Jesse Rantala

Applicability of Lean Principles and Kanban Method in Managing SaaS Delivery Projects and Tasks

Master’s Thesis
Espoo, October 22, 2018

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In software as a service project delivery, projects are implemented in a tight collaboration with customer, with fast and changing requirements. Generally, companies being able to answer fast and with quality to requests and issues prevail. To manage scope and requirements and deliver fast and with quality, a set of good practices, methods and tools in both project and task management are needed. Lean and Kanban are trending principles and methods in software industry to manage projects and continuously deliver value to customers.

The research problem this Master’s Thesis addresses is: How can Lean principles and Kanban method improve task and project management throughout the life-cycle of SaaS delivery projects? To answer our research problem, we conducted an action research in medium sized Finnish software company. Our empirical study focused on studying company’s current project and task management, their challenges and best practices. In our literature review, we studied concepts of Kanban and Lean, their characteristics and found benefits. Later we concluded our empirical and literature studies together and created a list of concrete improvement suggestions and guidelines for task and project management.

Kanban and Lean provide multiple benefits for task and project management, especially when there are challenges with task transparency, team collaboration and having a clear development process. Kanban and Lean together with best practices steer project work more towards fast deliveries, better knowledge sharing, improved collaboration and faster reactions to changes and bottlenecks. The preliminary results from a pilot team that took Kanban and Lean into use speak for mentioned benefits. Furthermore, unifying and harmonizing task and project management processes under same online tool help in management and following best practices. This tool should be shared with customers for better collaboration and value co-creation.

Keywords: Kanban, Lean, task management, project management, team management, SaaS

Language: English

I never considered studying at university when I finished my studies at high school. But you should never say never. Through many incidents, my path led to participate in examinations to enter Aalto University in 2011, one year after my graduation from high school. I think it was my stubborn and competitive nature that made me study hard for the examinations to enter studying computer science.

During the first weeks at the university I felt completely out of place. In one of the sessions where we had to introduce ourselves, all I heard others saying was that how they had done their own programs ever since they were 10-year-old, whereas my contribution to computer world was that I had played different computer games with my friends for some years. I felt like I started from way behind.

Luckily, I had a good group of friends at university to push each other forward. It was many times this friendly competition that we had that forced me to study harder. Thanks for this Tuukka, Henri, Patrick, Simo and Tommi. Our projects together, consisting of tears and laughter, taught me a lot and showed me where my strengths in software industry could be.

In the end, life at university has brought me a lot more than just learning how to program and trying to understand big software projects and their management. It has brought me new friends, life-experiences and work that I enjoy. Because of my studies, I have been able to travel around the world, live in different countries and learn new languages like Spanish (not just Python and Java). In the end, university has changed me more than I could have ever thought of. After seven years of, active and less active, studying I believe that I am leaving my studies behind as more mature, wiser and overall better person.

I want to thank my Spanish lecturer Carmen Rodellas at Aalto University for encouraging me to apply to do my Erasmus studies in Madrid. That truly changed my life, and resulted to much more than just a half year of studying in Spain.

To complete this Thesis work as my final contribution at Aalto University,
I wish to thank especially Jasmin Karasar and Sonja Rajala, for guiding my Thesis towards the right direction. I owe my endless gratitude to Jasmin for making me realize a need to take holidays from work and focus on my Thesis only. I believe that over 50% of this Thesis was written during those couple of weeks. Thank you Sonja for pushing me forward and redirecting my focus when I was about to bite off more than I could chew. I wish I would have listened better.

I wish to thank Professor Marjo Kauppinen for providing always constructive feedback, listening to my craziest ideas and problems and pushing me forward with my work.

Finally, I want to give thanks to my family, friends and girlfriend, for providing their support during this project. Thank you Ilkka and Marja for letting me escape from the outside world and write my Thesis in your peaceful cottage. Thank you mom and dad, for raising me to understand how to work hard and not leave anything unfinished. You have shown me what Finnish “sisu” stands for at its finest. Thank you Elena for providing your heartfelt support, listening to all my problems during the process of writing and eventually celebrating the end of the project together.

Without all the people above, this Thesis would have never been completed. Thank you!

Espoo, October 22, 2018

Jesse Rantala
# Abbreviations and Acronyms

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<thead>
<tr>
<th>Abbreviation</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>B2B</td>
<td>Business-to-business</td>
</tr>
<tr>
<td>JIT</td>
<td>Just-in-time</td>
</tr>
<tr>
<td>KPI</td>
<td>Key performance indicator</td>
</tr>
<tr>
<td>PM</td>
<td>Project manager</td>
</tr>
<tr>
<td>SaaS</td>
<td>Software as a Service</td>
</tr>
<tr>
<td>SCM</td>
<td>Supply chain management</td>
</tr>
<tr>
<td>SLA</td>
<td>Service-level agreement</td>
</tr>
<tr>
<td>TPM</td>
<td>Technical project manager</td>
</tr>
<tr>
<td>WIP</td>
<td>Work-in-progress</td>
</tr>
</tbody>
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Chapter 1

Introduction

In software as a service (SaaS) project delivery, projects are implemented in a tight collaboration with customer, with fast and changing requirements. Generally, companies being able to answer fast and with quality to requests and issues prevail. In the end, project success is measured by budget, schedule, quality, scope, resources and risks [1]. To manage the scope and requirements and deliver fast and with quality, a set of good practices, methods and tools in both project and task management are needed.

This Master’s Thesis has been done as a part of Software and Service Engineering studies at Aalto University’s School of Science department of Computer, Communication and Information Sciences. In this Thesis we follow action research method, combining empirical research of Case Company’s current best practices and challenges in task and project management with existing literature of Lean and Kanban, to later provide improvement suggestions for task and project management.

The study has been conducted during year 2018. At this time, Case Company has been experiencing heavy growth in terms of new projects and markets where the project delivery work remains unharmonized and best practices stay in silos. Thus, more transparent, harmonized and systematic approach to project delivery work is a current internal research topic at Case Company and a true need for better distributed best practices, methods and tools exists.

In this Chapter, the background and motivation for the Thesis is reasoned, from both literature and Case Company’s perspective. Second, the research problem and questions are presented and discussed, based on the background and motivation. Third, the scope and objectives of the Thesis are defined, limiting the scope, narrowing the focus and setting the concrete objectives for the work. Finally, the structure for the Thesis work is presented, and relation between empirical and literature study of the Thesis is analyzed.
1.1 Background and motivation

In today’s demanding and dynamic business and technology markets, the goal is to reduce operational costs and focus on shortening time-to-market through better productivity [3]. Ahmad et al. [3] argue that therefore the important questions become to be: how to develop better and cheaper software, deliver faster and answer ever changing customer requirements. Lean software development and Kanban have been argued to provide a solution delivering faster, answering faster to changes and improving quality [31, 32, 34].

Lean and Kanban are trending principles and method for project and task management in software industry [3]. Their focus is on analyzing waste in process [3] and eventually bringing value faster to customer. They have been applied in many different context and companies [5], and especially Kanban is discussed to be intuitive and easy to implement [19]. Together, they provide a way to manage the health of the project and recognize possible issues and non-value adding processes on the way. They help in collaboration, communication and transparency of current status of tasks in projects and teams [28]. Furthermore, they do not have time-boxed iterations or schedules but rather focus on continuous value delivery [5, 9]. Thus, they are lightweight task and project management principles and method, that do not fear changes and are capable of managing rapid delivery work.

Lean principles should guide organization’s focus to more valuable work through recognizing and cutting non-value providing activities and requirements in their processes [17] and thus serve its customers in the right level. Eventually, Lean as an ideology and a set of principles should guide to analyze what kind of activities are necessary for providing the value for the customer and cut the wasteful activities from the process [13, 32]. Kanban visualizes workflow and helps in recognizing waste and constraints from value stream, e.g. major bottlenecks in value delivery [33].

Currently Case Company’s customer projects are managed and implemented in a tight collaboration with the customer. Case Company vendors SaaS supply chain management (SCM) software. SaaS stands for web-based delivery model, where software is hosted and continuously maintained by the vendor [39]. SaaS focuses on delivering software functionalities to a big group of customers over web [36]. Still, it has been recognized that tailoring of the software to meet different customers’ needs is required [36]. In Case Company, tailoring the software to meet customer’s needs is done via hosting software in a separate instance for each customer where customer specific configurations are done. The continuous tailoring, maintenance, delivery and upgrading of various customer instances require good management tools on
CHAPTER 1. INTRODUCTION

vendor side.

Current work with customer and managing of tasks is not harmonized, tools and templates are partially outdated and individuals and projects have liberty of choosing their tools and models. While in some projects finding their own tools and methods may lead to good results and well working practices, some projects fail finding good ways to manage projects which eventually causes overhead, issues and delays in project delivery work.

Thus, Case Company has recognized a need for more effective, sustainable and value bringing customer project delivery work together with more systematic management of projects and teams. Furthermore, as Case Company has been growing to many new independently working markets, they have realized the need for better sharing of knowledge and best practices among the markets. Currently, many of the best practices remain in silos and are not shared in the company, especially across the markets. Therefore, a lot of repetitive work exists in project delivery work, both in operational and management sides.

This Thesis contributes to research by 1) analyzing applicability and potential benefits of Lean and Kanban in distributed SaaS project delivery work, 2) combining action research with literature review and contextual design methods to analyze Case Company’s current task and project management practices and 3) providing a practical guidelines and suggestions to SaaS project delivery task and project management that could be later evaluated and used in similar cases.

1.2 Problem statement

This Thesis work is constructed around understanding the current task and project management situation at Case Company, its best practices and challenges. We focus especially on technical work in Case Company’s customer projects and how technical project managers manage the work together with business consultants, project manager and customer. We further study what benefits and possibilities Lean principles and Kanban method could provide for Case Company’s project work and later provide a set of concrete improvement suggestions for the future. Thus, the research problem that this Thesis addresses is:

How can Lean principles and Kanban method improve task and project management throughout the lifecycle of SaaS delivery projects?
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To structure the Thesis and solve the underlying research problem, we have defined a set of research questions. These questions are listed below and furthermore reasoned.

**Research Question 1:** What benefits Lean principles and Kanban method can provide for project and task management?

The first research question guides us to study concepts of Lean and Kanban, and their applicability in SaaS delivery projects with many times distributed teams: what different possible benefits they could provide for task and project management in terms of efficiency, effectiveness, collaboration, communication and transparency. This research studies Lean principles, especially focusing on value and waste, and how to make project delivery work more effective. Furthermore, we analyze what benefits previous research on the subject has recognized and revealed. Finally, we describe Kanban method, its benefits in existing studies and how it could be used to provide the improvements needed at Case Company.

**Research Question 2:** What are the current best practices and challenges of project and task management at Case Company?

The second research question guides us to analyze what are the current best practices and challenges of project and task management practices at Case Company. This analysis considers several different dimensions and departments of Case Company and provides background and motivation for the Thesis. To answer the question, good understanding of the current state of Case Company is required. Therefore, different levels of hierarchy and their best practices and challenges are studied and recognized. This analysis is based on observations, documentation, semi structured interviews and contextual inquiry performed in different departments and country market teams of Case Company.

**Research Question 3:** What suggestions can be given for improving project and task management at Case Company?

The last research question guides the Thesis towards analysis of use of Lean principles and Kanban method alongside with already recognized best practices at Case Company. We further study how those together could improve processes, communication and performance of project delivery and team work. Eventually we will provide a prioritized list of improvement suggestions that should guide Case Company’s project delivery and service
customer management to more efficient direction. This analysis also investigates future needs of different stakeholders for task and project management in Case Company, and gathers an initial list of requirements for future improvements.

1.3 Scope and objectives of the Thesis

This Thesis will focus on studying the known possibilities of Lean principles and Kanban method in task and project management and how those could help SaaS project delivery of Case Company. Empirical study of the Thesis will study how the task and project management is currently executed and what kind of best practices and challenges can be recognized. Finally, the two will be mapped together to create a set of suggested improvements and a model for Case Company’s SaaS delivery project task and project management. The research questions and objectives of the Thesis are gathered to Table 1.1.

<table>
<thead>
<tr>
<th>Research question</th>
<th>Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RQ1</strong>: What benefits Lean principles and Kanban method can provide for project and task management?</td>
<td>Study Lean and Kanban concepts and theory based on existing literature and case studies. Gather their possible benefits for project and task management based on characteristics and case studies.</td>
</tr>
<tr>
<td><strong>RQ2</strong>: What are the current best practices and challenges of project and task management at Case Company?</td>
<td>Do the analysis based on interviews and observations. Analyze potential improvement points.</td>
</tr>
<tr>
<td><strong>RQ3</strong>: What suggestions can be given for improving project and task management at Case Company?</td>
<td>Gather best practices from empirical study and characteristics and benefits from literature review and map them together. Provide improvement suggestions for Case Company’s project and task management to tackle the major challenges found</td>
</tr>
</tbody>
</table>
CHAPTER 1. INTRODUCTION

Within the boundaries of this Thesis work, we will focus more on project and task management from technical project manager point of view. Nevertheless, it is important to recognize that project delivery work consists of both technical and business personnel. Therefore, the empirical study considers both entities, in order to create a better image of the current state.

Our focus in this Thesis was to understand the current best practices and challenges from Case Company’s employees point of view, as we were also interested in internal team management and work. Even though, project delivery is implemented in a tight collaboration with customer and projects are managed together, we have not interviewed Case Company’s customers in this Thesis and therefore project and task management is presented only from Case Company’s employees perspective.

1.4 Structure of the Thesis

To answer the research problems and questions, this Thesis will follow following structure: first, in Chapter 2 we present the used research methods to recognize the current state and challenges in Case Company and create a solution to solve these challenges. In this Thesis, we used action research method together with contextual design to gather qualitative data from Case Company and analyze it. Furthermore, we reviewed existing literature to help us answer our research questions. In Chapter 3, we study the existing literature and analyze the characteristics and benefits of Lean principles and Kanban method. In Chapter 4, we analyze and recognize the best practices and challenges of project and task management at Case Company and later present the suggested improvements to tackle the major challenges. We discuss the main results in Chapter 5, where we focus on the most important results of each research question and compare them with existing research. In Chapter 6 we conclude the Thesis to three main conclusions and present potential topics for future study.

Table 1.2 summarizes how the research questions are related to literature and empirical parts of this Thesis, and gives an overview of the structure of this study.
Table 1.2: Research questions and methods

<table>
<thead>
<tr>
<th>Research question</th>
<th>Literature review</th>
<th>Empirical study</th>
</tr>
</thead>
<tbody>
<tr>
<td>RQ1</td>
<td>Characteristics of Lean and Kanban as presented in existing literature. Benefits of Lean principles and Kanban method as described in case studies and experience reports.</td>
<td>Evaluating the use of Lean principles and Kanban method in a pilot team and analyzing the found benefits</td>
</tr>
<tr>
<td>RQ2</td>
<td>Comparing challenges and best practices to those found from other case studies</td>
<td>Observations, interviews, open discussions, documents, reports and contextual inquiry. Analysis using contextual design methods such as affinity diagrams and work modeling in addition to action research methods.</td>
</tr>
<tr>
<td>RQ3</td>
<td>The characteristics and known benefits of Lean principles and Kanban method as presented in the literature</td>
<td>The current best practices and challenges of Case Company mapped together with literature review. Evaluation of a part of improvement suggestions in a pilot team</td>
</tr>
</tbody>
</table>
Chapter 2

Research methods

2.1 Overview of research methods and process

The main objective of this Thesis was to recognize the current best practices and challenges of project and task management in Case Company, and later analyze and provide potential solutions for the found challenges based on existing literature. Therefore, we selected action research as the main research method in this Thesis. According to Avison et al. [8], action research encourages researchers to apply and evaluate their theories in organizations. It is a combination of theory and practice, to solve recognized problem(s) systematically in real situations [8, 35]. Action research has various different descriptions [8, 21, 35], but eventually they are describing the same set of activities of recognizing, analyzing and solving problems and finally evaluating solutions [35]. This set of activities aligned with the objectives of this Thesis, and therefore action research provided a fitting conceptual research framework for our study.

The three stepped cycle of iterative action research activities has been defined by Avison et al. [8] as problem diagnosis, action intervention and reflective learning. Similarly iterative action research routine ”look, think, act” was described by Stringer [35]. In this Thesis work, we will follow the three steps defined by Avison et al. [8] while applying many good methods suggested by Stringer [35].

Before, throughout and after the Thesis work, we participated in multiple Case Company activities such as project delivery work as one of the project delivery team members as well as members of technical project delivery country market team. Furthermore, empirical study and evaluation of suggested improvements in this Thesis were done and discussed with various employees.
CHAPTER 2. RESEARCH METHODS

and teams at Case Company. Therefore, action research in this Thesis could be addressed as a participatory action research.

This Thesis work started as observations and corridor talks that we applied systematically, discussing with different people in different teams at Case Company. This mainly focused on understanding the current situation on a high level, target audience being technical project managers (TPMs) from different teams and markets. The research question addressed with this was: What are the current best practices and challenges of project and task management at Case Company? Thus, in this phase, we practiced first step of action research: problem diagnosis. According to Stringer [35], the first stage of action research is to understand the stakeholders, their experiences and perspectives in a form of qualitative research. In the second stage of action research, as per Stringer [35], the analysis of first stage’s qualitative data is done. In our Thesis these two activities, gathering and analyzing the data, were part of problem diagnosis step.

We could recognize different challenges in current task management within the teams and thus the need for more systematic project delivery work and team collaboration. This led us to analyze applicability of Lean principles and Kanban method in technical project delivery work. Reasons to analyze especially Lean and Kanban rather than other methods or frameworks were due to the multidisciplinary and fast paced nature of project delivery work, rapidly changing requirements and Case Company’s need for more effective work and focus on customer value. This led us to our second research question: What benefits Lean principles and Kanban method can provide for project and task management? In this phase, we applied the second step of action research: action intervention. According to Stringer [35], based on the analysis of problematic situation the needed actions can be derived. Action intervention step in this Thesis was highly based and linked to literature review.

We then created an initial presentation and suggestion of use of Lean principles and Kanban method in TPM teams and project delivery work, which we validated with TPMs that had recognized the initial problems. In these sessions we received feedback and improvement suggestions. One improvement suggestion was to use Kanban boards in different levels of hierarchy and synchronize these boards together to better manage country team’s projects and whole Case Company’s project portfolio. This phase addressed then the third step of action research: reflective learning. As Stringer states [35], evaluation and redevelopment leads to effective solutions.

This led us to our second iteration, where we started to study the current challenges (and best practices) even deeper. We conducted a set of semi-structured interviews with various TPMs and PMs. These interviews
are further discussed in Chapter 2.3.2.1. We analyzed the interviews using contextual design methods such as affinity diagrams and work modeling alongside with good practices of action research as per Stringer [35]. These are further discussed in Chapter 2.3.3.

After the analysis of empirical data and recognition of current challenges and best practices, we studied literature on Kanban and Lean. We analyzed their benefits and applicability together with current best practices to tackle the recognized challenges and furthermore provide additional value to task and project management. The process of literature review is further discussed in Chapter 2.2. Finally, the good practices of Kanban and Lean together with the best practices of current task and project management of Case Company were used to form future improvement suggestion for Case Company’s project and task management. This led to us to answer the third research question "What suggestions can be given for improving project and task management at Case Company?"

After creating a suggested improvements for Case Company, the ideas were presented to a set of stakeholders. Furthermore, use of Lean principles and Kanban method was piloted in one technical team managing continuous service customers at Case Company. Goal was to evaluate the suggested improvements and thus apply third step of action research: reflective learning. Furthermore, this helped us further analyze the benefits of Lean principles and Kanban method at Case Company.

The research process in this Thesis consisted of three iterative steps of action research alongside with literature review, contextual design and action research methods, shown in Figure 2.1. These steps were finally executed in two iterations. The iterations, steps and research methods are illustrated in Table 2.1.

In the following Chapters we will discuss literature review and empirical study of this Thesis further and analyze the selected research methods.
Figure 2.1: Suggested three steps of action research as discussed by Avison et al. [8] with practiced research methods
Table 2.1: Action research iterations, steps and actions

<table>
<thead>
<tr>
<th>Action research step</th>
<th>Iteration 1</th>
<th>Iteration 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Problem diagnosis</td>
<td>Analysis of current challenges based on corridor talks, observations, documents, reports and contextual inquiry</td>
<td>Deeper interview study of current situation, best practices and challenges and analyzing the empirical data</td>
</tr>
<tr>
<td>Action intervention</td>
<td>Initial literature review of Lean and Kanban, their characteristics and applicability at Case Company and creating a presentation on the topic</td>
<td>Mapping the empirical study against literature on Lean and Kanban and defining the target state and suggested improvements at Case Company</td>
</tr>
<tr>
<td>Reflective learning</td>
<td>1-on-1 meetings with TPMs that acknowledged the initial problems and evaluating concepts of Lean and Kanban with them. Presenting the ideas to a set of stakeholders and receiving feedback.</td>
<td>Evaluation of suggested improvements with a pilot technical team and presenting suggestions to a set of stakeholders and receiving feedback. Listing main findings, conclusions and future research</td>
</tr>
</tbody>
</table>
2.2 Literature review

The literature review part of the Thesis focused on research question: What benefits Lean principles and Kanban method can provide for project and task management? Based on the initial action research and problem recognition, we saw an opportunity at Case Company to apply Lean principles and Kanban method to improve project delivery task and project management in different levels of hierarchy.

