-scrum-agile-development-methodology/> (Accessed 3 November 2019).

TechBeacon. (n.d.) *DevOps roles you need to succeed*. Available: <https://techbeacon.com/devops/7-devops-roles-you-need-succeed> (Accessed 4 November 2019).

Vukotich, G. (2011). *10 Steps to Successful Change Management*. Available: <https://www.oreilly.com/library/view/10-steps-to/9781562867539/part10.xhtml> (Accessed 14 October 2019).

Interview questions for CSA

General questions
1. How is a project defined in the case company?
2. Where the idea for a project comes from?
3. How is the decision made of which projects are accepted?
4. How are the IT projects carried out currently?
5. In what type of IT projects have you been involved? What was your role in these projects?
6. How carrying out the project, schedule and resources are agreed?
7. How are the responsibilities and tasks shared in IT projects?
8. On what basis have the projects been assigned to you?
9. After finishing the project is there a meeting or lessons learned workshop held to discuss about the project?
10. Can you improve or develop the project realization? How?
11. Are IT projects prioritized? If no, do you feel the need for better prioritization?
12. Are IT projects documented? If yes, how? If no, do you feel the need for documentation?
13. What are the strengths of the current project management model?
14. What are the weaknesses/challenges of the current project management model?
15. How is the communication working between ICT and business departments?
DevOps and Agile related questions
1. In your opinion, what does Agile mean?
2. What are the expected benefits from using Agile?
3. Do you believe that projects are carried out faster with Agile?
4. How are the roles and responsibilities changed in Agile compared to the traditional model?
5. Is Agile already used in some projects?
6. What are the fundamental reasons to utilize the Two Project Paths Model?
7. What are the expected benefits in the Two Project Paths Model?
8. Which projects utilize the traditional path and which DevOps path?
9. In the future, is DevOps path more used than the traditional path?

Questions for benchmarking workshops

1. What are the obtained benefits from DevOps?
2. What are the challenges and problems you have faced due to DevOps?
3. Has DevOps clarified project management?
4. Have the number of ongoing projects decreased? What about the project lead time?
5. Is the documentation different compared to the traditional model?
6. How do you prioritize projects?
7. How do you decided which projects utilize the traditional path and which DevOps path?
8. What new roles have emerged due to DevOps?
9. Has the engagement of the personnel been successful?
10. Have the responsibilities of IT and business departments cleared up?