To begin the literature review, we recognized a set of keywords and used those in queries in different search engines and libraries. Keywords, search engines, results and gathered sources are listed in Table 2.2.

With our keywords and searches, we got numerous results from different search engines and digital libraries. To limit the results, we had to do filtering. The initial selection of the sources for the Thesis was based mostly on topic and abstract of the source, alongside the publication date and number of times the source had been used as a reference. Finally, more recent and referred sources were preferred, as we believe that these are studies that set the direction of the industry and future research currently. Also, the match of the keywords of this Thesis against the source topic and abstract was used as an initial filter.

After the initial selection of sources we further read the sources. This included expanding reading to introduction and conclusion chapters especially. Furthermore, we were looking for additional sources from the bibliographies of promising studies.

Finally, this resulted to a list of sources that were used as references especially in the research method and literature review part of the Thesis. From the final set of sources, we were gathering especially following topics from Lean and Kanban, two main concepts of this Thesis:

- Characteristics: what are the basic characteristics of the key concept
- Applications and benefits: in which contexts and domains the key concept has been used, what kind of benefits has been recognized and from which characteristics the benefit stems from

Finally, these findings were used along with empirical study data to create the suggested model and framework for Case Company’s technical project delivery task and project management.
Table 2.2: Literature review sources

<table>
<thead>
<tr>
<th>Search engine</th>
<th>Keywords</th>
<th>Number of results</th>
<th>Number of sources selected for further reading</th>
<th>Number of sources through snowballing</th>
<th>Final sources</th>
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<td>-</td>
<td>[36, 39]</td>
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<tr>
<td>Google Scholar</td>
<td>Lean software</td>
<td>1 090 000</td>
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<td>-</td>
<td>[31, 32]</td>
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<tr>
<td>Google Scholar</td>
<td>Lean software engineering</td>
<td>273 000</td>
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<td>[22, 30]</td>
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<td>Google Scholar</td>
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<td>-</td>
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<td>Google Scholar</td>
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<td>-</td>
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<td>Lean software service management</td>
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<td>[13, 38]</td>
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<td>Google Scholar</td>
<td>Kanban software as a service</td>
<td>18 100</td>
<td>17</td>
<td>4</td>
<td>[2, 4, 9, 10, 16, 18, 19, 25, 27–29, 37]</td>
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<tr>
<td>Google Scholar</td>
<td>Kanban software</td>
<td>27 000</td>
<td>12</td>
<td>1</td>
<td>[1, 3, 6, 17, 23, 33, 34]</td>
</tr>
<tr>
<td>Aalto University library</td>
<td>Kanban</td>
<td>38</td>
<td>3</td>
<td>-</td>
<td>[5, 6, 22]</td>
</tr>
<tr>
<td>Aalto University library</td>
<td>Lean software</td>
<td>117</td>
<td>2</td>
<td>-</td>
<td>[31, 32]</td>
</tr>
<tr>
<td>Aalto University library</td>
<td>Agile and Lean software development</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>[24]</td>
</tr>
<tr>
<td>Aalto University library</td>
<td>Action research</td>
<td>1 684</td>
<td>2</td>
<td>1</td>
<td>[8, 21, 35]</td>
</tr>
<tr>
<td>Aalto University library</td>
<td>Contextual design</td>
<td>-</td>
<td>1</td>
<td>1</td>
<td>[14, 15]</td>
</tr>
</tbody>
</table>


2.3 Empirical study

2.3.1 Case description

Case Company studied in this Thesis is a medium sized Finnish software company vending and delivering a supply chain management software as a service for its customers. The software consists of a core software with a set of basic functionalities but has a high level of configurability. Whereas the core software and its development are the responsibility of product management, development and release management teams, tailoring and delivery of software to Case Company’s customers is executed in multidisciplinary teams of technical and business personnel. Project work consists of at least one technical project manager (TPM), project manager (PM) and supply chain consultant from Case Company, and their counterparts at the customer.

Case Company studied in this Thesis has been under heavy growth throughout the past years. This growth during over thirteen years has taken the company from a small one market business-to-business (B2B) software company to medium sized global SaaS software company with over 400 employees and 10 country offices operating in many continents. Furthermore, the size of the projects and customers has been constantly growing, and the focus of Case Company has shifted towards bigger cases. These recent changes at Case Company had begun to posses challenges in how projects and tasks are managed in ever growing number and size of new projects and continuous service customers, and furthermore how to do resourcing and divide teams and responsibilities in such settings.

Case Company’s current organizational models, project methodologies and processes have been starting to get outdated: projects and deliverable software have changed throughout the years, the current processes do not scale up anymore and more unified and organized way of working has been asked for by both technical and business personnel. Furthermore, there is a need for becoming more effective and cost efficient in customer project delivery. Therefore, a need for improvements in task and project management had already been recognized by both technical and business personnel.

To further and better understand the actual current challenges, we conducted an empirical study in multiple project and country teams. The goal of the empirical study was to understand the current state in Case Company: what are the current best practices and how could those be expanded to all the project and country teams and what are the current challenges and how could those be tackled in the future. Therefore, the main research questions addressed in the empirical study were: What are the current best practices and challenges of project and task management at Case Company? and What
suggestions can be given for improving project and task management at Case Company? Furthermore, we evaluated use of Lean principles and Kanban method in a pilot team at Case Company, and thus we answered shortly to research question *What benefits Lean principles and Kanban method can provide for project and task management?* in our empirical study as well.

In this Chapter, we go through the methods used in empirical data gathering, analysis and action and evaluation of suggested improvements.

### 2.3.2 Data collection

#### 2.3.2.1 Interviews

According to DiCicco-Bloom and Crabtree [11], interviews are one of the most familiar means for collecting qualitative data. There are different types of conducting interviews but they mainly fall into three categories: structured, semi-structured and unstructured interviews [11]. Structured interviews are more related to questionnaires and produce more often quantitative data than semi-structured or unstructured interviews that are closer to guided conversation [11]. Interviews may provide in-depth information about the individuals, and that should be the objective: to get to know more about the interviewee [11]. Interviews let the interviewees to discuss their experiences and reveal features regarding the studied issue [35].

In this thesis work we conducted sixteen semi-structured interviews that lasted between 45 - 90 minutes each. As DiCicco-Bloom and Crabtree suggest [11], semi-structured interviews were scheduled in advance at specific time and location outside from everyday work. We concluded an initial set of 31 open ended questions for technical side employees and 33 open ended questions for business side employees defined in Appendices A.1 and A.2 respectively. These were used as a backbone for the interviews, not necessarily all the questions were asked and in most interviews additional questions were presented. This highlights the semi-structured nature of our interview study.

In action research, the researcher should not be influencing finding the issues and problems but rather let the interviewees explore and express the challenges in their work in their own terms [35]. Furthermore, Stringer [35] defines different types of questions that researcher could go through in the interview study. Grand tour questions should guide the interviewees to explain the situation in their own words [35]. These may be two different types: typical questions and specific questions [35]. Whereas typical question asks the interviewee to explain how things are usually done, specific question asks for explanation of a specific situation or event [35]. An example of typical question used in our interview studies is: "How are tasks managed currently
“Do you recognize yourself in following situations... Could you give an example of such a situation?”.

To receive even in more detailed understanding of current situation, we used guided tour questions e.g. asking the interviewees to show and walk-through their current task and project management systems. Guided tour questions let the interviewee to explain in detail the activities and different stakeholders of the setting [35]. Guided tour questions let us better understand the current state of project management, employees’ actions and workflow.

We focused on four different markets, referred as A, B, C and D in this Thesis. In addition to these markets, Market E was studied partly as some of the interviewees from the main focus markets worked simultaneously in Market E. The descriptions of the studied markets are gathered into Table 2.3 and all the interviewees are listed in Table 2.4.

The goal with the interviews was to understand the current state of task and project management especially in technical project delivery teams. We wanted to recognize the current best practices and challenges of task and project management and how TPMs work individually, together as market teams and as a part of project teams with business side PMs. We wanted to understand the activities that are currently done, what possible waste there is and how the maximum value could be provided for the customer. Also, we wanted to study how teams manage themselves and allocate tasks within the teams. This provided an insight to resource management and allocation within projects, teams and markets.

We categorized the questions to five different categories that were used to steer the interviews to right direction and provide answers to our research questions:

- **Interviewee background** This category of questions tried to understand the interviewee better and authorize and place the person to right place in Case Company

- **Project management** In this category of questions, we wanted to better understand the lifecycle of projects at Case Company. We wanted to recognize the different activities, participants and objectives of these different phases. Furthermore, we were interested in seeing what kind of tools project managers currently use to manage the projects and how is it carried out.
### Table 2.3: Studied markets and teams

<table>
<thead>
<tr>
<th>Market</th>
<th>Description</th>
<th>Number of on-going projects</th>
<th>Number of service customers</th>
<th>Number of project work employees</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Located in the headquarters of the Case Company and oldest market of the company. This market has experienced some challenges lately with how to manage the big team of people, new employees and work among them especially in TPM side</td>
<td>36</td>
<td>27</td>
<td>46</td>
</tr>
<tr>
<td>B</td>
<td>Alongside A the biggest and oldest market of Case Company. It is a stable market with distributed teams where technical and business resources are located in different countries.</td>
<td>15</td>
<td>27</td>
<td>32</td>
</tr>
<tr>
<td>C</td>
<td>Stable and big market with a lot of experience. This team also works remotely between two countries but still has a big team (technical and business) of people sitting in the same area in Case Company’s headquarters.</td>
<td>18</td>
<td>9</td>
<td>26</td>
</tr>
<tr>
<td>D</td>
<td>New and big market. Has a remote technical team which highlights the challenge of managing the work between two sites in different time zones with 7-8 hours of time difference.</td>
<td>10</td>
<td>4</td>
<td>25</td>
</tr>
<tr>
<td>E</td>
<td>New and small market.</td>
<td>4</td>
<td>0</td>
<td>10</td>
</tr>
</tbody>
</table>
### Table 2.4: Interviewees

<table>
<thead>
<tr>
<th>Role</th>
<th>Experience at the Case Company</th>
<th>Market</th>
<th>Current duties</th>
<th>Number of projects</th>
</tr>
</thead>
<tbody>
<tr>
<td>TPM</td>
<td>One and half year</td>
<td>A</td>
<td>Full time senior technical project manager</td>
<td>4</td>
</tr>
<tr>
<td>TPM</td>
<td>One year</td>
<td>A</td>
<td>Full time senior technical project manager</td>
<td>5</td>
</tr>
<tr>
<td>TPM</td>
<td>10 months</td>
<td>A &amp; E</td>
<td>Part time junior technical project manager</td>
<td>2</td>
</tr>
<tr>
<td>PM</td>
<td>Three and half years</td>
<td>A</td>
<td>Business owner and project owner, leading and mentoring team of project managers</td>
<td>-</td>
</tr>
<tr>
<td>TPM</td>
<td>Three years</td>
<td>A</td>
<td>Full time senior technical project manager and team lead</td>
<td>4</td>
</tr>
<tr>
<td>PM</td>
<td>Three years</td>
<td>A</td>
<td>Business owner and project owner, leading and mentoring team of project managers</td>
<td>-</td>
</tr>
<tr>
<td>TPM</td>
<td>One year and ten months</td>
<td>B</td>
<td>Full time senior technical project manager</td>
<td>10 - 15</td>
</tr>
<tr>
<td>TPM</td>
<td>Two and half years</td>
<td>B</td>
<td>Full time senior technical project manager</td>
<td>1</td>
</tr>
<tr>
<td>PM</td>
<td>Two and half years</td>
<td>B</td>
<td>Business project manager and supply chain consult</td>
<td>1</td>
</tr>
<tr>
<td>TPM</td>
<td>One year and four months</td>
<td>C</td>
<td>Full time senior technical project manager</td>
<td>4</td>
</tr>
<tr>
<td>TPM</td>
<td>One and half year</td>
<td>C</td>
<td>Part time junior technical project manager</td>
<td>1</td>
</tr>
<tr>
<td>PM</td>
<td>Two years</td>
<td>C</td>
<td>Business project manager and supply chain consult</td>
<td>4</td>
</tr>
<tr>
<td>TPM</td>
<td>Three years</td>
<td>D</td>
<td>Full time senior technical project manager</td>
<td>1</td>
</tr>
<tr>
<td>TPM</td>
<td>Two and half years</td>
<td>D &amp; E</td>
<td>Full time senior technical project manager, working still in two different markets. Team lead for remote technical team</td>
<td>1-3</td>
</tr>
<tr>
<td>PM</td>
<td>Two years</td>
<td>D</td>
<td>Business project manager and supply chain consult</td>
<td>1</td>
</tr>
<tr>
<td>PM</td>
<td>Three and half years</td>
<td>D</td>
<td>Responsible of both technical and business operations of given market</td>
<td>-</td>
</tr>
</tbody>
</table>
• **Interviewee’s and team’s tasks** In this category of questions, we wanted to find out the current best practices and challenges in task management, what is the tasks’ current lifecycle and what kind of processes and methods there are currently. As a result we wanted to do value stream mapping and thus create a basis for a potential Kanban board.

• **Current workload, value and waste** With this category of questions we wanted to recognize the possible waste in the current processes and management and map it with seven wastes of Lean [13, 24, 31, 38]. Furthermore, we want to understand how, if at all, the delivered value is measured before and after completing tasks.

• **Team work** With this set of questions, we wanted to understand how the individuals work in teams and with whom they interact in their work. We wanted to recognize the current state of the company, whether people tend to work individually or with a group of people and how that affect their work. The goal was to understand the need for team work and communication within and among the teams. Furthermore, we wanted to analyze what are the best practices and challenges of communication and team work currently from task and project management point of view.

We did audiotape recording and field notes during our interviews, two data recording methods described by Stringer [35]. Field notes were used mostly as a support for audiotape recordings and to take notes of observations that could not be derived from recordings, such as facial and emotional expressions. Both methods were used only after permission of the interviewee, and is some cases were later sent to her for proof-reading and checking the accuracy as suggested by Stringer [35].

The interviews were executed during two months period, with maximum of one interview per day and two to three interviews a week. Ideally there were one to three days between sequent interviews for transcription, analysis and reflection on previous interviews. According to Holtzblatt and Jones [15], reviewing the interviews is important to analyze the focus of the interview research. The interviews were transcribed as soon as possible after the interviews as suggested by Stringer [35] and Holtzblatt and Jones [15]. This especially facilitated a continuous analysis and improvement of the interviews, their structure, questions and objectives. Furthermore, we used the time between interviews to improve our skills in guiding the interviews. Improvements were especially done to the questions and letting the intervie-
wee to find and describe the issues without influencing them with additional questions or other guidance.

Especially challenging part of the interview study was translating some of the interviews from Finnish to English. Also the spoken language differs from written one and transcribing interviews to text may have an effect of losing meaningful information. In general, transcribing tape-recorded interviews to text is time consuming and demanding job - especially including translation work. This is also recognized by DiCicco-Bloom and Crabtree [11] and Holtzblatt and Jones [15].

2.3.2.2 Observations, documentation and contextual inquiry

Contextual design tries to bring user data into design through sequence of activities, in a way that the user data can be used in design activities [14]. Contextual design is especially used for user interface, product and service design. In this Thesis, contextual design and inquiry methods were used in align with action research methods in helping to analyze the current situation, different activities and processes better and later on creating new models and improvement suggestions for those. The first step of this approach is contextual inquiry [14].

Contextual inquiry is a research method where the researcher observes the users and their normal activities, and later possibly discusses the activities with the user. Most of the time this is in a form of contextual interview performed by a team of designers, where the user is observed at her work and asked questions and interrupted [14]. Contrary to a traditional interview, explained in the previous Chapter, this is not done in isolation or away from the work, but actually within the context and therefore benefiting from the real experience happening simultaneously [14]. According to Holtzblatt and Beyer [14] this has the benefits of designers to understand the user’s world and thus involving the user in design process that way. Involving user like this, rather than user participating in design, has benefit of that user does not have to learn or understand the design process itself [14].

Contextual inquiry is fairly similar activity as observations in action research defined by Stringer [35]. As Stringer mentions [35], observation in action research is related to ethnography, focusing to understand the environment and activities of the observed. In observation, the researcher should take field notes regarding places and locations of activities, people involved and their roles, objects, a set of acts (activities) taken, related events, purposes and objectives of people, duration and frequency and finally feelings emerging from activities [35].

In this Thesis contextual inquiry and observations were performed espe-
cially when we participated in team and market responsible meetings, where responsible discussed current status of their markets’ projects as well as resource situations. Furthermore, we were part of various project teams and one technical market team throughout the Thesis work. We continuously did observations and notes of current work practices of co-employees as well as customers. We also observed other teams and stakeholders working in their everyday life and asking them questions, thus applying contextual inquiry.

In addition to observations and contextual inquiry, we also studied the existing documentation and other written sources of Case Company, taking notes and summaries of significant information related to Thesis topics. Most of the reviewed material was found from Case Company’s wiki pages, online communication channels and project documentation.

2.3.3 Data analysis

To analyze the gathered empirical data, we used contextual design methods such as affinity diagrams and work modeling alongside with analysis practices used in action research as defined by Stringer [35].

After transcribing the interviews and gathering our observations and notes to documentation we distilled the data from them. We wrote down facts about the stakeholders, their activities and our ideas on Post-It notes, as suggested by Holtzblatt and Beyer [14]. After finishing all the empirical data, we gathered the notes to clusters which were named and collected to higher-level groups [14]. This representation of data is referred to as affinity diagram by Holtzblatt and Beyer [14].

Affinity diagram has multiple similarities to categorizing and coding method used in action research. Basically, the clusters of notes, higher-level named groups, of affinity diagrams [14] are equal to categories and their coding [35]. Affinity diagrams are a bottom-up process of analyzing and structuring large amount of information [15].

In this study, we created four separate affinity diagrams, one per Case Company market resulting to over 700 Post-It notes. Our affinity diagram groupings are illustrated in Appendices B.1, B.2, B.3 and B.4. We had two level grouping where we first grouped similarly themed Post-Its together and eventually we further clustered several groups together. This led to five high level groups: project management, task management, teamwork and communication, waste and future improvement needs. All of these high level groups are discussed further in our empirical study in Chapter 4. Final affinity diagrams of the four markets are illustrated in Figure 2.2.
Figure 2.2: Affinity diagrams from four Case Company market interview studies

Based on this data, we began to create work modeling. Work modeling represents the stakeholder’s work: its roles, communication, information, tasks, steps, motivation and strategy [14]. Holtzblatt and Beyer [14] defines four types of models: context, physical, flow and sequence work models. Basically these models represent the different parts of stakeholder’s work.

Context work model is a representation of organizational culture, its standards, procedures and policies. Physical work model shows the physical environment and space effect to work. Flow work model represents the different kind of roles of the stakeholders and what kind of communication and coordination there exists between them. Sequence work model shows the sequence of actions for the important activities in work and thus represents the different tasks stakeholders do. With such models and diagrams, the work can be explicitly described and the common understanding of stakeholder’s work can be communicated better. [14]
Especially flow and sequence work model were used in this Thesis to understand the different roles and responsibilities of stakeholders, their team work and communication and value bringing activities. Eventually this resulted to value stream mapping and creating the initial Kanban board in action and evaluation phase of our action research.

### 2.3.4 Action and evaluation

After the data analysis we gained understanding of stakeholder’s work and had modeled it. Furthermore, we were able to recognize the current challenges and best practices at Case Company. Thus, we started to create our suggested solutions for the future. Holtzblatt and Beyer [14] suggest creating new models for each work model type, but removing details of each stakeholder’s work [14]. Thus, anything that is left out from these abstract models will not be supported by the new system or way of working. This way the designers can recognize the whole organization / market needs separated from the individual ones but still being based on the individual user research [14].

Then, Holtzblatt and Beyer suggest [14], that the new model should be reflected against the original user data and new contextual inquiries conducted with new users.

In this Thesis, we applied the contextual design methods so that we could create the new work models for Case Company’s task and project management. The new models were created especially on top of the found best practices both in current task and project management at Case Company and found benefits of Lean principles and Kanban method in literature. We focused especially on flow and sequence work models in form of mapping workflow and creating a new model for communication and organizational roles, hierarchies and team formations.

When the new models were solid, we could start to design the environment of the user. This represents how the user’s work will be structured within the new system and way of working [14]. Holtzblatt and Beyer [14] highlight that the consideration should be in what are the parts of the system and their relations. Thus, the final result of this phase will be requirements on the implementation, system data model and structure of the UI [14]. This structure would be testable with walkthroughs with scenarios and thus usability problems recognized could be fixed even before the user interface (UI) design [14]. In this Thesis, we found a set of requirements for project and task management tool. Later we used work models to create a system design to illustrate what kind of tool and model of working could tackle the found challenges and fullfill the recognized needs and requirements of the users.
Final stage in contextual design is to design UI, which reflects the user environment design on a specific platform [14]. According to Holtzblatt and Beyer [14], when creating the UI it should be designed in such a manner that by its looks the user can understand which part is used for which kind of work. One way of designing the UI is by mockup prototypes. The benefits with prototypes is that they provide an interaction between the design and the user, and could be easily modified. They work as a tool for communication between designers and users as well. Good way of using prototypes is performing usability tests with them and iteratively better them [14]. Prototypes also let the design team to test different alternatives with the customer [14].

In this Thesis, we created initial Kanban boards to represent users work and how it could be managed in future project and task management tool. Furthermore, we created a set of improvement suggestions for future task and project management. We presented our initial Kanban boards to one pilot team, that later implemented our suggested solution of using Kanban board to manage team’s all projects in a single place. We then conducted new contextual inquiries and interviews with this team to analyze the results of the new model.
Chapter 3

Literature review

The literature review part of this Thesis, focuses on two main subjects: Lean and Kanban. The two are closely linked together as Kanban is based on Lean principles. Lean is a set of principles and an ideology, first created to guide manufacturing at Toyota where it had huge impact on efficiency [30]. After Toyota’s supremacy, the ideology has been applied to many different domains and industries. Poppendieck M. and Poppendieck T. were the first ones to apply those principles in software development [31]. Later on, different applications of Lean in different industries led to also copying Lean tools, methods and practices across the industries. Kanban, has been argued to be a good method to introduce Lean principles in an organization [30].

First we will give the definition of Lean and its principles. This review is done based on studies of Lean in different disciplines and domains. We base our categorization of Lean principles in several studies and use them to later support Case Company’s lean transformation and management in the future. Second, we study Kanban practices and elements. Finally we analyze the benefits of Lean and Kanban based on existing case studies and later analyze the results of literature review and found results. Based on the found benefits of Lean and Kanban, we list the main Lean categories and Kanban elements that result to these benefits. We will later use this knowledge to create a suggested model of Lean and Kanban as a method to guide Case Company’s task and project management across different levels of hierarchy.

3.1 Lean

Lean is a set of principles and an ideology, first created to guide manufacturing and later development of products and services. Originating from
Toyota’s manufacturing practices and their supremacy in efficiency in automobile industry [30], Poppendieck M. and Poppendieck T. applied those principles to software development [31]. Lean development focuses on discovering and delivering value throughout the whole life-cycle of the product [30].

Table 3.1: Categories and principles of Lean

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Waste and Value</td>
<td>Value</td>
<td>Eliminate waste</td>
<td>Eliminate waste</td>
<td>Eliminate waste</td>
</tr>
<tr>
<td>2. Quality</td>
<td>-</td>
<td>Build integrity in</td>
<td>Build quality in</td>
<td>Build quality in</td>
</tr>
<tr>
<td>3. Knowledge</td>
<td>-</td>
<td>Amplify learning</td>
<td>Create knowledge</td>
<td>Learn constantly</td>
</tr>
<tr>
<td>4. Decisions</td>
<td>Pull</td>
<td>Decide as late as possible</td>
<td>Defer commitment</td>
<td>-</td>
</tr>
<tr>
<td>5. Fast delivery</td>
<td>Flow</td>
<td>Deliver as fast as possible</td>
<td>Deliver fast</td>
<td>Deliver fast</td>
</tr>
<tr>
<td>6. People and team</td>
<td>-</td>
<td>Empower the team</td>
<td>Respect people</td>
<td>Engage everyone</td>
</tr>
<tr>
<td>7. Value stream</td>
<td>Value stream</td>
<td>See the whole</td>
<td>Optimize the whole</td>
<td>Optimize the whole</td>
</tr>
<tr>
<td>8. Continuous improvement</td>
<td>Perfection</td>
<td>-</td>
<td>-</td>
<td>Keep getting better</td>
</tr>
</tbody>
</table>

According to Poppendieck M. and Poppendieck T. [32] there are seven principles of Lean software development that emerged from having seen how waterfall approach failed in even relatively small projects. These seven principles have been defined in different ways in various studies [24, 30–32] and have been evolving throughout the years. Furthermore some studies define five [38] and some even up to 14 principles [25]. This highlights that there is
no pure Lean approach and all of them are context-dependent [26]. We have mapped the different specifications of Lean principles used in this Thesis to Table 3.1 and furthermore, we have classified the principles to eight categories of Lean that are used in this Thesis to categorize the Lean principles. We also discuss some of the 14 principles defined by Liker [25] that have most similarities to the ones defined by other studies. In the Table 3.1, the Lean principles are ordered from the oldest publication on the left, to the latest on the right. This illustrates the evolution of Lean principles and similarities between different domains.

In the following subchapters, we will go through these categories and principles. Furthermore, we focus more precisely on waste and value, two core terms of Lean, and what they stand for and how those could be recognized.

### 3.1.1 Waste and Value

Lean is based on understanding and recognizing the waste, i.e. non-value adding activities, and eliminating it from the process [13]. Thus, the first principle of Lean is to Eliminate waste that refers to eliminating all the possible non-value-adding activities, resources etc. that happen between the certain timeline (with a start and end) of a process [32]. According to Poppendieck M. and Cusumano M. [30], anything that does not add value for the customer directly or increase knowledge how to deliver the value more effectively is waste. According to Hicks [13], only after recognizing the waste is possible to do improvements in processes and apply Lean tools.

The main focus of Lean is to recognize waste and later on mitigate its effect on projects, and therefore improve lead-time, become more productive and decrease use of resources [17]. But to understand what is waste, one needs to understand what value means [32, 38]. According to Womack and Jones [38], it is the customer who defines value in terms of a product and service and how they meet customer needs at a specific price and time. Womack and Jones [38] argue that defining the value is the very first step in Lean thinking. Similarly, according to Poppendieck M. and Poppendieck T. [32], having an understanding of value is the first step to eliminate the waste.

Only after understanding what the customer values, it is possible to recognize what interferes with delivering that value [32]. Poppendieck M. and Poppendieck T. [32] recognize extra features to be one of the biggest waste of software projects and thus encourage to incremental development - one of the practices of Lean. According to Poppendieck M. and Cusumano M. [30] the biggest sources of waste in software development are finding and fixing defects, unnecessary features, lost knowledge in handovers, partially done work and multitasking. They further argue that these wastes stem
from partially done work, delays and lost knowledge all due to boundaries between different functions [30]. Poppendieck M. and Poppendieck T. [32] also reason that boundaries between different teams and functions are one of the major causes of waste in software development.

The goal of the Lean is to create a continuous flow with little waste between stages in value stream [25]. Liker [25] argues that forcing continuous flow into process will bring the problems to surface. These problems occur in a form of a waste that should be eliminated. Furthermore, leveling out the workload helps in minimizing the waste and not overloading the people [25].

As a good tool to recognize the waste in process, many Lean studies encourage to do value stream mapping, meaning recognizing all the steps and activities in the process that add the value and how big of an effort is needed to add the value and how much of time is wasted in waiting [24, 31, 38]. According to Poppendieck M. and Cusumano M. [30], looking at the flow of the value through the whole value stream facilitates recognizing the sources of waste and reacting to those. Womack and Jones [38], encourage to do value stream mapping as the second step in applying Lean thinking into the organization.

Seven wastes were recognized in manufacturing systems by Ohno [27] and Womack and Jones [38]. Later, the same seven wastes were converted to software industry by Poppendieck M. and Poppendieck T. [31]. We have gathered the sources of waste and what they stand for in different industries as per Womack and Jones [38] and Hicks [13] in manufacturing, and Poppendieck M. and Poppendieck T. [31] in software development into Table 3.2.

**Overproduction** is considered as extra features in software industry, i.e. features that are not used and/or features that were not requested by customer causing loss of effort and resources but also increasing the complexity [24, 31]. Extra features need to be tracked, developed, integrated and tested, which consume resources [17]. Furthermore, it causes a risk for the future as it is a one more point of failure [31].

**Waiting** is a waste that does not add value for the end product or service [17]. Delay blocks the realization of value for customer [31] and is an inactivity period where there is no progress on a task. According to Poppendieck M. and Poppendieck T. [31] waiting and delay is directly related to the time in which team can respond to critical customer requests.

**Transport** is considered as task switching in software industry [24, 31]. This happens especially when resources are assigned to multiple projects [31]. Multitasking may lead to unnecessary overheads and mistakes, especially due the time taking to re-orientate between different tasks and issues [17]. Furthermore, it slows the delivery and causes delay [31].
### Table 3.2: Seven wastes of Lean

<table>
<thead>
<tr>
<th>Source of waste</th>
<th>Manufacturing [13, 38]</th>
<th>Software development [31]</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Overproduction</td>
<td>Overproducing the products leads to excess of products and increased inventory.</td>
<td>Extra features</td>
</tr>
<tr>
<td>2. Waiting</td>
<td>Periods of inactivity in downstream activity when upstream activity has not delivered on time</td>
<td>Waiting for other people’s / teams’ input</td>
</tr>
<tr>
<td>3. Transport</td>
<td>Unnecessary motion and transportation of materials</td>
<td>Task switching</td>
</tr>
<tr>
<td>4. Extra processing</td>
<td>Extra operations such as rework because of defects</td>
<td>Extra processes, that add no value for the customer, e.g. paperwork that no one is waiting to be finished</td>
</tr>
<tr>
<td>5. Inventory</td>
<td>Extra inventory that is not needed to fulfill customer needs and orders</td>
<td>Partially done work</td>
</tr>
<tr>
<td>6. Motion</td>
<td>Motion and extra steps needed by employees that do not add value to the product or service</td>
<td>Motion and handovers. Unnecessary physical and information movement</td>
</tr>
<tr>
<td>7. Defects</td>
<td>Products and services not meeting customer’s expectations leading to dissatisfaction and rework</td>
<td>Defects and bugs, similarly causing rework and dissatisfaction.</td>
</tr>
</tbody>
</table>

In the study of Ikonen [17], they recognized that large amount of open tasks led to task switching, which then lead to partially done work. Furthermore, he recognized that in some cases task switching was option for waiting when team members were waiting for others to finish and then meanwhile
they started other tasks [17]. This highlights the relation between different wastes and how one waste can launch a vicious circle of waste in project.

**Extra processing** are processes that are non-value-adding activities, such as unnecessary documentation, which only consumes resources [17] and customer does not perceive any value out from it. As an example, Poppendieck M. and Poppendieck T. [31] mention that if no one is waiting for a paperwork to be finished, it is likely to not produce any value. The question to be asked in all the processes and their value would be: does customer feel like this process makes the product to provide more value for them [31].

**Inventory** is considered as a partially done work in software industry, i.e. unimplemented or partially implemented features and designs [24, 31]. In software development, partially done work tend to become outdated and it delays other work that needs to be done [31]. In the empirical case study of Ikonen [17], they recognized that delays and not having progress with tasks caused partially done work which later on caused task switching and even more delay in project.

**Motion** is seen as physical distance between resources, knowledge and information sharing and handovers between teams or team members in software industry [17]. This waste is similar to extra processing, but focuses more to individual task level and unnecessary physical and information level movement [24, 31]. Handing over information between people has high possibility of losing information [31]. Ikonen [17] recognized that a centralized communication model where one person handles e.g. customer communication, caused waste of motion and knowledge sharing. Poppendieck M. and Poppendieck T. [31] suggest that teams should work in a single room when possible, so that the information is always at hand and the answers to questions are instant.

**Defects** are considered as defects and bugs that cause rework and customer dissatisfaction [24]. Furthermore, bugs and defects that are found long time after delivery are even more wasteful since it requires re-orientation similarly as with multitasking and task switching [17]. Ikonen [17] recognized this as an issue especially in their case project where feedback was slow and team had to wait for the feedback longer and thus started other tasks. Poppendieck M. and Poppendieck T. [31] discuss that the waste caused by defect is derived from its impact and time it has gone undetected. Therefore, they see finding and solving defects immediately after they have occurred as a major way of reducing the impact of defects and amount of waste they produce [31]. This then again, is highly related to Lean principle of delivering fast and that way enabling fast feedback and improvements [31].

Based on the above, we can reason that many of wastes are highly related to each other, and by cutting one waste you may mitigate others. Clear
relations are for example motion and extra processing resulting in waiting; defects and waiting causing task switching; and task switching leading to inventory and defects.

### 3.1.2 Quality

Poppendieck M. and Poppendieck T. [31] defined Build Integrity In as a Lean principle in their early studies. They discuss that integrity can be divided to two: perceived and conceptual integrity [31]. Perceived integrity stands for balance between functionality, usability, reliability and customer satisfaction [31]. On the other hand, conceptual integrity stands for system and its functionalities working as a coherent whole. Building integrity in stands also for developing the software so that the changes are easy to do also in the future and that is maintainable [24]. Usefulness, maintainability and meeting the customer needs and requirements could be argued to reflect the quality of a software.

In their later studies, Poppendieck M. and Poppendieck T. defined Build Quality In as one of the Lean principles [32]. This refers to instead of focusing on how to track defects, one should focus on not having defects in the very first place [32]. This is aligned with Liker’s [25] fifth principle of Lean: “Build a culture of stopping to fix problems, to get quality right the first time”. If not possible though, like in big complex systems having completely flawless software is close to impossible, the project team should focus at least on fixing the defects found immediately and not just track them and wait for later phases of testing and fixing the issues [32]. Defect tracking could be considered as a partially done work, something that needs to be refactored and reworked [32]. In Lean, partially done work is seen as one of the major wastes, and thus should be eliminated.

### 3.1.3 Knowledge

The third principle of Lean, defined by Poppendieck M. and Poppendieck T. in 2007 is Create Knowledge [32]. The knowledge should not be in a form of early locked design and requirements documentations but rather come through constant evolving of product and feedback from the markets, users and customers [32]. Liker [25] highlights the visual aspect of sharing the knowledge and making work visual so that the problems are recognized faster. Therefore, Poppendieck M. and Poppendieck T. [32] suggest that new knowledge should be received openly from these different sources by way of releasing minimum features for customers to get feedback and evaluation,
building daily to get feedback from tests and focus on architecture that enhance quick and easy addition of new features and changing old ones. Thus, this continuous learning will decrease the amount of non-valuable features and time spent on developing those features [30].

3.1.4 Decisions

The fourth principle of Lean according to Poppendieck M. and Poppendieck T. [32] is Defer Commitment that refers to avoiding (early) decisions that lock the project team to design decisions that are later hard and costly to change. The decisions should be made in last possible moment, with the best possible knowledge at hand as defined by other Lean principle create knowledge [30, 32]. Thus, Poppendieck M. and Poppendieck T. [32] suggest that software system should not be completely flexible but include options in the parts where the changes are most likely to happen. Therefore, the design decisions made should be reversible until very late as possible [32]. Poppendieck M. and Poppendieck T. [31] argue that the best decisions are made when they are based on facts rather than speculation.

This is tightly related to Toyota’s way of thinking with just-in-time (JIT) manufacturing: the decisions are delayed as long as possible until they are made with the best knowledge to make them right [31]. Liker [25] suggests to make decisions slowly considering all options and later delivering implementations rapidly.

Furthermore, new features and products should be started only by customer’s demand [38]. Thus, the decisions to start working on new features would be done in the last possible moment, i.e. when the feature is required and requested by the customer. This is referred to as a pull system and stated as one of the Lean principles by Womack and Jones [38] and Liker [25].

3.1.5 Fast delivery

The fifth principle of Lean according to Poppendieck M. and Poppendieck T. [32], is Deliver fast that refers to reducing the time-to-market of the software. Accompanied by principle of building quality in but also highly responsible and dedicated people, delivering fast may help in achieving high quality while reducing time-to-market [32].

Without fast delivery, it is not possible to delay the decisions or receive fast, instant and reliable feedback [31]. The shorter and faster the development cycles are, the faster the feedback and improvements can be made [31].
According Womack and Jones [38], after specifying the value stream and eliminating wasteful activities from the stream, the focus should be on making the activities flow without delays. Similarly, Liker [25] argues continuous process flow to be one of the Lean principles. In software development, having a continuous end-to-end flow would mean enabling faster and continuous deliveries, rather than time-boxed iterations.

### 3.1.6 People and team

The sixth principle of Lean according to Poppendieck M. and Poppendieck T. [32] is Respect People that refers to creating great products through great leaders, expert technical workforce and responsibility-based planning and control that emerges from good work practices, processes and culture of the company. That way the leaders enhance the teams to be engaged, self-organized and focused on delivering excellent product based on the general plans and reasonable goals, whereas the teams possess the needed technical expertise to develop the needed product [32].

Liker [25] argues that leaders have the responsibility of teaching Lean philosophy so that the Lean organization is maintained. Developing teams to follow the philosophy and become high performing is the basis for the success [25].

Making the decisions on the lowest possible level is fundamental in Lean, as the people who do the work understand the details the best [30]. Because of late decisions and fast delivery, the work cannot be managed by central authorities as there is no time for it [31]. In Lean it is the team managing their own work, processes and schedule through pull techniques [31].

### 3.1.7 Value stream

The seventh principle of Lean according to Poppendieck M. and Cusumano M. [30] is Optimize the Whole, that refers to recognizing customer’s needs and what brings value for the customer. The value is not in the software itself, but instead in how the product is delivered and used [30]. Thus, delivery process of the software to the customer should be divided to different value providing activities - value stream. Good tool to recognize these different activities is value stream mapping [24, 31, 38] as discussed previously.

Instead of dividing the work to subdivisions and measuring them separately, the work should be measured as a whole and with a single measurement that really matters [32]. Many times, stakeholders tend to focus solely on improving performance of their speciality area instead of seeing the whole overall performance [31]. Instead of fighting against trade-offs between a big
set of measurements and suboptimizing different parts and activities, having one higher-level metric analyzing the whole value stream helps the project to have better focus [32]. Therefore, optimizing the whole stands for seeing, analyzing and improving the whole value stream from the moment of receiving customer requirement to the moment of delivering it to the customer.

### 3.1.8 Continuous improvement

Womack and Jones [38] define perfection as one of the Lean principles. Continuous improvement and perfection has been referred to as kaizen [25, 38]. Improving specific activities is not going for perfection, instead focus should be on improving the whole value stream [38]. Liker [25] suggests organizations to constantly learn and getting better through reflection and continuous improvement.

Poppendieck M. and Cusumano M. [30] define keep getting better as one of the Lean principles. This stands for continuous improvement of a work system, in the lowest possible hierarchial level, i.e. where the work is done [30].

Liker [25] states that standardized tasks and processes are foundation for continuous improvement and employee empowerment. Lean thinking would guide organizations to start with specific practices, but later improving and adapting them overtime by the teams doing the actual work [30]. One of such practices is Kanban, which Poppendieck M. and Cusumano M. [30] argue to be a good method to introduce Lean principles in an organization.

### 3.2 Kanban

Kanban, originating from Lean principles applied in manufacturing at Toyota, was transformed to software industry by Anderson [4, 6]. At Toyota, kanban stood for a tool managing the production and enabling just-in-time (JIT) production [4, 27]. According to Ladas [22], Lean and Kanban are based on two axioms: “It is possible to divide the work into small value adding increments that can be independently scheduled” and “It is possible to develop any value-adding increment in a continuous flow from requirement to deployment”. These highlight incremental, continuous delivery and whole value stream approach of Lean and Kanban, where small work items are pulled through value stream and finally delivered to customer continuously.

Thus, Kanban does not use fixed timeboxes for iterations [5]. Kanban disregards the iterations and focuses more on constant and continuous single-
piece flow where work moves through the value stream in single units [5, 9]. Finally, the delivery cadence defines how fast the (single-piece) deliveries are made to the customer [5]. Therefore, one of the main differences between Kanban, Scrum and Waterfall models is incremental development. Whereas Kanban focuses on single-piece flow and continuous delivery of features and work items, Scrum develops the project in small batches consisting of multiple user stories delivered in timeboxed iterations. Then again, Waterfall has a batch size of whole project with planned estimated end date.

Anderson and Carmichael [7] defines Kanban method (differentiated from kanban by capitalized word) through six general practices to successfully implement it:

1. Visualize
2. Limit work-in-progress
3. Manage flow
4. Make policies explicit
5. Implement feedback loops
6. Improve collaboratively, evolve experimentally

Liker [25] suggested to use visualizations of work in Lean and similarly Kanban’s first practice is to visualize [7]. Kanban visualizes the workflow, i.e. mapped value stream, on a board, where each column represents a step in the value stream [30]. Kanban cards, representing work to be done, are moved through the columns as they meet the specified definitions of done of the columns [30]. Thus, Kanban is a visual representation of the flow of work [30], and it derives from understanding the current system and analyzing potential areas for improvement [7].

Whereas Scrum does not have any specific roles among team members and the tasks have statuses e.g. new, in progress, ready and done, Kanban has kind of an assembly line where there are clear cuts and divisions between different stages among the value stream e.g. analysis, development, test and ready for deployment [5]. These stages should stem from value stream mapping [5], as suggested similarly by Lean studies [24, 31, 38]. This is something that is similar between Kanban and Waterfall models. But in contrary to Waterfall model where these sub-phases have their own responsibilities and specialized workforces handing off their work for the next phase, in Kanban and Lean these may be the same people throughout the value stream [5].
Though, not only process is visualized in Kanban board. Policies are important to visualize, e.g. defining definitions of done between the columns [7]. The cards representing tasks and work items are also one point of a visualization [7]. Furthermore, work-in-progress limits need to be visualized and maintained in Kanban board [7].

What makes Kanban board special is the limit of work in progress in any column, which means that every value-adding activity has a limit of Kanban cards that it can contain simultaneously [30]. This limits the work in progress of the activities and moreover the whole system [30]. That way, Kanban is especially useful in eliminating waste of task switching and recognizing bottlenecks when a certain stage cannot start new tasks when the stage has reached its WIP limit, and therefore eventually blocks and slows down the progress in other stages and whole value stream. Therefore, WIP limit makes Kanban a pull system instead of a push system, meaning that new tasks are not started before previous ones are finished [7].

**Managing flow** stands for measuring and optimizing the whole value stream, as suggested by Lean studies [30–32]. The continuous flow of work should maximize the delivery of value, minimize lead times and become predictable [7]. Therefore, it is important to recognize, solve and manage possible bottlenecks and other constraints in the value stream [7]. To make flow of work predictable and constant, metrics are needed to evaluate it. Cost of delay is a metric that Anderson and Carmichael [7] suggest to be used as a definition of priority for tasks. Lead time on the other hand is a main metric for the customer, to analyze how fast tasks and features are done in Kanban system [7].

**Making process policies explicit** means defining guidelines, rules and process that is more than just workflow visualization [7]. When process is expressed as a workflow and policies, it can be used to guide team towards best practices that empowers the process and helps in improving it [7]. Standardized tasks and processes guide towards continuous improvement [25]. WIP limits and definitions of done are examples of explicit policies in a process [7].

**Implement feedback loops** stands for defining recurring opportunities to give feedback [7]. Anderson and Carmichael [7] provide seven feedback opportunities, referred to as cadences. Still, they argue that teams need to decide a need for the meetings and feedback sessions themselves and the interval of those meetings [7]. The two meetings that they see working as a baseline in most of the Kanban implementations are Kanban and replenishment meetings [7]. In Kanban meeting team goes through the current work situation, possible blockers and manage and solve possible issues together [7]. Replenishment meeting then again considers approving tasks and enter-
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Improve collaboratively, evolve experimentally means that Kanban should start from current processes and aim to improve those continuously and incrementally [7]. This is an experimental process, where organization focuses on keeping and improving beneficial changes and reverting ineffective ones [7].

In their comprehensive systematic literature review, Al-Baik and Miller [4] gathered 20 basic elements of Kanban. We will use these 20 basic elements to describe Kanban as it is understood in this Thesis work, and later analyze the most critical elements to be further used at Case Company. These elements are summarized to Table 3.3 together with general practices of Kanban as defined by Anderson and Carmichael [7], illustrating the relation of elements and practices.

**Kanban board** is used for the visualization of the workflow [4]. Usually, it is used to cover up the whole lifecycle of production: from conceptualization to delivery to the customer [4]. Value stream defines the workflow of all the steps and activities between ideation and realization of the value for the customer [5] which eventually facilitates more business-driven approach [33]. One approach of setting up the Kanban board is to map the current activities to the value stream and later improve the activities and process [4, 9]. Value stream mapping is one of the key activities in Lean, where the whole process from defining customer requirements to the delivery of value would be identified to individual steps [9]. Later as suggested by Corona and Pani [9], the value adding and non-value adding steps should be recognized and thus the wasteful activities could be removed from the process and the value-adding steps could be continuously improved.

**Team collaboration** stands for better cross-team collaboration through use of Kanban [4]. As the work becomes more transparent through Kanban board between different teams and individuals, the communication improves as well as contribution and cooperation [2, 19, 23, 26, 28].

**Avatars** are representations of owners of work items [4]. This would generally help in communication of task owners and current resource situation with a single glance at the Kanban board [4].

**Waste identification** stands for recognizing the waste in processes as defined by Lean [4]. Visualization and transparency of Kanban should guide to better identification of non-value adding, i.e. wasteful, processes and activities [4].
Table 3.3: Properties and elements of Kanban

<table>
<thead>
<tr>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Visualize</td>
<td>Kanban board</td>
</tr>
<tr>
<td>Visualize</td>
<td>Team collaboration</td>
</tr>
<tr>
<td>Visualize</td>
<td>Avatars</td>
</tr>
<tr>
<td>Visualize</td>
<td>Waste identification</td>
</tr>
<tr>
<td>Visualize</td>
<td>Bottleneck</td>
</tr>
<tr>
<td>Limit work-in-progress</td>
<td>Work-in-progress (WIP)</td>
</tr>
<tr>
<td>Limit work-in-progress</td>
<td>Pull system</td>
</tr>
<tr>
<td>Limit work-in-progress</td>
<td>Prioritized queue</td>
</tr>
<tr>
<td>Manage flow</td>
<td>Cycle / Lead time</td>
</tr>
<tr>
<td>Manage flow</td>
<td>Performance measurement tool</td>
</tr>
<tr>
<td>Manage flow</td>
<td>Validated learning</td>
</tr>
<tr>
<td>Make policies explicit</td>
<td>Policies</td>
</tr>
<tr>
<td>Make policies explicit</td>
<td>Planning and estimation</td>
</tr>
<tr>
<td>Make policies explicit</td>
<td>Inclusion criteria</td>
</tr>
<tr>
<td>Make policies explicit</td>
<td>Done item</td>
</tr>
<tr>
<td>Make policies explicit</td>
<td>Reverse item</td>
</tr>
<tr>
<td>Make policies explicit</td>
<td>Slack or Buffer</td>
</tr>
<tr>
<td>Make policies explicit</td>
<td>Meeting structure</td>
</tr>
<tr>
<td>Implement feedback loops</td>
<td>Feedback loop</td>
</tr>
<tr>
<td>Improve collaboratively, evolve experimentally</td>
<td>Continuous improvement</td>
</tr>
</tbody>
</table>
**Bottleneck** stands for a situation where a work process cannot pull work items at the same pace as other preceding processes are delivering [4]. This leads to waiting times and possible task switching, that are considered as some of the wastes in Lean [24, 31, 38]. Thus, by visualizing the work flow, it is possible to recognize the bottlenecks easier and react to them accordingly [4, 26, 33].

**Work-in-progress (WIP)** is the maximum number of work items that are permitted to exist in one Kanban board column, i.e. work process, at a time [4]. This is one of the main characteristics of Kanban and guides it to its main objective of limiting the work in progress [37]. WIP limit should be used so that the resources are not under- or overloaded [5]. This is in align with Liker’s [25] Lean principle of leveling out the workload to minimize the waste and not overloading people.

**Pull system** refers to pulling work items from upstream to downstream as resources are freed [4]. This element relates to Lean principle of pull defined by Womack and Jones [38] and Liker [25]. They defined pull so that new features and products should be started only by customer’s demand and that way pulled through the value stream [25, 38]. According to Anderson and Carmichael, it is the WIP limit that makes Kanban a pull system instead of a push system [7].

**Prioritized queue** stands for an ordered list of requirements from where the work is pulled [4]. Priority of a work item, i.e. task, is defined in terms of value, urgency and importance [4]. Also, Anderson and Carmichael [7] suggest cost of delay to be used as a definition of priority for tasks.

**Cycle / Lead time** are used to measure the efficiency and effectiveness of the process [4]. Though, lead time and cycle times are not clearly defined and used according to Al-Baik and Miller [4]. Cycle time has been argued to be an ambiguous term that should be further and clearly defined in use context [7]. Middleton [26] states that lead time is the total time elapsed from receiving customer request to delivering that to the customer. Anderson and Carmichael [7] define lead time to be the time it takes for work item to move from starting the work and entering Kanban board to finish and deliver it to the customer. Measuring lead time variance defines how reliable the process is [26].

**Performance measurement tool** defines how the performance is measured in Kanban [4]. Cumulative flow diagram is one of the basic reporting tools and charts that can be used within Kanban [4, 5, 9] and in the study of Corona and Peri [10] it was the most used tool for quantitative management of process. It gives an overview of WIP and cycle time through time [4]. In addition, total throughput, work items deployed on time and missed delivery dates are useful metrics and KPIs [5]. The goal is to maintain the same or
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greater throughput but with less WIP [26]

Validated learning stands for a process to measure the business value of delivered work [4]. Still Al-Baik and Miller [4] do not provide any tools for this and only refer to [19] mentioning that monitoring and learning is a key performance indicator (KPI) measuring project success. Therefore, this element is vaguely defined and is highly dependent on domain and developed product or service. Thus, each business needs to define their own KPIs and agree how the business value is measured.

Policies define how the Kanban should be governed [4]. According to Al-Baik and Miller [4] these would be guidelines that specify what and how work should be done. One of such policies would be expedite classes of service where highly urgent customer requests can be prioritized over any other ongoing tasks [5]. Additionally, different types and classes of work can be separated to swimlanes that are horizontal lanes on Kanban board [5]. Middleton and Joyce [26] recognized expediting as a good practice to manage exceptional circumstances, sudden urgent items and late changes.

Planning and estimation is usually seen as a waste in Kanban, and should be avoided [4]. Rather, Kanban follows Lean principle of deferring commitment and focuses on making decisions slowly and in the last possible moment [5, 25, 27, 31, 32]. Therefore, the element of planning and estimation refers to avoiding planning and estimation. Anderson [5] encourages to replace estimation with service level agreements (SLAs) based on existing cycle time and letting that work as an objective for the team.

Inclusion criteria means that the work item / requirement needs to fulfill a certain preset criteria before it can be added to Kanban board [4]. Criteria should evaluate whether the work item / requirement provides value for the customer [4]. In our empirical study, we recognized that teams have difficulties in analyzing what value means for the customer and how to measure it. Similarly, none of the studies referred by Al-Baik and Miller [4] had pre-defined an inclusion criteria. Only study of Polk [29], discussed the use of different priority lists and product management team in analyzing the priorities and thus deciding what development team needs to focus on next.

Done item stands for a definition for a work that can be considered done [4]. In most simplified versions, this could be a checklist of things to do [4].

Reverse item is a work item going to opposite direction in workflow, mainly standing for a found defect [4]. E.g. a task has been done, but later it is found to cause a defect. In this case, task would be going back to e.g. development and test stages in Kanban board.

Slack or Buffer is created to provide assistance in case of bottlenecks and decrease their negative impact in whole process [4]. By defining buffers, it is possible to keep work ongoing and measure the waiting time especially
in bottleneck processes [4]. Based on the WIP limit, queue and buffer sizes could be determined, so that the team has always new work to do [5].

Meeting structure is loosely described by Anderson and Carmichael [7]. They highlight seven feedback opportunities, cadences, in Kanban [7]. Still, Lean principles should guide Kanban team to organize and analyze the need for meetings, and self manage themselves accordingly. Thus, Kanban does not per se guide to any structured or reoccurring meetings according to findings of Al-Baik and Miller [4]. Many studies mention different meetings that were supporting Kanban: daily standups as one key meeting, especially to enable continuous improvement as a routine and addressing the issues in the process [19, 26] and; weekly meetings where demos were presented to customers and team had a specific retrospectives similarly as in Scrum [19].

Feedback loop is the objective of Lean principle of delivering fast, and thus one of the key elements of Kanban as well [4]. Later, this information can be used to recognize the value providing requirements and features. Still, as Al-Baik and Miller [4] discuss, it is not clearly stated how Kanban has empowered customer to provide their feedback better.

Continuous improvement, kaizen, is one of the key elements of Kanban [4, 9] and categories of Lean [25, 30, 38]. It stands for continuously and incrementally evaluating and implementing Kanban method, leading to continuous improvement of itself [4].

### 3.3 Benefits of Lean and Kanban

We studied a set of case studies analyzing use of Kanban method and Lean principles in software development and maintenance teams in different context and domains. The selected studies are represented in Table 3.4.

We analyzed especially the found benefits of Lean and Kanban and from which Lean categories and Kanban general practices these benefits can be derived. We have summarized the found benefits of Lean and Kanban to Table 3.5 together with the general practice of of Kanban and category of Lean from where the benefit stems. The Lean categories are based on our analysis of Lean principles in Chapter 3.1 and Kanban practices are based on book of Anderson and Carmichael [7]. In this Chapter, we will discuss these found benefits in more detail.
Table 3.4: Case study references for analysis of benefits of Lean and Kanban

<table>
<thead>
<tr>
<th>Source</th>
<th>Data type</th>
<th>Context</th>
<th>Size of the team</th>
</tr>
</thead>
<tbody>
<tr>
<td>[2]</td>
<td>Qualitative semi-structured interviews</td>
<td>Software maintenance teams in big and global software companies</td>
<td>6 - 8</td>
</tr>
<tr>
<td>[17]</td>
<td>Quantitative questionnaire together with qualitative observations and semi-structured interviews</td>
<td>University laboratory software projects creating new product prototypes</td>
<td>9 - 13</td>
</tr>
<tr>
<td>[18]</td>
<td>Qualitative semi-structured interviews</td>
<td>University laboratory software project creating new product prototype</td>
<td>13</td>
</tr>
<tr>
<td>[19]</td>
<td>Qualitative video and direct observations and semi-structured interviews</td>
<td>University laboratory software project creating a new product prototype</td>
<td>13</td>
</tr>
<tr>
<td>[23]</td>
<td>Quantitative questionnaire study of benefits of Kanban and Scrum in software project management</td>
<td>Several</td>
<td>Several</td>
</tr>
<tr>
<td>[26]</td>
<td>Triangulation, combining quantitative and qualitative data e.g. interviews, observations and statistical analysis of the performance of the system</td>
<td>Applying Lean practices and principles in a team doing software development and maintenance in big and global media house</td>
<td>9</td>
</tr>
<tr>
<td>[28]</td>
<td>Qualitative analysis of Kanban’s impact on collaboration and communication</td>
<td>Mobile software</td>
<td>8</td>
</tr>
<tr>
<td>[34]</td>
<td>Quantitative analysis of system performance and qualitative interviews</td>
<td>Software consultancy company tailoring software solutions for its customers</td>
<td>100 developers in 10 teams</td>
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<tr>
<td>Benefit of Lean and Kanban</td>
<td>General practice of Kanban</td>
<td>Lean category</td>
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<tr>
<td>Capability to react fast to changes and defects [2, 19, 23, 26, 34]</td>
<td>Visualize</td>
<td>Fast delivery</td>
<td></td>
</tr>
<tr>
<td>Knowledge sharing, team collaboration and cooperation [2, 19, 23, 26, 28]</td>
<td>Visualize, manage flow</td>
<td>Value stream, knowledge, people and team</td>
<td></td>
</tr>
<tr>
<td>Fast and continuous delivery [2, 19, 26, 34]</td>
<td>Implement feedback loops, limit work-in-progress</td>
<td>Fast delivery</td>
<td></td>
</tr>
<tr>
<td>Better understanding of project status [2, 23, 28]</td>
<td>Visualize</td>
<td>Value stream</td>
<td></td>
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<tr>
<td>Improved quality [23, 26, 34]</td>
<td>Implement feedback loops</td>
<td>Quality, fast delivery, knowledge</td>
<td></td>
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<tr>
<td>Improved meeting of customer needs and better customer satisfaction [23, 26]</td>
<td>Implement feedback loops</td>
<td>Knowledge</td>
<td></td>
</tr>
<tr>
<td>Better understanding of whole process [23, 28]</td>
<td>Visualize</td>
<td>Value stream</td>
<td></td>
</tr>
<tr>
<td>Recognizing and cutting wasteful activities and tasks from process [18, 26]</td>
<td>Visualize, limit work-in-progress, improve collaboratively, evolve experimentally, manage flow</td>
<td>Value stream, waste and value</td>
<td></td>
</tr>
<tr>
<td>Good priority, schedule and scope management in projects [23]</td>
<td>Implement feedback loops, limit work-in-progress</td>
<td>Value stream</td>
<td></td>
</tr>
<tr>
<td>Fast feedback [19]</td>
<td>Implement feedback loops, visualize</td>
<td>Fast delivery</td>
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</table>
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Capability to react fast to changes and defects; fast and continuous delivery; fast feedback

Kanban is currently used among many different industries: from manufacturing to crowd control [5]. The first use cases for Kanban in software industry were on maintenance, support and IT service requests and business intelligence reporting [5]. Kanban has been argued to fit well to maintenance work, where changes and urgent issues are received fast, customer is not on-site, release dates are selected randomly and therefore time-boxed iterative processes do not fit this hectic setting [2]. Anderson [5] argues that Kanban could be utilized in large scale software projects as well, where teams find it hard to fit the incremental development to timeboxed iterations and where teams have problems of recognizing the customer-valued work.

Iterationless workflow of continuously delivering features, where team members can pull work when they are ready and deliver features to customer as soon as tasks are done, is resuting to major benefit of Kanban found in our literature review. In study of Lei et al. [23] comparing Scrum and Kanban, they found out that Kanban without time-boxed iterations can react faster to changes than Scrum with its time-boxed iterations. Thus, capability to react and deliver fast could be seen directly deriving from having non-time-boxed iterations and continuous flow. Lean category of delivering fast and its objective of implementing continuous and fast feedback loop [31], further speaks for the benefits. This is in align what Ikonen [19] found in his study: faster delivery enables faster feedback loops, where feedback should be instant, and therefore resulting to faster fixes and improvements.

Ahmad et al. [3], discuss that in a work where there are recurring changes in priorities and constantly new, unpredictable and high priority tasks, Kanban is suitable tool to manage and continuously deliver features after completion. Lei et al. [23] found out that team being able to react fast to changes was one major benefit of Kanban. Faster and iterationless delivery was also one of the main reasons for Case Company in study of Sjöberg et al. [34], to change from Scrum to Kanban. Eventually they were able to halve their lead time of delivering features to their customers, reduced the amount of bugs and improved their productivity [34].

Middleton and Joyce [26] found in their study that applying a subset from 14 Lean principles defined by Liker [25] together with Kanban boards reduced their lead time and made their flow more stable. The main reasons for the found benefits were due to limiting the amount of work in whole process [26].
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Knowledge sharing, team collaboration and cooperation; better understanding of whole process; better understanding of project status; better overview of projects and resource management

Oza et al. [28], recognized in their study that Kanban enhances team collaboration and task coordination, especially in the beginning of the project. This resulted to more harmonized work and recognizing better missing tasks [28]. But when teams got more familiar working together, the significance of Kanban board in communication decreased and was not anymore critical in team communication as the team started to have more interpersonal communication [28]. Still, according to Oza et al. [28] Kanban clearly helped in recognizing issues and team members to collaborate and provide help in case of issues. Middleton and Joyce [26] recognized that Kanban boards made the status of progress and bottlenecks clearer for whole team, and this transparent information led team to self-organize and manage the flow so that it becomes smoother. As one of the respondents of study of Oza et al. [28] stated, the project team is better aware of what others are doing and that way Kanban facilitates monitoring everyone’s work. Therefore, Oza et al. [28] state that Kanban works as an interface for collaboration within the team, even though later on the communication would be more interpersonal.

This is related to Lei et al. [23] findings that Kanban increases the awareness of project status in project teams, eventually resulting to better collaboration and working to achieve expected results. According to Lei et al. [23], visualizing the workflow is one of the major characteristics of Kanban in empowering better awareness in teams. Furthermore, both Ahmad et al. [2] and Ikonen et al. [19] recognized that through visualization, team members became more aware of their own but also whole team’s tasks and were that way capable to react faster to issues and solve them together. Thus, visualization also helps teams to better understand the whole process [3].

One major benefit in the study of Ahmad et al. [2], was the capability for management to have a better overview of current situation, each team’s and team member’s work and later on helping even in resource allocation and moving people between teams. More facilitated reallocation of resources between various projects and customers stemmed also from better visibility of tasks in different projects, and thus from better knowledge sharing [2].

Improved quality; improved meeting of customer needs and customer satisfaction

In the comprehensive literature review study of Ahmad et al. [3], they recognized improved quality and improved meeting of customer needs and
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Customer satisfaction as two major benefits of Kanban. Lei et al. [23] found project quality and meeting of business requirements to be major benefits of Kanban. Middleton and Joyce [26] mentioned also the customers to be generally happier when the team followed an approach where: 1) the work with the highest value to customers was being processed first, 2) the work was delivered quickly and 3) minimizing the risk of waste in working on misunderstood or incorrect requirements. Furthermore, in their study they recognized a drop in the amount of reported bugs and defects [26]. One of the reasons was that the team began to focus more on paying down technical debt and had more time to do that [26].

Recognizing and cutting wasteful activities and tasks from process

Kanban and especially Lean focus on eliminating waste from process. Seven wastes of Lean [13, 27, 31, 38], should be mirrored against the process and possible wasteful activities and tasks should be recognized and mitigated with use of Kanban. The main use of Kanban boards in the study of Middleton and Joyce [26] was to recognize bottlenecks and manage the amount of WIP. In addition to recognize bottlenecks and waiting, WIP limits should decrease the amount of task switching and partially done work and eventually lead to cutting extra features when the task queue would be maintained in prioritized order. Through workflow visualization, the wasteful processes should be recognized, discussed and eliminated.

Still, in the study of Ikonen et al. [18], they found out that waste exists even in Kanban projects. Biggest waste was found in partially done work, extra processes, extra features and motion due to lack of communication [18]. Though, as they argue themselves as well, wasteful activities are highly likely to be found from any software project, the case project had relatively little waste and Kanban is helpful in recognizing waste [18]. As one of the team members in the study of Ikonen et al. [18] mentioned, they were able to recognize the unnecessary steps in their process and Kanban board and eventually eliminate those. Finally, Ikonen et al. [18] provide a list of waste that should be especially observed:

- partially done work due to delays in critical path
- extra processes due to inefficient meetings and unnecessary steps in Kanban board that were not necessary for all types of tasks
- extra features due to unawareness of key features
motion due to lack of communication

Womack and Jones [38] also discussed, that even though kaizen and waste elimination activities are performed multiple times, there is always more waste to eliminate. Having a process without any waste is impossible [38].

Through workflow visualization and WIP limits, focus is on recognizing which activities are constraining other activities and thus whole value stream [33]. Shalloway [33] gives an example of such a situation, where testing activity is receiving more tasks than what it can process. Therefore, the preceding activity of development cannot process any more work as it cannot handoff the work to testing [33]. Middleton and Joyce [26] could recognize in their case study right after doing value stream mapping, i.e. visualizing different stages on Kanban board and representing work on each stage with cards, that there were more bottlenecks and WIP than team had realized. Eventually this should result to a situation where (project) team analyzes what actions they should take in order to get testing work in harmony with development. The power of Kanban is not in providing solutions but highlighting possible issues [33]. Continuous improvement, kaizen, should guide team to analyze the issues and improve processes accordingly.

**Good priority, schedule and scope management in projects**

Kanban, similarly as Lean, discourages estimations, a little planning is done and the decisions are left to the last possible moment [5]. Kanban wants to get rid of estimation and replace it with a promise to the customer in terms of SLA, which indicates the expected lead time for a request [5]. In Kanban, work needs to be broken down to small enough and similar-sized chunks that helps in narrowing down the big variations between cycle times of the items in value stream [5]. Instead of estimating single tasks and committing to those estimates, Anderson [5] sees offering a regular SLA time to complete work more valuable.

In their empirical study comparing Kanban and Scrum in six project management factors: budget, risk, quality, resources, scope and schedule as defined by PMBOK 4.0 [1], Lei et al. [23] found that Kanban performs better than Scrum managing schedule of a project. It was based mostly on teams being better aware of project status when using Kanban and due to capability to react fast to changes [23]. Furthermore, Kanban had better capability of managing the scope and making it clearer according to respondents of their survey [23]. Differences between Scrum and Kanban in other factors were insignificant, and on those they were considered equally good [23].
Limiting WIP and visualizing workflow helps in discussing task priorities and let team focus on what is bringing the most value [33]. When team can work by pulling new work items from backlog anytime they are ready, work can be initiated and delivered quickly in priority order whereas in time-boxed iterations such as in Scrum, new work items would need to wait for next iterations [33]. As an additional feature in Kanban, when high priority item needs to be done immediately, it can be delivered in an expedite class of service where it can be prioritized before the other items [5]. Even though this affects to WIP, flow, throughput of the items completed and lead times negatively, the value seen in delivering expedite request faster is much higher [5]. In Scrum this would require a new Sprint planning and immature ending of the current one and in Waterfall this would go through bureaucratic pipe of change management.

3.4 Analysis of literature review

In our literature review we focused studying potential benefits of Lean and Kanban in existing case studies, and from which Lean categories and Kanban practices those benefits derive. As can be seen from the most referred benefits of Lean and Kanban in the existing studies in Table 3.5, they are heavily related to Kanban practices of visualization, implementing feedback loops, limiting work-in-progress and managing flow. The most prominent Lean categories are fast delivery, knowledge, value stream and people and team. These Kanban practices and Lean categories have improved: 1) the possibility to react fast to changes and defects when the task status is better visible, 2) knowledge sharing, team collaboration and cooperation when the tasks have improved transparency between team members and therefore possible issues are faster emphasized and managed collaboratively by the team, 3) fast and continuous delivery through Lean category of fast delivery and focusing on having faster feedback through feedback loops. Thus, the most important elements of Kanban based on found benefits and their corresponding Kanban practices are: Kanban board, team collaboration, feedback loops, WIP limits and bottlenecks. These are also the Kanban elements where we focus in our first steps in applying Kanban and Lean in Case Company in the empirical study part of the Thesis.

Most of the books, case studies and other academic papers of Lean and Kanban, have been focusing on benefits and applications, and the challenges and drawbacks have been less documented. Still, it is important to recognize that not only benefits have been reported. These challenges can be roughly divided to two main categories:
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- Not having unambiguous principles, guidelines and practices
- Cultural and organizational change

The first challenge category can be seen in number of different definitions of Lean principles \([24, 25, 30–32, 38]\) and sometimes loose and vague definitions of practices and elements in Kanban \([4]\). According to Poppendieck M. and Cusumano M. \([30]\), not having specific rules or roles in Kanban, it requires thoughtful consideration and adaptation. Therefore, Ahmad et al. \([3]\) recognized that Kanban does not work alone but requires other supporting practices. For example not having specified meeting structure leads to a situation where the teams need to self-manage and evaluate the need for different meetings, leading to contradictory views on meetings \([4]\). Corona and Pani \([10]\) listed agreeing meeting schedules and formats as one step in setting up Kanban system whereas Sjøberg et al. \([34]\) recognized meetings as a source of waste. Still, for example daily standups has been a practice that has been adapted to different teams using Lean and Kanban \([19, 26]\) and is also suggested by Anderson and Carmichael \([7]\). Furthermore, not having guidelines for implementing Kanban method and missing guidance in applying some of the Kanban elements was recognized challenging in case studies studied by Al-Baik and Miller \([4]\). Thus, unclear definitions for some of Kanban elements are used and they are sometimes defined even in conflicting manner by different studies \([4]\).

The second challenge category addresses the issues in adapting Kanban and Lean to organizations, and how to apply cultural change. Ahmad et al. \([3]\) recognized lack of specialised skills and training being one challenge in adapting Kanban. Al-Baik and Miller further discuss the need to have deep understanding of Lean principles, concepts and practices in order to apply Kanban \([4]\). Not having pure Lean approach and having numerous context-dependent definitions of Lean principles \([26]\), will not enhance learning.

In the study of Ahmad et al. \([3]\), cultural change to use Lean and Kanban was mainly hard due to previous adapted software development methodologies. Kanban has been argued to be intuitive in other studies where the team is new and has not had previous methodologies \([19]\). Still, cultural change was recognized also as one of the challenges in Lean by Middleton and Joyce \([26]\). They argue that the existing standards and processes tend to force applying Lean (and Kanban) more into discussion of cultural change rather than implementing new tools and methods \([26]\). They argue that Lean does not work well with targets, milestones, Gantt charts and traffic light reporting systems, as Lean and Kanban focus more on being transparent, limiting WIP and delivering frequently \([26]\). Furthermore, in order to deliver value to
customers, developers need to collaborate with customers and analyze their problems and later evaluate if business value has been created [26]. This would require in some cases reorganizing and restructuring the development teams [4]. Middleton and Joyce [26] argue that in some organizations this would be seen as developers being outside from their responsibility areas. Furthermore, self-managing teams force managers to work in more facilitating role [26]. Therefore, teams may have hard time to adapt new role of recognizing problems and solving them themselves and managers may feel uncomfortable with their new roles [26].

Based on our literature review, we have recognized multiple benefits of Lean and Kanban, stemming from their principles, practices and elements. In our empirical study part, we will analyze those benefits, and especially their related Kanban elements and Lean principles, against found challenges, best practices and current state at Case Company. Based on this, we will provide a suggested model of Lean and Kanban for Case Company.

Still, we have recognized that Kanban and Lean leave space for speculations and are not unambiguously defined. This will be a challenge when creating improvement suggestions for Case Company’s task and project management based on Lean and Kanban theory. Furthermore, cultural and organizational changes are hard and they form a domain of study of their own. In the comprehensive literature review of Dikert et al. [12], they recognized 35 challenges in large scale agile transformations.

As Hui [16] discusses, there is no predictable process to get from point A to B in organizational transfromation and thus it should base on experimenting, feedback, learning and improving. Dikert et al. [12] recognized piloting also as one success factor in agile transformation. Thus, later in our empirical study part, we will take the most prominent Kanban elements and Lean categories, and later evaluate them in small pilot team, starting from processes that they currently have. Focus will be on applying Kanban and Lean practice of continuous improvement, kaizen, and thus begin continuously evolve and improve work processes related to task and project management at Case Company.
Chapter 4

Empirical study

In this Chapter we will go through the current state of the Case Company, its hierarchy, organizational and team structures and further task and project management and teamwork and communication. Based on the analysis of the current state of Case Company, we summarize the most important best practices and challenges of task and project management. Later we will map these best practices and challenges with known benefits, categories and elements of Lean and Kanban to create a suggested improvements and a model for task and project management in Case Company. This model could be later expanded to individual, project, team and portfolio levels to cover the whole lifecycle of the Case Company’s project delivery and service customer management.

4.1 Overview of current state

4.1.1 Organizational structure and project delivery

Case Company delivers SaaS SCM system with high level of configurability to its customers. Professional services and technical project management teams are responsible of delivery projects and configuration of the software. Professional services team consists of project managers, business consultants and service managers, that are responsible of overall progress of the projects, but also setting up business configurations and ensuring the meeting of business requirements. Furthermore, service manager handles communication with the customer, upsells new features and helps customer to gain the maximum value out of the software after the project. Professional service team has local subteams in each of Case Company’s markets that are highly independent in their operation and projects.
Technical project management team consists of technical project managers, that are responsible of technical implementation, configuration and maintenance of customer instance. Technical project management team is mostly located in Case Company’s headquarters, with just two additional local teams in bigger markets. The bigger team in Case Company’s headquarters is divided to smaller subteams, serving separate markets and their local professional service teams and customers.

After the project has been delivered and finished, it will be taken to support and service phase. This stands for two centralized support teams taking a role in handling errors, responding customer queries and maintenance of customer instance. Whereas technical support team is responsible for handling technical errors and maintenance of customer instance, central business analysis team provides support for customer in business related issues.

Figure 4.1 illustrates the organizational structure of customer project delivery and different teams involved as discussed above. Different technical project management and professional service teams have been separated with alphabetical identifiers, that stand for different markets. In our empirical study, we interviewed members of professional service and technical project management teams in four different markets A, B, C and D.

Figure 4.1: Organizational structure of customer project delivery
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In following subchapters, we will walk through Case Company’s current situation in two main focus areas of this Thesis: project and task management, giving an overview of the current state of the company. In addition to these two, we included teamwork and communication as a separate entity into this Thesis due to its importance in both project and task management, being an essential part of both of them and also due to recognized challenges and best practices in it. In this this Thesis teamwork and communication consists of topics such as team management, resourcing, communication and responsibilities. The relationship between project management, task management and teamwork and communication at Case Company is illustrated in Figure 4.2.

![Diagram of project management, teamwork and communication](image)

Figure 4.2: Project management, teamwork and communication and task management

**Project management** is practiced throughout several phases of projects. Generally, project team consists of at least one project manager and technical project manager. In addition, there can be supporting team members such as business consultants helping in business configuration of the software and junior technical project managers providing support in technical implementation, configuration and maintenance of customer instance. During the project, a constant and frequent **communication and collaboration with the team** and customer is required. Projects are implemented in a tight collaboration with the customer. Throughout the whole project, support and service phases a consistent **task management** and known workflow between
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project team and customer is needed, to further support successful delivery of the project and features.

In following subchapters we will discuss the different levels, topics and models separately in deeper level.

4.1.2 Project management

The normal phases of Case Company’s customer project is illustrated in Figure 4.3.

Figure 4.3: Project phases of the Case Company

Case Company’s project delivery model is waterfall type of a model, where there are clear separate phases with certain objectives. Still, some phases, especially technical implementation and business configurations, are done in parallel in many projects and project teams include agility in terms of feedback loops and continuous improvements in those phases. Focus on being more agile during technical implementation, business configuration, user acceptance and early phase support was especially mentioned by Market A and D business managers. Also several TPMs recognized that changes are done throughout the project and those are not feared. The different phases and activities are followed in rather similar manner in different markets and no major differences were found.

Sales phase was recognized as one of the phases that is not particularly part of project model or even project work. Still, its affect to project work and especially the beginning of the project is crucial. In sales phase it is good to have limited implementation of software to demonstrate features. Based on that implementation, sales team has the discussions on different potential features and high level objectives. Goal is to plan the project together with customer. Later sales people share their knowledge, pass information about customer and internal expectations regarding project to people assigned to project delivery work. There might even be overlaps with sales and project initiation phases where the scope and objectives of the project are discussed. Still, some of the TPMs interviewed are not sure what has been done in sales phase.
Later in **Project initiation and specification** phase, the objectives, scope and different roles, responsibilities and resources for the project are set and agreed with the steering group and project teams both on customer and Case Company sides. Meetings where the current situation and what the business processes should be in the future are part of the initiation of the project. These workshops were referred to *As is - to be* workshops in many interviews and were recognized as one central activity in the beginning of the projects.

*As is - to be* workshops finally lead to analysis of objectives, goals and scope of the project. In some projects, especially in Market D, the scope of the project is expressed as a list of requirements, that are later used as a basis for acceptance testing and evaluation of results. Project initiation phase ends up to kick off meeting where the key people are present and agree on the material gathered during initiation. People involved are at least PM, TPM and sales people. In kick off meeting the project schedule and plan and different communication channels and responsibilities are presented. Furthermore, Case Company’s project model is walked through and common management tools and methods are agreed on with customer. In Market C projects, PMs usually suggest excel sheet template as a task management tool but in many projects customer has some tool that can be used.

After kick off meeting, the project team focuses on getting data from the customer as fast as possible. This phase of the project is referred to as **Technical implementation**. The objective is to get the necessary data from the customer to set up the needed business processes and fulfill the customer’s requirements that have been recognized and listed in previous project phase. The data requirements and integrations are presented in technical workshops where TPM is usually in key role of guiding the discussions and creating integration documentation. Still, depending on the roles of the PM and TPM in projects, both of them can do technical specifications with the customer. In technical workshops project team and customer together analyze what data is needed and from where that data should be retrieved. Later technical integration and work is done by one or two TPMs assigned to the project. This work consists of maintenance of customer environment, data integrations and partly data validation work with the customer. Integration testing is the responsibility of the technical resources on both Case Company and customer side whereas the validation of the data is mostly customer’s business side’s duty under the guidance of Case Company’s business consultants and PM.

TPMs and PMs in all of the markets interviewed in this thesis had recognized that getting the initial data from the customer takes usually a lot of time. Therefore, they had started to do more detailed business workshops where business consultants and PMs start to set already configurations in
software with partial data and evaluating those with the customer in parallel with technical implementation. In Market D they created new documentations and templates, referred to as functional design documents, that did not exist before to better model business configurations without data and evaluate those configurations and processes with customer.

When the needed customer data is received and integrated to Case Company’s software, business side PMs and consultants set up the initial business configurations. This is an iterative process that contains many changes and possibly new hidden needs emerge from customer side. The changes may require refactoring in data integrations and thus include a lot of coordination, communication and testing. This iterative process is done in tight collaboration with customer and adjusting the settings together with the key people from their side.

When the data is validated and tested, and business configurations have been setup, the customer goes through the system doing user acceptance testing. Customer validates results that the business configurations are giving and asks for further improvements if needed. In Market D acceptance testing was done based on test cases matching the requirements listed in the beginning of project. The project teams in Market D argued that this way customer can go through the whole project in more organized way. When customer is confident with the results, the project is moved forward to early use support where the software is taken into use in different customer locations gradually and validating results in production. Piloting is usually started with a smaller scope and still iteratively improving system and doing changes, possibly in both technical and business implementation.

When the rollout is finished, the project team hands the project over to support and service where technical support and teams take care of the customer’s queries and issues. Service manager manages the continuous service of the customer, meaning further development and configuration of the system with the customer to provide always better results.

Usually Case Company project model is followed more strictly in smaller projects where Case Company has more leading role. In larger projects, Case Company tends to follow more customer’s project models, methodologies and schedule as the project might be part of a larger enterprise project. In these larger projects, waterfall type of phases are followed more strictly.

Whereas project phases and activities under different phases are followed in different markets in similar manner, the project documentation and templates are differing between the markets and teams apart from the project plan and technical integration documentation template. The challenge have been that no one has been responsible of maintaining the standard templates and thus they have outdated and most of the material is passed around in
smaller sub teams. PM in Market C sees the templates and standard documentation as a good starting point as a new employee, but most of the material and knowledge is received from others in the same market. Other challenge has been that even though project task template, containing different project phases and the main activities and tasks under them and even definition of done for each task, is seen beneficial but it cannot be shared with the customer and thus many projects do not use it in their project management. Therefore during the Spring of 2018, a new team and a set of people from both business and technical project delivery took the responsibility of gathering and maintaining the standard documentation and project material.

Projects are monitored mostly through project plan and project schedule templates on weekly basis. In addition, weekly meetings with customer project team and internally are considered as an important part of project monitoring and communication. In these meetings, there is usually one TPM, one PM and one business consultant and their counterparts from customer side. PM sends also weekly status report emails where weekly tasks, main outcomes and following week’s priorities and main focus areas are discussed. Steering group meets to check project status once a month or between different project phases and to discuss the risks, schedule and next steps in project. Communication and teamwork in projects are discussed further in Chapter 4.1.4.

Project and business managers use mostly used time versus budgeted time in monthly level as a performance metric in projects. There has been a lot of development on this area, and the projects are currently guided to follow same template on hour reporting to better monitor the bottlenecks, use of hours and also for better hour estimation in the future projects. The objective is to know better where the time is spent and to improve the profitability of the projects. Still, monitoring of the projects and having a better overview of the project status but also tasks and resourcing have been requested especially by both business and technical team leads that are responsible of managing bigger team of people in different projects and service customers.

Most of the teams use also task/issue lists in different forms to track the status of the different smaller activities and tasks in the project, and some of the teams use them to go through the open issues in the weekly meetings with the customers. These task lists and task management in general are discussed further in the next Chapter 4.1.3.
4.1.3 Task management

4.1.3.1 Task management process and characteristics

We modeled the different activities and the normal process during project delivery and service customer technical development and business configuration with a sequence work model illustrated in Figure 4.4. There is no documented or unified process among the projects but the activities and steps in doing tasks depend on market, project and individuals doing the projects. Still, the basic steps are similar and could be mapped based on the interview study. This value stream mapping resulted to a process definition that we would use as a basis for initial Kanban boards used at Case Company.

![Sequence model of solving tasks](image)

Figure 4.4: Sequence work model of task management

**Elicitation of requirements and customer needs** is the first step in the process of taking new functionalities and implementations to production. It is important to understand the background of requirements, so that project team has a good view on customer situation and can help in solving the issues on their side. Requirements emerge based on direct requests by the customer, discussions with them and in weekly meetings with whole project team. Elicitation work is mostly done by business consultants and PM who work in tight collaboration with the customer and have a better overview of the current situation and their possible requirements and (hidden) needs.
Then again, TPMs are not always sure from where the requirements originate from and what are their background.

**Analysis of requirements** is an important step for project team to analyze the needs and requirements both internally and with the customer, to better share the common understanding of the issue and also find optional ways to solve them. Purpose and background of a requirement should specifically be mentioned, and everyone should understand why something is built. In this phase it is also important to be able to question the customer’s requirements, both by TPM and PM, and whether the features provide enough value compared to the amount of time they take to create and complexity that they add to system. PM from Market D also recognized this: “*We should question our customer requirements and think if we are delivering the best practice and does it make sense before implementing*”. The initial filtering of needs and requirements is done usually by business PM and later asking TPM’s input and opinions in technical work. According to one Market A TPM: “*We need to say ‘no’ more often to the customer*” because agreeing to all customer requirements lead to complex solutions and harder maintainable environments as was mentioned by a TPM in Market D as well. This has been recognized by a TPM in Market B who mentioned that many custom implementations has led to more issues later on in service phase customers when they are harder to maintain and cause more work. Weekly meetings are an ideal place and time to discuss the needs and requirements and whether something needs to be implemented or not. Without bigger analysis of a requirement, project team might have ended up to implementing them based on wrong specifications and/or limited amount of knowledge how to solve the issue and that has later led to bad implementations and refactoring. The biggest changes should be discussed in steering group level, as they may affect project schedule, scope and pricing.

**Task creation and specifications** can be done when everyone agrees on a task. At least the key people both on the technical and business side should give their agreement on the tasks before their implementation can be started. Especially in Market A, it was recognized that verbal agreements are not enough, as they might lead to misunderstandings and wrong implementation, and thus it is important to write, share and agree on the specifications between the key people in the project. Furthermore, a TPM in Market B has preferred that tasks are better defined and specified on business side before giving to technical people, which was a clear improvement during his project. Good written specifications have especially a benefit that the work can be initiated faster when the specifications are in deep enough level, which is especially important for remote TPM team that has big time difference with business and customer in Market D. Still, maintaining the
tasks on too detailed level causes an overhead that should be avoided.

After the tasks are specified and agreed on and everyone has a common understanding of the tasks, they are normally prioritized. Prioritization is a phase where already specified tasks are prioritized and allocated and often times even estimated. According to PM in Market D, prioritization is an important activity to recognize what brings the most value for the customer and are necessary for other parts of system to be implemented and work. In general, there are three different levels of prioritization: (1) PM/project owner should do larger scale prioritization with the customer and steering group, (2) customer should prioritize its own day-to-day requirements and (3) smaller scale, single task level prioritization should be done together with customer and Case Company’s project team in weekly meetings. Most of the projects that maintain task lists actively use those in weekly meetings to go over the tasks and their priorities. Priorities are mostly done by the people who work more in collaboration with the customer and especially on site. In Market C, project team prioritizes tasks together with customer in weekly meetings and later does own internal prioritization. In general, if prioritization does not exist, TPMs and business consultants take tasks based on their own prioritization. Still, in the end it is customer who should be giving their priorities and project team then align their work based on that. Case company’s project team gives their estimates for the work based on their current workload, other tasks and their dependencies. In service customers service managers are asking for estimates for tasks, and are not always able to estimate technical tasks themselves. In Market D, remote TPM team lead prioritizes tasks and gives estimates for service managers and customers. The prioritization and estimation in most projects work in a weekly level where past week done work and following weeks to be done work are discussed together with customer.

Task allocation and development is normally done based on task priorities but usually tasks are open to be worked on without restrictions and when people have time for them, and in that way has similarities to Kanban pull system. In some projects, especially larger tier 1 projects, PM or TPM lead are still allocating the tasks as they have the best overview of the top priority tasks to be done and they have more administrative role in project, managing the overall progress of the project, scope, schedule and resources.

Testing and validation is an important step in process of taking new features and implementations to production. Both TPMs and PMs in all the markets interviewed in this study have recognized that it is important to have someone else than the one implementing features and/or changes to test and validate the functionalities. This reduces the amount of errors and
misunderstandings in implementations, but also facilitates knowledge sharing. TPMs feel that the business consultants and business PMs might have a better understanding of customer needs and different use cases and therefore can do more thorough testing and validation of the features even together with the customer. Still, especially in technical implementations related to data changes, both TPMs and business side PMs and consultants should do the validation together and after that inform the customer and ask for customer’s agreement and further validation of results and testing. In many markets, both TPMs and PMs mentioned that validation might take a long time and many times stays pending on customer side. Only after the customer has validated and agreed on features and implementations, they should be **deployed to production**.

It is important that tasks are communicated and transparent between the customer and project team and that individuals commit to maintain and update the tasks. This way team has clearer specifications and common understanding of what needs to be done, but can also see if tasks are on hold and how customer is working with tasks. Tasks usually contain information such as status, responsible organization and person, priority and deadline (start and end dates), area or category, topic and more defined specifications. This way required information can be easily accessed and one may find information even later or if not originally part of the discussions and know why something has been implemented or changed. Task status is communicated through task management tools, chats and meetings with the customer and internally at Case Company.

Currently TPMs feel like customers are not completely aware of process nor the implemented logic, and even PMs see technical work as a black box. The tasks that are shared with the customer are usually bigger entities whereas the ones maintained and managed internally are split to smaller tasks and contain more specific details and many times even internal information that cannot be shared with the customer. Therefore, tasks shared with customer and internal tasks are separated from each other in many projects and markets.

Work in Case Company’s projects and service customers has been recognized to be fast paced where new requirements are emerging constantly and where project team’s main strength of reacting fast to customer needs and requests is highlighted. Lead time of the tasks is short, but some tasks taking longer time require PM pressure to decrease waiting times. Especially in smaller projects the work is continuous and the features and changes are done fast on both customer and Case Company side. Furthermore, work is seen iterative and consisting of a lot of changes, to which customer has learned to trust as Case Company can react fast to issues. According to TPM in Market
 CHAPTER 4. EMPIRICAL STUDY

D. project phase work is changing all the time and new tasks are received fast and old ones may be even deferred. In service work, tasks can be more structured and systematic when system is already more stable. Both TPMs and business side consultants and PMs feel that they can work by taking the next bigger task under development when the previous one is done, but the priorities may change fast and some tasks are later deprecated. Also, when people work in different projects simultaneously there is a lot of task switching. This leads to situations where new requests are received and there has not been time for sufficient resource planning and team leads struggle to plan the schedules and they need to react fast to new requests with minimal resources. This leads to uncertainties and work that is hard to estimate and manage.

Urgent requests are received especially from service customers. This issue was especially present in Market A and B where most of the company’s service customers are situated. Especially on TPM side, service customers cause a lot of overhead and task switching which delays TPM work in ongoing projects. Service customers usually have only one TPM responsible over them, and who is simultaneously part of ongoing projects. One sub team in Market A had started to prototype a duty officer model where TPMs are taking turns of working as a duty officer being responsible over service customers of the team for a week and then handing over the duty for the next one. This model has been received well and has reduced the amount of task switching, enabled better focus on a longer development and improved workload balancing and knowledge sharing within technical team. Business manager of the same sub team thinks that Case Company should start to divide service and project work more from each other in the future and have different resources for two.

In Market D, technical teams are divided to on site and remote teams. Remote team has been especially responsible over service customers and managing those tasks together as a team of three - four people. This model has been starting to take over in other markets as well, and the remote team has taken more service customers under their responsibility from different markets.

In one larger project in Market A, the team has more determined release cycle that lets them to plan the work better and structure it according the resources. The given project team also argued that the set releases has a benefit of that “we don’t break the system so often”. This is maintained especially in service phase smaller development work that can be maintained in more structured manner.

Overall, the flexibility to adapt to different customer needs and requirements is seen as one of the biggest benefits in project work with the customer, but also a potential pitfall of implementing everything that customer
requests. This highlights the importance of analysis of customer requirements before implementations. But as mentioned by a TPM in Market D, the possibility to adapt fast to changes and customer requests has enabled the trust between Case Company and customer where rapid development, changes and fixes are not feared anymore.

4.1.3.2 Task management tools

Task management tools play key role in sharing the knowledge and managing the tasks and project together with the customer and project team. As a TPM from Market D stated “In big projects you have to remember to maintain all the things listed somewhere so that you do not forget anything”. Without any task lists tasks would remain open and get forgotten. Currently, there is a broad spectrum of different project and task management tools and methods in use and no common way of managing the tasks and projects is known. Most common tools, their use cases, pros and cons are listed into three different Tables 4.1, 4.2 and 4.3, separated by the characteristics of different tools. Table 4.1 contains all the offline task management tools that are either physical or not available through web. Table 4.2 contains all the task management tools that are purely ment for task management and are used online. Table 4.3 contains online tools that are mostly used for communication and information management, rather than task management. Still in our empirical study, we found these to be used as task management tools, either by maintaining separate task management lists inside the tool, or using the information gathered from a tool as a main method to manage the tasks.

Whereas most of the tools are capable of managing tasks on both project team and individual level, the main differences were in usability, transparency and capability of sharing the tool with the customer. Access rights to different tools and not being able to share tools with customer or internally with others than project team, has been seen as one of the major cons. Obviously, physical and offline tools listed in Table 4.1 perform the worst in this aspect, as these are not possible to be shared with others efficiently. Furthermore, the lack of possibility to maintain all project information in a single tool has been seen as a con in many of the tools. Information management tools, listed in Table 4.3, are good way to manage all the information in the same place, but these are not as flexible in task management as tools listed in Table 4.2. Lack of visibility and access rights in different tools have resulted to having information and tasks under many different systems.
Table 4.1: Different offline task management tools, their use cases, pros and cons

<table>
<thead>
<tr>
<th>Tool</th>
<th>Use cases</th>
<th>Pros</th>
<th>Cons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excel</td>
<td>Shared view of the situation of the tasks in the project</td>
<td>High level tasks and quick view</td>
<td>Little information and can get quite heavy and tasks may get lost in big sheets. A lot of communication happens outside of the sheet and information gets scattered. Needs a common place where it can be shared, or otherwise needs to be sent back and forth</td>
</tr>
<tr>
<td>Physical board</td>
<td>Used in daily standups in customer premises</td>
<td>Visuality of the board and clear status of the project by one look</td>
<td>Needs everyone to be on site</td>
</tr>
<tr>
<td>Own notes in a text file or Post-It notes</td>
<td>Individual daily tasks</td>
<td>Easy to maintain and necessary if no proper task management is done in projects or scattered under different tools</td>
<td>No transparency</td>
</tr>
</tbody>
</table>
Table 4.2: Different online task management tools, their use cases, pros and cons

<table>
<thead>
<tr>
<th>Tool</th>
<th>Use cases</th>
<th>Pros</th>
<th>Cons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Redmine</td>
<td>Internal tasks and specifications and code changes linked to tickets</td>
<td>Good existing template project template. Code commits gathered under tickets and good traceability.</td>
<td>Cannot be shared with customer and is heavy and hard to use for some employees</td>
</tr>
<tr>
<td>Trello</td>
<td>Individual task lists and task boards shared with project team and/or customer</td>
<td>Lightweight, visual and easy to maintain. Many times shared with customer</td>
<td>Gets outdated if it does not contain enough information and provide significantly value. In Tier 1 project it did not work as it did not give good overview and had too much information</td>
</tr>
<tr>
<td>JIRA</td>
<td>Shared with customer and to manage the tasks together with customer</td>
<td>Shared view of project with the customer, possibility to see person’s own tasks and project’s progress easily. Good to have all the communication in the same place</td>
<td>-</td>
</tr>
<tr>
<td>Smartsheet</td>
<td>Shared task lists with customer, managing the tasks and project together</td>
<td>Shared task lists with customer and being able to see current status. Hierarchies and filtering of the tasks.</td>
<td>Overall progress of the project and getting an overview of many projects is not easy to find. Less documentation and comments regarding changes.</td>
</tr>
<tr>
<td>Microsoft Task</td>
<td>Similar board view as in Trello. Used in one project for internal task management</td>
<td>Visuality and clearer process</td>
<td>Not shared with customer</td>
</tr>
</tbody>
</table>
Table 4.3: Different information, communication and documentation management tools, their use cases, pros and cons

<table>
<thead>
<tr>
<th>Tool</th>
<th>Use cases</th>
<th>Pros</th>
<th>Cons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Confluence page</td>
<td>Gather all tasks in same place with project documentation and other information</td>
<td>Having all project information in the same place</td>
<td>Not being able to filter tasks and it becomes heavy to maintain. Cannot be shared with customer</td>
</tr>
<tr>
<td>Teamwork</td>
<td>Redmine type of project space and management tool where all the project information is maintained</td>
<td>All project related information is in the same place and shared with customer</td>
<td>A lot of information and hard to use. Customer does not update information frequently</td>
</tr>
<tr>
<td>Google Drive</td>
<td>Project documentation and internal task lists</td>
<td>All information in the same place in structured folders</td>
<td>Not shared with customer</td>
</tr>
<tr>
<td>SharePoint</td>
<td>Project space for documentation and task list</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Company chat application</td>
<td>Communicate and discuss the tasks fast through Case Company's chat application with all the relevant people</td>
<td>Fast communication and minimal overhead</td>
<td>Tasks and information gets lost and forgotten easily and there is no transparent overview available. Harder to maintain overall status</td>
</tr>
</tbody>
</table>

4.1.4 Teamwork and communication

In most of the projects, the project team consists of one to two TPMs, one PM and one to two business consultants from Case Company side. Later after support handover, technical and business support teams take the responsibility over customer’s questions and issues and further development is
taken care of by service manager and TPM. Teamwork, responsibilities and communication is modeled in Figure 4.5.

Figure 4.5: Teamwork and communication in Case Company projects

Many projects have two TPMs assigned to one project: one senior and one junior. Senior TPM has the responsibility of specifying the technical integration with customer and providing technical help for project team, whereas junior is doing most of the implementations. This way junior TPM can focus better on larger development for longer time and when there are more tasks, other TPM can help in workload balancing. This model works especially well in Market C where TPMs discuss the implementations together and learn from each other. Still, in most of non-tier 1 projects it is only one TPM who knows everything about the implementation and is responsible of
doing development work, both in project and service phase.

PMs would want to have more TPMs available in their projects to do technical tasks. Especially in Market C, one PM felt that her projects are not that highly prioritized and TPMs in those projects are tied to more important projects that take most of their time: “Not all the projects have same prioritization and some of the resources are tied to higher priority projects which cause waiting times in others”. She would prefer to have a team of TPMs to which she could assign technical tasks of her projects. This kind of a shared responsibility over projects on technical side was recognized as one big improvement point by Market A and B TPMs and PMs as well.

In general TPMs are responsible of guiding the technical workshop in the beginning of the project, technical integration, implementation and unit and integration testing and maintenance of the customer environment. Especially in Market B, business side would want to have TPMs more on site and more involved in projects. Also, especially in Market A and B, business side feels that a lot of technical communication goes through PM and business side rather than TPM. Still, according to TPMs they communicate quite a lot with the customer. In Market B tier 1 project, TPM felt that he was even overwhelmed with questions and direct contact by customer in certain phases of the project and that led to big amount of tasks, questions and open issues and made his work hard. During that time the project did not have any proper task management tool in use either. Later point, a lot of tasks have been filtered by PM and all the questions and issues are not directly sent to TPM.

PM is responsible over every phase of the project and is overseeing that the project is in schedule. PM is more customer orientated and works in tight collaboration with them. Usually projects have one PM and one junior business consultant. In smaller customers PM might also be doing business configurations in customer environment, whereas in tier 1 projects PM has more administrative role and is more responsible of customer communication, overseeing the project and managing the resources, budget, schedule and tasks. In tier 1 projects, there are numerous business consultants doing the actual business configuration work. Business consultants and PM are responsible to understand the business needs and translating those to configurations in the system.

In most of the markets, TPMs would want that PMs and business consultants would have more technical knowledge and vice versa PMs and business consultants would prefer that TPMs would understand the business better and also therefore to do better implementations and validations. In Market C some of the teams work in collaborative manner where PM and TPM sit down together to discuss solutions, implementing and testing them in one
CHAPTER 4. EMPIRICAL STUDY

longer workshop. That way they try to reduce the waiting times and also benefit from different knowledge that they have. TPM feels like the communication and collaboration with technically aware PMs is easier and vice versa.

Experience and general knowledge level of TPM or PM affects how responsibilities in projects are shared. There are some gray areas where it is not clear who is responsible and different experience and knowledge levels affect to that as well. In the end this might lead to a situation where other one has to take more responsibility of project and manage work on both technical and business side.

Scheduled weekly meetings in project phase with the customer and internally with the project team are the main means for sharing the status of the project and issues collectively between everyone. In many projects task lists are communication tools in these meetings and open issues are discussed together in meetings. This was recognized as a best practice especially in Market C. In service customers on the other hand, service manager has seldom meetings with the customer, depending on service manager and customer how regularly those are set. Workshops at customer site and working on site with the customer has been seen beneficial and a necessary part of the project. In Market B and D tier 1 projects, business side had also daily standups with the customer representatives two to five times a week to discuss the open issues and current status.

Otherwise emails are the most common communication channel with the customer. PMs send weekly reports over an email where they list current development areas, what has been done lately and what should be done in the near future. A business manager from Market A thinks that those emails are hardly read by anyone, and that they therefore do not provide any real value. Some of the projects in Market A had taken shared chat applications into use with the customer that also lowered the threshold for questions and requests from customer, but helped in collaboration with the customer and reduced the response times and delays. It has increased the feeling of collaboration and working towards common goal with customer.

After the projects are closed, project team discusses the lessons learned and what worked well and what worse during the project. Especially in Market A, both TPMs and PMs thought that this kind of retrospectives could be useful more often even during the project to improve the work already then and not hear about the issues only after the project. In Market B tier 1 project, retrospectives are done every three months and project team thinks that it is enough.

TPMs and PMs are assigned to many different projects in different phases at the same time, except in tier 1 projects the team is mostly focusing on that
project. TPMs are assigned to multiple service phase customers that causes them a lot of work, especially when they are the only ones that know those projects in detail. This has been recognized as a big challenge especially in Market A and B with the biggest amount of service customers. All the smaller development and issue investigations rely on one TPM in these customers and during holiday seasons it is hard to find people to take care of the projects. There is a need to share knowledge better and take more shared responsibility over the projects.

Figure 4.6: Project, team and portfolio level management and communication

The different levels of project, team and portfolio management and their communication is illustrated in Figure 4.6. It highlights the frequency of different meetings and information synchronizations in different levels of hierarchy in technical project management team. In project level, project teams are having regular and frequent weekly meetings with customer and internally. In this level, project and task management and communication with the customer are highlighted. Furthermore, project team workload is being analyzed and balanced. In market team level, TPM teams are having irregular team meetings where they go through the given market’s projects and resource situation and analyze possible issues. They evaluate and estimate the market team’s workload, and assess the need for new resources. On the highest level, Case Company project portfolio situation is discussed by CTO together with technical market leads. In these meetings, the project
and resource situation in all the markets are analyzed and possible issues are highlighted on a higher management level.

Even though TPM team is divided to different market teams, TPMs work mostly by themselves with their projects. TPMs get help from others but it is hard to delegate tasks for others when everyone is busy and handovers take a lot of time. TPM in Market B with many customers both in service and project phase stated that it is hard to share tasks and responsibility of projects to others when they do not know big picture and all characteristics of projects. Furthermore, there is no shared knowledge or a single source of an information for an overview of status of different projects under Market teams. Then, handovers would require a lot of effort when responsible TPM would need to explain special characteristics of a task and project. Therefore, projects and tasks are preferred to be done individually by a single TPM rather shared with a team.

4.2 Best practices

In this Chapter we will list the main best practices in three areas of this Thesis: project management, task management and teamwork and communication based on the overview of current situation in Case Company. These are the current best practices that are being followed in all of the markets, or have been recognized to provide significant value in some projects. All of the best practices are not necessarily always applicable in all the customer projects, and therefore their possible use should be evaluated by a project team. Still best practices should be followed whenever possible. In addition to listed best practices in tables, we discuss some of good practices from individual projects that could be considered in other projects as well.

4.2.1 Project management

The current main best practices of project management are gathered into Table 4.4. We have separated the best practices under three main categories: project model, templates and documentation and tools and monitoring. These are the best practices that have been used to some extent in all the markets or have been recognized to provide significantly value in project management in a certain market(s) and project(s). We have listed the markets and types of projects where the best practices have especially been recognized.
Table 4.4: Best practices in project management

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
<th>Markets</th>
<th>Type of projects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project model</td>
<td>Focus on being as iterative and adaptable to changes as possible</td>
<td>All</td>
<td>All</td>
</tr>
<tr>
<td>Project model</td>
<td>Demo implementation in a sales phase</td>
<td>All</td>
<td>All</td>
</tr>
<tr>
<td>Project model</td>
<td>Sales to project delivery handover</td>
<td>All</td>
<td>All</td>
</tr>
<tr>
<td>Project model</td>
<td>As is - to be workshops where customer’s current process is analyzed and future goal is specified</td>
<td>All</td>
<td>All</td>
</tr>
<tr>
<td>Project model</td>
<td>Listing business requirements and basing acceptance tests on those</td>
<td>B, D</td>
<td>Tier 1</td>
</tr>
<tr>
<td>Project model</td>
<td>Technical workshops by TPM and creating integration documentation</td>
<td>All</td>
<td>All</td>
</tr>
<tr>
<td>Project model</td>
<td>Iterating business configurations in a tight collaboration with customer</td>
<td>All</td>
<td>All</td>
</tr>
<tr>
<td>Project model</td>
<td>Business workshops creating configurations and analyzing results with customer</td>
<td>All</td>
<td>All</td>
</tr>
<tr>
<td>Project model</td>
<td>Gradually rollout software with a smaller scope and iteratively improve the system</td>
<td>All</td>
<td>All</td>
</tr>
<tr>
<td>Templates and documentation</td>
<td>Documentation in shared place (in cloud) with customer</td>
<td>All</td>
<td>All</td>
</tr>
<tr>
<td>Templates and documentation</td>
<td>Project plan and schedule and integration documentation</td>
<td>All</td>
<td>All</td>
</tr>
<tr>
<td>Tools and monitoring</td>
<td>Project management tools and methods should be discussed and agreed in kick off meeting with customer</td>
<td>All</td>
<td>All</td>
</tr>
<tr>
<td>Tools and monitoring</td>
<td>Gather project information as much as possible under one system and avoid using many separate tools with overlapping information</td>
<td>All</td>
<td>All</td>
</tr>
<tr>
<td>Tools and monitoring</td>
<td>Weekly meetings internally and with customer</td>
<td>All</td>
<td>All</td>
</tr>
<tr>
<td>Tools and monitoring</td>
<td>Steering group status checkup once a month and between project phases</td>
<td>All</td>
<td>All</td>
</tr>
<tr>
<td>Tools and monitoring</td>
<td>Used versus budgeted hours measured on monthly level</td>
<td>All</td>
<td>All</td>
</tr>
</tbody>
</table>
Project model in general is recognized to be waterfall type of a model with consecutive phases. Still, all the markets recognized that it is a good practice to be always ready for changes and work in an iterative manner with the customer, working in a continuous development/configuration, validation, feedback and improvement loop. Case Company’s fast reaction to changes was recognized as one of the biggest benefits and value providing characteristics. To manage the fast changes and create working feedback and improvement loops, a best practice would be to discuss project and task management and communication tools and methods alongside with Case Company’s project model in the kick off meeting of project.

In the sales phase and beginning of the project, the discussions on scope and requirements are good to base on some implementation of a software and could be recognized as a best practice. Later this customer specific knowledge and important notes on customer and internal expectations are good to pass from sales to project delivery people, so that goal of the project from sales perspective is clear also for project team.

As is - to be workshops were recognized in all the markets as one main activity in the initiation phase of the project. This is a necessary part of the project, to better understand customer’s current situation and then collaborate and plan the improvement needs and goals for future. These needs and goals have been converted to an actual list of requirements that can then be later be used as a basis for acceptance test cases in Market B and D in tier 1 projects. This is a good practice to validate and test system and results more thoroughly and in more organized manner.

A list of requirements should work as a basis also for technical workshops where TPM is guiding a discussion on data requirements and creating integration documentation together with the customer. Especially in markets B and D it was recognized that deeper business workshops are good to start simultaneously with technical implementation, as technical integrations are many times delayed and late. These business workshops aim to model configurations in software, and iteratively improve and develop them. Later when software is configured with customer’s data, the actual results of configurations can be validated and presented to customer who then approves or asks for improvements. In this phase it is important to work in tight collaboration with customer and work as much as possible with them on site and provide support in validation and improvements.

When customer is satisfied with results, gradual rollout of the software can be initiated. Good practice is to start with a smaller scope, and still iteratively improve the system when software is taken into use step by step in different customer units.

Documentation should always be shared with the customer in a com-
mon, usually cloud based, **tool**. This facilitates version control of documentation and having all the relevant information being available for all the people involved in the project. One related best practice that is not always followed in projects due to constraints with different tools, is to maintain all the relevant information regarding the project in the same place and not scatter the information under many different systems. The necessary and most value providing documentation that should exist in all projects is project plan and schedule defining the scope and timeline of work; and integration documentation defining the data integrations between customer and Case Company. Functional design used in Market D in tier 1 project, due to the delayed technical implementation, was a good tool for defining and modelling business configurations in a sufficient level before actual configuration work in software, but would not be applicable in all the cases due to its heaviness.

To **monitor** projects better, regular weekly meetings internally and with customer are used in all the markets and is considered as a best practice to be followed. This facilitates constant follow up on issues and keeps all the stakeholders committed to project. Weekly meetings are also a place and time to raise questions, new requests and discuss current status of project. Higher level steering group status checkups should be scheduled once a month and between project phases. Objective of steering group meeting is to review project schedule and plan, and evaluate the current status, scope and possible risks and challenges of project and communicate those to higher management on customer side. Steering group should analyze whether some actions are needed to make project perform better in case of issues. Basic performance metric in projects is calculating used and budgeted hours in monthly level, and analyzing where the hours are spent and whether Case Company is performing efficiently, and if not what are the reasons for that.

### 4.2.2 Task management

The current main best practices of task management are gathered into Table 4.5. We have separated the best practices under three main categories: process, transparency and tools. These are the best practices that have been used to some extent in all the markets or have been recognized to provide significantly value in task management in a certain market(s) and project(s). We have listed the markets and types of projects where the best practices have especially been recognized.
### Table 4.5: Best practices in task management

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
<th>Markets</th>
<th>Type of projects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Process</td>
<td>Elicitation of requirements especially by PM and business consultants</td>
<td>All</td>
<td>All</td>
</tr>
<tr>
<td>Process</td>
<td>Analysis of requirements</td>
<td>All</td>
<td>All</td>
</tr>
<tr>
<td>Process</td>
<td>Written specifications of requirements</td>
<td>All</td>
<td>All</td>
</tr>
<tr>
<td>Process</td>
<td>Prioritization of requirements with customer and internally</td>
<td>All</td>
<td>All</td>
</tr>
<tr>
<td>Process</td>
<td>Testing and validation of implementations by customer and several people internally</td>
<td>All</td>
<td>All</td>
</tr>
<tr>
<td>Process</td>
<td>Deploying to production only after required stakeholders have tested and validated changes</td>
<td>All</td>
<td>All</td>
</tr>
<tr>
<td>Process</td>
<td>Iterations of one week</td>
<td>All</td>
<td>All</td>
</tr>
<tr>
<td>Transparency</td>
<td>Shared task management and process with customer</td>
<td>All</td>
<td>All</td>
</tr>
<tr>
<td>Transparency</td>
<td>Tasks should have status, responsible organization and person, priority and deadline (start and end dates), area or category, topic and more defined written specifications</td>
<td>All</td>
<td>All</td>
</tr>
<tr>
<td>Tools</td>
<td>Shared task management tools with customer</td>
<td>All</td>
<td>All</td>
</tr>
<tr>
<td>Tools</td>
<td>Separate internal task management for internal tasks</td>
<td>All</td>
<td>All</td>
</tr>
<tr>
<td>Tools</td>
<td>Technical tickets and code commits linked to those tickets in an internal task management tool</td>
<td>All</td>
<td>All</td>
</tr>
<tr>
<td>Tools</td>
<td>Require commitment for task management from whole project team and customer</td>
<td>All</td>
<td>All</td>
</tr>
</tbody>
</table>
Regarding process of managing tasks together with customer and also internally within project / TPM / PM teams it is a best practice to follow steps of:

- **Elicitation of requirements**, where especially PM and business consultants are responsible of converting customer needs to an actual requirements

- **Analysis of requirements**, where received needs and requirements are analyzed with project team and customer, and whether it is valuable to implement. It is important to recognize non value providing requirements and decline those.

- **Specification of requirements**, where agreed requirements are specified in written form in a shared place where everyone can access the information

- **Prioritization of requirements** with customer and internally. This should be focus especially in weekly meetings together with customer and openly discuss on where the current focus and prioritization should be.

- **Testing and validation of implementations** by customer and several people internally. Best practice is to test the implementations internally by the one doing implementations but also by someone else to avoid misunderstandings and mistakes.

- **Deploying to production** after implementations are validated, tested and agreed by everyone. Deploy should be coordinated, communicated and agreed with relevant stakeholders.

This process follows usually weekly iterations where in regular weekly meetings the implemented tasks since last meeting, currently open tasks and new tasks are discussed together with customer. In these meetings, the prioritizations of the tasks should be discussed and where the main focus should be during the following week. In weekly meetings the focus should be especially on the first four steps of a process and creating a common understanding of needed requirements and their importance.

To have a better **transparency** of current status of tasks and avoid misunderstandings and unnecessary waiting, a shared task management **tool** with customer is recognized as a best practice. Task management tools are
furthermore used in many markets as a communication tool in weekly meetings. In this tool, all the tasks that need action or opinions from both customer and Case Company, should be shared and documented clearly. Best practice is to include at least following information regarding tasks: status, responsible organization and person, priority and deadline (start and end dates), area or category, topic and more defined specifications.

Tasks that contain sensitive information and/or are not desired to be shared with customer, should be maintained separately in an internal tool. These tasks are many times related to technical issues and core product deep level information. Best practice is to create technical tickets in internal task management tool, where code commits, comments and more detailed internal specifications are gathered. This facilitates traceability of the changes and code commits.

Unused or irregularly updated task management tool does not provide any value. Therefore, it is important to get project team and customer committed in using the common task management processes and tools. One recognized best practice to get customer and project team committed is to use task management tool in weekly meetings and base the discussion on top of it. Thus, task management tool should be helping also in teamwork, customer collaboration and communication throughout the project.

### 4.2.3 Teamwork and communication

The current main best practices of teamwork and communication are gathered into Table 4.6. We have separated the best practices under three main categories: communication, responsibilities and resourcing. These are the best practices that have been used to some extent in all the markets or have been recognized to provide significantly value in teamwork and communication in a certain market(s) and project(s). We have listed the markets and types of projects where the best practices have especially been recognized.

Regular weekly meetings internally and with the customer during the project is the key concept of project communication and best practice followed in all the markets. As already previously mentioned, these are a mean for project monitoring but also task management and discussing any concerns regarding project.
Table 4.6: Best practices in teamwork and communication

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
<th>Markets</th>
<th>Type of projects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication</td>
<td>Regular weekly meetings internally and with the customer</td>
<td>All</td>
<td>All</td>
</tr>
<tr>
<td>Communication</td>
<td>Regular on site visits at customer</td>
<td>All</td>
<td>All</td>
</tr>
<tr>
<td>Communication</td>
<td>Regular TPM team meetings to analyze workload and satisfaction of the team</td>
<td>All</td>
<td>All</td>
</tr>
<tr>
<td>Communication</td>
<td>Regular TPM market lead meetings to analyze workload across the markets and resourcing situations</td>
<td>All</td>
<td>All</td>
</tr>
<tr>
<td>Communication</td>
<td>Project and TPM / PM team sitting together</td>
<td>A, C, D</td>
<td>All</td>
</tr>
<tr>
<td>Communication</td>
<td>TPM and business consultant sessions where implementations are created together</td>
<td>C</td>
<td>Medium sized and tier 1 projects</td>
</tr>
<tr>
<td>Responsibilities</td>
<td>Administrative PM being responsible of overall progress of the project, scope and costs</td>
<td>All</td>
<td>Tier 1 projects</td>
</tr>
<tr>
<td>Responsibilities</td>
<td>PM doing initial filtering of the tasks</td>
<td>All</td>
<td>All, but especially tier 1 projects</td>
</tr>
<tr>
<td>Responsibilities</td>
<td>TPM being responsible of technical implementation phase and guiding and managing the work there</td>
<td>All</td>
<td>All</td>
</tr>
<tr>
<td>Resourcing</td>
<td>At least two TPMs and business consultants in one project</td>
<td>All</td>
<td>All</td>
</tr>
<tr>
<td>Resourcing</td>
<td>Separate individuals / teams to manage group of service customers and their technical issues and further development</td>
<td>A, D</td>
<td>All</td>
</tr>
</tbody>
</table>
In addition to weekly meetings, some Market A projects recognized a good practice of having shared instant messaging applications with the customer that lowers the threshold of communication and helps the team to collaborate and work together with the customer even more efficiently and gives expression of working more as a partner with the customer. Though, in some cases this results to more contacts and faster response time expectations from customer side, and thus might cause overhead and more work on Case Company side. Therefore, even though recognized as a benefit in some of the projects, instant messaging applications shared with customer should be seen just as a good practice that project teams can consider in their projects.

Other good practice of giving more partner feeling for the customer was recognized to have regular, two to five times a week, daily standups where open issues, current development and any concerns are openly discussed shortly. Regular on site visits and having the daily standups on site with the customer are recognized as a good practice mostly in tier 1 projects in Markets B and D, where project teams are close to customer premises and able to provide more support and physical presence at customer site. This might not be possible due to distances between customer and Case Company in some cases, and therefore having regular site visits is a best practice that might not be followed in all the projects.

For internal team management, regular TPM team meetings were recognized as a best practice that is followed more strictly in other markets and less regularly in others. Especially in Market C, these meetings are being held regularly once a month. According to TPM in Market C there is no need to have more as the team is sitting and located in the same place and everyone is therefore aware of the status of others in a high level. In these meetings, TPM teams are discussing the status of projects of each team member, what is their current workload and if they have any other concerns or best practices to be shared. In addition to team level meetings, TPMs are having regular market lead meetings, where market TPM leads sit down with CTO, and discuss the market situations especially focusing on resources, project statuses. On PM side, these kind of cross market meetings and analyzing the market workloads, resources and ongoing and upcoming projects does not exist.

For internal teamwork and communication it was recognized that when the project team can sit and work together in same place, it provided the best results. Mostly Markets A, C and D have a possibility to have at least in some projects most of the technical and business people sitting in a same place together. Two TPMs in Market C mentioned a good practice of sitting together with PM / business consultant irregularly, reserving a couple
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of hours for working together with a set of customer requests, specifying
them together, analyzing the best possible solutions and implementing and
validating them together. According to TPMs, this reduced especially the
waiting time of validation work, that otherwise many times stay pending but
also helped in doing better implementations and creating better knowledge
for both business and technical people of overall solution. Even though these
best practices might not be possible in all the projects or markets, we en-
courage teams to aim to these whenever possible due to their big impact in
improved communication and teamwork.

Having one more administrative PM filtering tasks and requests coming
from customer and taking overall control of the project has been seen as
a best practice regarding responsibilities. This facilitated work of TPMs
and business consultants and let them to focus on actual solution and de-
velopment work. Similarly, when doing resourcing of a project, it was
recognized that in many cases having two TPMs and two business side con-
sultants working in one project helped in workload balancing, finding better
solutions together and avoiding mistakes through more thorough testing, re-
viewing and validation. In technical side, a best practice is to have one TPM
being responsible of technical specifications and customer communication
whereas other one is focusing more on technical implementations based on
specifications and working in more isolated way. Having one more senior and
one junior paired in projects was also recognized to provide better knowledge
sharing and learning.

In Market A, one TPM team started to have a duty officer being respon-
sible of managing the technical tasks coming from team’s service customers
in one week periods. The team has been content with the new model and
feel like that has helped in workload balancing, knowledge sharing of team’s
different customer projects and overall knowledge of product and different
implementations, taking more shared responsibility of projects and further-
more let others focus better on longer term project work. In Market D,
a separate team of TPMs started to work remotely with Market D service
customers and taking full responsibility of service customers, their technical
issues and further development, and that way separating technical project
and service work from each other.

TPM is mostly responsible of technical implementation phase of the
projects, and guiding and managing work during that phase. Critical ac-
tivities for TPM are creating and maintaining integration documenta-
tion, maintaining customer software environments, implementing data integrations
with customer’s IT department, doing integration and unit tests and later on
helping in data validation. Business consultants are responsible of creating
business configurations and processes for customer, and analyzing customer
needs and converting those to business requirements.

4.3 Challenges

In this Chapter we will list the main challenges in three areas of this Thesis: project management, task management and teamwork and communication based on the overview of current situation in Case Company.

4.3.1 Project management

The current main challenges of project management are gathered into Table 4.7. We have separated the challenges under three main categories: project model, templates and documentation and tools and monitoring. These are the challenges that have been recognized to some extent in all the markets or have been recognized to cause significant challenge in subset of markets and projects. We have listed the markets and types of projects where the challenges have especially been recognized.

Current project model being waterfall type of a model with consecutive phases, has been recognized to have challenge with criticality of early specifications, designs and requirements. In different types of projects, especially in Market A and B, the requirements and specifications were done in deep level in early stages of a project which locked them down to certain designs. As deep level specifications have been recognized to be hard to do, especially in early stages of a project, these led many times to refactoring and redesigning the data integrations and requirements. Many times early design and requirement decisions are highly theoretical and not always represent or apply in practice. This has been especially problematic when the changes have been needed in customer side data integrations, as those are many times the main cause for delays in technical implementations and later on in whole projects. When technical implementation is delayed, teams have started business configurations in parallel with technical work and before technical phase has finished. In some projects this led to an issue where the data had not yet been completely validated and the business configurations were set based on wrong data and it was hard to see whether the results were bad because of the data or configuration.
## Table 4.7: Major challenges in project management

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
<th>Markets</th>
<th>Type of projects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project model</td>
<td>Criticality of good and comprehensive early specifications, designs and requirements, and their affect to refactoring</td>
<td>A, B</td>
<td>All</td>
</tr>
<tr>
<td>Project model</td>
<td>Delays in technical implementations</td>
<td>All</td>
<td>All</td>
</tr>
<tr>
<td>Project model</td>
<td>Not clear support handover and responsibilities</td>
<td>All</td>
<td>All</td>
</tr>
<tr>
<td>Templates and documentation</td>
<td>Outdated templates and documentations not applicable in all projects</td>
<td>All</td>
<td>All</td>
</tr>
<tr>
<td>Tools and monitoring</td>
<td>Current tools for project management and monitoring are not good or unified in Case Company</td>
<td>All</td>
<td>All</td>
</tr>
<tr>
<td>Tools and monitoring</td>
<td>No good tools that could be shared with the customer to better manage the project together</td>
<td>All</td>
<td>All</td>
</tr>
<tr>
<td>Tools and monitoring</td>
<td>Information is scattered to numerous systems and it is hard to have an overview</td>
<td>All</td>
<td>All</td>
</tr>
<tr>
<td>Tools and monitoring</td>
<td>Not having professional appearance without proper tools and methods</td>
<td>All</td>
<td>All</td>
</tr>
</tbody>
</table>
Support handover has been recognized to be a challenge. Many projects struggle in this phase as some of the projects do not have clear cut between support and project phase, and some projects stay long time somewhere between project and support work occupying resources from both teams. Furthermore, even if the projects are completely handovered to the technical support team, especially TPMs receive a lot of queries and questions from their old projects and are still considered as responsibles over their old projects. This is mainly due to technical support team not understanding or knowing all the details of the specific customer and that restricts their assistance only to a certain extent. Furthermore, technical support team lacks the required knowledge to solve the most technical issues independently. Therefore, any future smaller technical development that is needed for service customers, relies on old TPMs of the project.

Especially many PMs mentioned that project management templates and documentation are outdated or not applicable in all projects. Therefore, a lot of material is shared between smaller sub teams and no company level templates and documentation are maintained and/or used. This has been a separate internal development project throughout Spring 2018 and many markets already recognized that the situation has gotten better.

All of the markets mentioned a challenge of not having proper tools for project management provided by Case Company. Projects rely many times on customer having project management tools and methodologies that could be used and followed in projects. Furthermore, there are no good tools for monitoring the projects and especially having an overview of all projects of a certain team, that especially team leads would be interested to see. Currently the information is scattered under many different tools and systems, that might not even be accessible by other than project members. Furthermore, especially PMs, would prefer to have company wise project management tool and methodology that could be presented to customer already in kick off meeting and the beginning of project, and that way give more professional expression.

### 4.3.2 Task management

The current main challenges of task management are gathered into Table 4.8. We have separated the challenges under three main categories: transparency, tools and process. These are the challenges that have been recognized to some extent in all the markets or have been recognized to cause significant challenge in subset of markets and projects. We have listed the markets and types of projects where the challenges have especially been recognized.
### Table 4.8: Major challenges in task management

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
<th>Markets</th>
<th>Type of projects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transparency</td>
<td>Task status is not always transparent and some tasks remain open and are forgotten</td>
<td>All</td>
<td>All</td>
</tr>
<tr>
<td>Transparency</td>
<td>There is no overview of work and workload within project teams and internal teams</td>
<td>All</td>
<td>All</td>
</tr>
<tr>
<td>Transparency</td>
<td>No visibility of what is in progress on customer side and vice versa</td>
<td>All</td>
<td>All</td>
</tr>
<tr>
<td>Transparency</td>
<td>Tasks are received with short notice</td>
<td>All</td>
<td>All</td>
</tr>
<tr>
<td>Transparency</td>
<td>Misunderstandings in logic and implementations</td>
<td>All</td>
<td>All</td>
</tr>
<tr>
<td>Tools</td>
<td>No set task management tools that could be shared with customer</td>
<td>All</td>
<td>All</td>
</tr>
<tr>
<td>Tools</td>
<td>Internal tools are not used comprehensively</td>
<td>All</td>
<td>All</td>
</tr>
<tr>
<td>Tools</td>
<td>Large amount of different tools in different projects</td>
<td>All</td>
<td>All</td>
</tr>
<tr>
<td>Process</td>
<td>Not analyzing requirements enough and starting implementations with too little knowledge</td>
<td>All</td>
<td>All</td>
</tr>
<tr>
<td>Process</td>
<td>There is no documented process or best practices for development and configuration work</td>
<td>All</td>
<td>All</td>
</tr>
<tr>
<td>Process</td>
<td>Development process is not clear internally or for customer</td>
<td>All</td>
<td>All</td>
</tr>
</tbody>
</table>
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Not having clear, visible and documented process between customer and project team leads many times to situation where the task status and task management is not transparent. This is one big challenge recognized in all of the markets. According to project managers in all the markets there should always be some shared task list with the customer. This is acknowledged by a senior TPM as well: “Without shared task management with customer, it is like controlled chaos”. Shared task list is also something requested by customers: in Market A, a senior business manager stated that they do not have service customer tasks shared anywhere with their customers, and some of their customers have been asking for that; and a PM in Market C stated that “most customers would like it if we could have a shared ticket system that everyone can access and see what everyone is working on and how things work together”. When tasks are not communicated well enough between customer and project team and a senior TPM in Market A states that they do not get any updates from the customer, but rather receive a large amount of tasks from them when customer is ready. Not receiving any updates from the customer leads to a situation where the tasks come unexpectedly and then project team needs to react fast and do some reprioritization and estimations. Team leads and PMs would want to know how much of work there is overall and what are work estimates and priorities so that it could help them in prioritization.

There has been requests from customers to have better defined and visualized development process in delivery projects. During the Spring of 2018, the authors were requested to provide documentation or template of development process in customer delivery projects by the customer and/or third party developers. One related big challenge in project delivery work with the customer is that there is no unified and documented process in Case Company. This leads to issues where the steps and process presented in Chapter 4.2.2, to ensure high quality and common understanding of features, are not always followed and not even known by customer or project team. Therefore, many best practices are left unused and in some cases this leads to misunderstandings in requirements between customer and Case Company and later errors in production environments; waiting times between different people when it is not clear who should take actions; and forgotten tasks and features. One especially big challenge has been recognized to be lack of analysis of requirements, and starting implementations too quickly with too little knowledge. All the above challenges have resulted to different kind of waste as defined by Lean studies in Case Company’s project delivery work. These are further analyzed in Chapter 4.4.
When there are no ready solutions and/or tools for task or project management provided by Case Company, many projects struggle in finding good tools and are losing a big amount of effort from actual project work. In one project in Market A, project team struggled for first three months of project in finding a good solution for task management and that resulted to hard manageability of the project but also even in misunderstandings and wrong implementations as project team did not have anything shared with the customer where the specifications and tasks could be maintained. The lost effort in the beginning of project was also recognized by Market C PM: “It would be easier if we would have one system for all the customers so you do not have to setup a new thing every time you start a new project”.

In some projects, especially in Market B, the teams are not maintaining tasks anywhere, but rather rely on individuals keeping track of their own tracks coming from emails, weekly meetings and/or instant messaging applications. This has resulted to losing a track of many tasks, forgetting about them and also misunderstandings when the tasks are not specified collectively anywhere but rather needs to be collected from many different sources. This is especially a challenge in bigger projects when the amount of information grows and it is hard to find relevant information from anywhere and have a quick overview of individual’s and team’s tasks. In general both PMs and TPMs had a common need for getting all the information visibly gathered to a single system and maintain all the task related relevant information well structured under a certain task.

When there is no set task management tool at Case Company, it finally results to having different tools in use in different projects making team level management less transparent and difficult when there is no clear overview of team’s work available. Furthermore, individual level task management becomes troublesome when a person needs to be updated in several different tools at the same time. In some markets there were even multiple different tools in use for a single project and having overlapping information in them. Both of these challenges result to bigger overhead of maintaining the tasks in different systems and also losing track or information in some of them.

Many markets recognized that the internal task management tools contain a lot of good information and generic tasks for any project to follow, but it is not used in many projects as the tool itself cannot be shared with the customer and some of PMs perceive it as hard to use. It is still maintained especially for technical tasks and linking those to code commits, but there are differences in level of detail and actual tracking of the tasks between projects and markets and no common best practices of using the tool has been set.
4.3.3 Teamwork and communication

The current main challenges of teamwork and communication are gathered into Table 4.9. We have separated the challenges under three main categories: resourcing, communication and responsibilities. These are the challenges that have been recognized to some extent in all the markets or have been recognized to cause significant challenge in subset of markets and projects. We have listed the markets and types of projects where the challenges have especially been recognized.

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
<th>Markets</th>
<th>Type of projects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resourcing</td>
<td>Finding a right amount of technical and business people in projects and how to distribute them among projects</td>
<td>All</td>
<td>All</td>
</tr>
<tr>
<td>Resourcing</td>
<td>Service work and old projects occupying project resources</td>
<td>All</td>
<td>All</td>
</tr>
<tr>
<td>Resourcing</td>
<td>Projects depending on single person and not having shared knowledge or responsibility</td>
<td>A, B</td>
<td>All</td>
</tr>
<tr>
<td>Communication</td>
<td>Remote technical teams and collaboration with customer and business</td>
<td>B, C, D</td>
<td>All</td>
</tr>
<tr>
<td>Responsibilities</td>
<td>Gray areas in responsibilities resulting to unbalanced workloads</td>
<td>All</td>
<td>All</td>
</tr>
</tbody>
</table>

Even though in Chapter it was recognized as one best practice in teamwork and communication to have several TPMs and business consultants assigned to a single project, that is not properly followed in most of non-tier 1 projects. Especially in Market A and B, TPMs are mostly working as an only technical resource in their projects and being only ones knowing the details of that given project. This results to situations where projects become dependent on a single person and handing over projects to others is overwhelming. Some TPMs stated their concerns also that it is hard to
find replacements for longer holiday periods. From risk management perspective, having only one person knowing the technical details of a project is a challenge as the person may leave the project or company, even unexpectedly. Furthermore, a TPM working in Market A and having the biggest team of technical people in Case Company has experienced issues with technical debt increasing in projects when a lot of newer employees are allocated to their own projects without any proper review process. On the other hand, in the projects where there are more resources involved, TPMs stated that projects include more coordination work, there might be overlapping work done, conflicts in code base and thus overall management becomes harder. Thus, finding a correct balance in amount of resources in a single project and level of collaboration and knowledge sharing are major challenges in teamwork and communication.

Currently TPMs are struggling with getting replacements to their projects and getting help for their tasks. Challenge is especially when the tasks are rather small and urgent in e.g. service customers that it takes more time to handover a task to someone else than actually doing the task. When TPMs are assigned lonely to multiple different service customers, it causes a lot of task switching and delays in longer term project work. TPM in Market B, having a couple of on going projects and several service customers dependent only on him, stated that “people should work more as a team and share the knowledge about the projects”. One related challenge is that many technical issues in service customers are not clearly responsibility of TPM or technical support team. Some of the TPMs stated that technical support team forwards technical issues from service customers too easily to TPMs and that they lack technical knowledge.

Current setup of having PMs and TPMs located in different countries in all the other markets than Market A poses its own challenges. According to PM in Market C, there is a risk for miscommunication and errors when technical and business people are situated in different locations. Furthermore, in some cases TPM does not even have direct contact with customer but rather communicates through PM. PM in Market B would want TPM to be involved more in project and participate more on site meetings where customer has their own technical counterparts present. Then again, TPM from Market C does not see bigger issue in being situated in different countries, but still recognizes that when he can work face-to-face with PM, validation work and other responses are a lot faster and makes the communication a lot more efficient. PM from Market C stated that: “If I am at headquarters I can talk directly to the technical guys. It is perfect because in 5-10 minutes discussion everyone knows what needs to be done and that is fine.”.

Responsibilities are not always clear e.g. in communication of technical
issues during and after the project and data validation. TPM, PM and business consultant responsibilities in projects vary a lot depending of the knowledge level of technical and business resources and many times lead to unbalanced responsibilities where other one takes more responsibility of the project.

4.4 Recognized waste

In our literature review, we learned that recognizing waste is one of the first steps in applying Lean thinking into an organization. It was also one of the additional objectives in our interview study, in addition to recognizing current challenges and best practices of project and task management. Still, some of the challenges recognized in previous Chapters are clearly sources of waste. Recognized waste and their sources are gathered to Table 4.10.

Table 4.10: Recognized waste and their sources at Case Company

<table>
<thead>
<tr>
<th>Waste</th>
<th>Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delays and waiting</td>
<td>Development and validation work on customer side</td>
</tr>
<tr>
<td>Transport and task switching</td>
<td>Simultaneous urgent tasks in many projects and service customers</td>
</tr>
<tr>
<td>Motion and handovers</td>
<td>Handovers of projects and tasks when having holidays, switching department or leaving the company</td>
</tr>
<tr>
<td>Defects</td>
<td>Misunderstood business requirements</td>
</tr>
<tr>
<td>Defects</td>
<td>Starting implementation without proper analysis of the request and whether it is possible</td>
</tr>
<tr>
<td>Defects</td>
<td>Urgent need to get results fast and creating workarounds</td>
</tr>
<tr>
<td>Defects</td>
<td>No proper review process</td>
</tr>
<tr>
<td>Overproduction</td>
<td>Urgent requests by customer that are finally never used</td>
</tr>
<tr>
<td>Inventory</td>
<td>Implementations stay pending in test and validation for a long times and/or are completely forgotten</td>
</tr>
</tbody>
</table>
One of the biggest causes for waste of delay had been recognized to be customer’s activities. As work in project delivery and service customers at Case Company is highly collaborative with customer, it must be done by both the customer and supplier. Especially in the beginning of projects, the challenge for customer has been to deliver data according to project schedule. Furthermore, in many projects and markets, customer validation takes long times and tasks stay pending in test phase, and in some cases are never taken to production and are forgotten.

In many markets, task switching and especially due to multiple simultaneous projects and service customers, causes a lot of waste of transport. Individuals are having hard time to focus on longer development work when they receive new requests constantly from many different sources, and need to manage and track those requests in different systems.

There has been recognized challenges in many markets where projects are dependent on a single person and his/her knowledge. Therefore, it is challenging to delegate tasks or handover projects for others as it requires significantly time and resources. During holiday seasons tasks and projects are handovered, which many times results to issues and defects when others are not familiar with the specific project and are still busy with their own projects. Similarly, when old project team members leave from projects and handover them to others, information is lost and many times causes issues in projects. Furthermore, when project team member has switched department inside Case Company, it has been hard for him/her to handover project completely to a new person, and questions and issues have followed him/her to new duties.

Misunderstandings in business requirements, were one of the biggest sources of waste of defects. This was recognized by a TPM in Market A, when in the beginning of a project a lot of implementations were refactored and/or wrong due to misunderstandings in requirements when the specifications were only verbally agreed. Later this was improved when team started to use Kanban kind of a task board together with customer with agreed and written specifications for tasks. Still, a challenge with misunderstood requirements and not deep enough analysis before implementations exists in all markets, especially in projects where there are no shared task lists with the customer.

Many times project teams receive urgent requests and needs to get fast results, and therefore teams create fast workarounds and technical debt into the system. These have caused defects later in the projects. Furthermore, not having a proper validation and code review process has been argued to further make system error prone. Technical debt affects the maintenance of the system and therefore increases the amount of service tasks emerging after the project has been handed over to support and service teams.
In many markets it was recognized to be a challenge that project team too eagerly develops all the possible customer requests without analyzing them further. Customers also tend to ask for features that are later not needed anymore. This has led to in some projects and markets to a waste of overproduction when customer requests are implemented but finally never used. Furthermore, there has been a recognized waste of inventory when some implementations are needed but later forgotten about and stay in test.

4.5 Improvement suggestions

During our interviews, we have recognized needs of different stakeholders regarding project and task management and teamwork and communication. From these needs we gathered a list of requirements, in a form of user stories, for future project and task management online tool and team management at Case Company. These requirements are presented in Table 4.11.

There is a clear need for unified online project and task management tool, that could be shared with customer to manage project together. This way project teams would not lose the effort in not having any proper project and task management tool or searching for a good tool themselves. The interest of all stakeholders was to maintain all the project information, documentation, project schedule and tasks under the same system and not have relevant information scattered across multiple platforms, systems and documentations. Ideally discussions regarding tasks would be under tickets and tasks in the project and task management tool, and not separately in different emails, phone calls and chats. Having everything in the same system has benefit of finding information faster, knowing why and when something has been done and also have a better overview of a project.

Currently many markets and projects are struggling with multiple systems, overlapping information and losing track of tasks. Later in individual level, managing tasks and information becomes even harder as every customer project has different systems in use. TPMs have especially stated a need for having all their tasks from various different customers collected to a same list, so that they do not have to keep themselves updated in several different tools and systems. Therefore, having all projects and information of those projects under same system would reduce the overhead and waste in project teams’ work and would make the management of numerous complex projects and tasks of individuals easier. There is a need for hierarchial structure of projects and gathering individual’s tasks from different projects
<table>
<thead>
<tr>
<th>Category</th>
<th>User story</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project management</td>
<td>As a PM / TPM I want to have one common policies, methodology and tool that could be shared with the customer both in projects and service customers so that I do not have to setup, find and/or learn a new tool in every project</td>
</tr>
<tr>
<td>Project management</td>
<td>As a PM I want to have an automatic project plan and schedule creation based on project’s tasks so that I do not have to maintain that manually and so that it is based on actual tasks and not rough high level estimations</td>
</tr>
<tr>
<td>Project management</td>
<td>As a PM I want to have a possibility to share the documentation with the customer in one system so that we do not maintain information in many different places and need to manually synchronize it</td>
</tr>
<tr>
<td>Project management</td>
<td>As a TPM/PM I want to see quickly the big picture and status of a project</td>
</tr>
<tr>
<td>Task management</td>
<td>As a TPM I want to have the possibility to communicate under the ticket so that it is not scattered to different emails, chats and other systems</td>
</tr>
<tr>
<td>Task management</td>
<td>As a TPM I want to see all my customers’ tasks in the same view/board so that I do not have to search the information from many different customer specific views/boards</td>
</tr>
<tr>
<td>Task management</td>
<td>As a TPM I want to see quickly what are my tasks</td>
</tr>
<tr>
<td>Task management</td>
<td>As a TPM team lead I want to know the whole amount of incoming tasks, their prioritizations and estimations to help in resourcing</td>
</tr>
<tr>
<td>Teamwork, resourcing and</td>
<td>As a business manager / TPM team lead I want to have a visibility over my team and see how much of work they have so that I can do better resourcing decisions</td>
</tr>
<tr>
<td>communication</td>
<td></td>
</tr>
<tr>
<td>Teamwork, resourcing and</td>
<td>As a business manager I want to be able to move people between projects if we know that someone has more time currently</td>
</tr>
<tr>
<td>communication</td>
<td></td>
</tr>
<tr>
<td>Teamwork, resourcing and</td>
<td>As a TPM I want to have more TPMs involved in one project so that we can pass the knowledge and share the responsibility</td>
</tr>
<tr>
<td>communication</td>
<td></td>
</tr>
<tr>
<td>Teamwork, resourcing and</td>
<td>As a PM I want to have more TPMs available in my projects so that I do not have to wait for a certain person to be free</td>
</tr>
<tr>
<td>communication</td>
<td></td>
</tr>
<tr>
<td>Teamwork, resourcing and</td>
<td>As a business manager / PM I want that project team could store their hours to the application under their tasks so that I can see how hours are used against budgeted hours</td>
</tr>
<tr>
<td>communication</td>
<td></td>
</tr>
</tbody>
</table>
under his/her own list of tasks automatically and therefore reducing heavy manual work of finding and updating information in multiple places.

In many markets and projects, it was recognized that there are internal tasks that cannot be shared with customer, and which should be managed separately. These tasks are most of the times technical and contain classified information that should not be shared with customer. Future project management tool should be able to separate tasks shared with customer and tasks only shown internally. Optionally internal tasks could be managed in a separate system that would be integrated with the one shared with customer, and Case Company’s employees could update their tasks only in one system still.

In addition to a common project and task management tool, there is a need for having better defined process and way of working in projects and service customers. According to a business manager in Market A: “It is good that we have self managed teams but the problem is that there are many ways of doing things and as company grows, we cannot afford it”. This affects especially on the work with customers when there is no unified process with them. Not having clear development process and policies leads to many challenges and waste in work. Furthermore, many PMs stated that they would appear “more professional in customer’s eyes when we provide a tool and methodology” already in project kick off meeting. Currently for example in Market C, PMs are presenting excel as a project and task management tool, which had its limitations and is not considered as “professional”.

Furthermore, one big challenge was related of resourcing and having projects dependent only on one TPM. These is a need to have a team of people for a set of projects, working all together, taking shared responsibility over those projects and having visibility over that work. Additionaly, PMs have requested more flexible cross-project working inside a team so that Case Company could mitigate the risks of being dependent on one person only, do better workload balancing and knowledge sharing across the projects and therefore being able of moving people between projects to provide help when needed. Therefore, PMs and projects would not be depending only on one, most of the time busy, TPM that needs to balance as an only technical person between numerous projects with different priorities and tasks, leading to delays in some projects. The need for better teamwork especially on technical side, and the shared responsibility of projects inside a team was a need emerging especially from Case Company’s oldest markets A and B with the biggest amount of projects and people.

Therefore, both PM and TPM team leads would need better tools to manage and have an overview of teams and their work. To accomplish this, a hierarchial structure of projects and their tasks would be needed, so that
team leads would have an overview of team’s current workload, resourcing and status in a single project and task management tool. Different performance metrics such as team’s lead time and throughput could help team leads to analyze the workload and health of the team in addition to gathering information of used hours versus budgeted hours in projects under the same tool. PMs had also requested that project plan and schedule should be created and updated automatically based on the tasks’ deadlines and estimates in the project, and thus it would give a better overview of project status and schedule. Project schedule is represented in a form of Gantt chart. Currently, project schedule is updated manually based on rough estimations of status of tasks collected from various sources, which makes recognizing possible delays early on harder.

We believe that Lean and Kanban provide good principles and method for managing tasks in both projects and service customers. According to found benefits from literature, Lean and Kanban provide potential benefit of having a better overview of project status. Furthermore, Kanban and Lean could potentially facilitate better teamwork and thus help in current challenges of projects being dependent on a single resource and not having shared knowledge of team’s projects. In our literature review, we found out that Kanban and Lean may empower knowledge sharing, collaboration and communication. With Kanban and Lean, currently not transparent and not visual development process could be better managed and shared with customer and project and market teams.

Furthermore, according to found benefits of Lean and Kanban in literature, they potentially provide faster reaction to changes and delivery of features to the customer. As quick reaction to customer needs and changes was recognized as one of the best practices of Case Company, we believe that Kanban and Lean would facilitate that well.

Ultimately, Kanban is based on Lean principles. One of the main objectives of Lean is to remove waste from the process. In our empirical study, we have recognized multiple sources of waste in Case Company’s project delivery work. Thus, Kanban and Lean could provide potential benefit of further recognizing and guiding teams to remove waste and bottlenecks from the process in the future.

The above requirements combined with the current challenges and best practices of project and task management provide a list of improvement suggestions for the future. Furthermore, the found benefits of Lean principles and Kanban method and their relation to found challenges and best practices, encouraged us to suggest a use of Lean principles and Kanban method as method and principles for task management in Case Company. We focus especially implementing Kanban elements of: Kanban board, team collabo-
ration, feedback loops, WIP limits and bottlenecks. Furthermore, we want to empower Lean categories of fast delivery, knowledge, value stream and people and team in Case Company. These elements and categories were related to most referred benefits of Lean and Kanban in our literature review. All the improvement suggestions are gathered to Table 4.12 with their priorities in scale of high, medium and low, based on the need of different stakeholders and possible value for Case Company.

Our suggestion at Case Company is to begin prototyping, validating and implementing improvement suggestions in priority order. The first action point would be to evaluate, prototype and purchase project and task management tool that could be used in all Case Company’s projects and service customers. This tool should satisfy, if not all, the most of gathered requirements for future task and project management previously in this Chapter. Most importantly, it should be used to maintain all project information in the same place, and avoid scattering information to many systems. Furthermore, it would provide a set tool for project teams to share with the customer and avoid challenges of teams not having good tools for management.

One important aspect in common project management tool would be to unify and visualize the development process and thus create best practices for creating value for customer. With a visualized process, the communication and project management together with customer would be better facilitated. Based on the found benefits of Lean and Kanban in our literature review, we suggest to use Kanban board with its WIP limits as a tool to visualize the development process. Based on the best practices of task management current process, we created a Kanban board that could be used as an initial board across the projects and teams. Thus, we created our Kanban board based on current activities and as a result of value stream mapping.

Kanban board should be shared with customers in projects to better manage project together, visualize the status of the project and its tasks and have a common understanding of the development process and best practices of taking changes to production. Furthermore, this would help in having clear specifications of tasks and avoid misunderstandings in requirements, when they would be gathered to a single tool and a proper process of analyzing and specifying requirements would be followed. According to the current best practices, the required information for tasks should at least be: status, responsible organization and person, priority and deadline (start and end dates), area or category, topic and more defined specifications. The status of a task is represented by different columns in Kanban board where tasks are pulled from left to right as tasks are finished in preceding column and there is a space in subsequent column.
Table 4.12: Improvement suggestions for Case Company and their priorities

<table>
<thead>
<tr>
<th>Priority</th>
<th>Improvement suggestion</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>Purchase a tool for project and task management to be used in all Case Company’s projects</td>
</tr>
<tr>
<td>High</td>
<td>Manage the tasks and all project information in the same tool and avoid scattering information under many systems</td>
</tr>
<tr>
<td>High</td>
<td>Project plan and schedule should be automatically created and updated based on current tasks in project</td>
</tr>
<tr>
<td>High</td>
<td>Create general template of Kanban board, development process and best practices to be used in Case Company’s project and service customer task management</td>
</tr>
<tr>
<td>High</td>
<td>Use Kanban and Lean as method and principles for task management</td>
</tr>
<tr>
<td>High</td>
<td>Share project and task management tool for customers</td>
</tr>
<tr>
<td>High</td>
<td>Have weekly meetings in projects with customer and internally and use Kanban board as a basis for discussions</td>
</tr>
<tr>
<td>Medium</td>
<td>Create hierarchies of projects and teams to collect team tasks together in a single Kanban board inside the tool</td>
</tr>
<tr>
<td>Medium</td>
<td>Manage market team’s projects together as a team of TPMs and guide towards shared knowledge and responsibility through market team level Kanban boards</td>
</tr>
<tr>
<td>Medium</td>
<td>Separate project and service work from each other and dedicate separate teams for both</td>
</tr>
<tr>
<td>Low</td>
<td>Use lead time, throughput and cumulative flow diagram as KPI tools in projects alongside with used versus budgeted hours</td>
</tr>
<tr>
<td>Low</td>
<td>Retrospectives in projects every four weeks where customer and project team discusses work practices</td>
</tr>
<tr>
<td>Low</td>
<td>Market team meetings every two weeks to discuss current workload, projects status and work practices using team Kanban board and KPIs as a basis for discussion</td>
</tr>
<tr>
<td>Low</td>
<td>Cross market team lead meetings every four weeks to discuss higher level market resource needs, status and project pipeline using market team Kanban board and KPIs as a basis for discussion</td>
</tr>
<tr>
<td>Low</td>
<td>Include presentation of Case Company’s project management tool and Kanban method and Lean principles into kick off meeting and present those as main tools for project and task management</td>
</tr>
</tbody>
</table>
The suggested Kanban board is illustrated in Figure 4.7. The columns of the board are:

- **Analysis** of requirements, where received needs and requirements are analyzed with project team and customer, and whether it is valuable to implement. It is important to recognize non value providing requirements and decline those, and specify to be implemented requirements deep enough level

- **Backlog**, where agreed requirements are specified in written form and prioritized and ordered as the highest priorities on top. Prioritization, agreement, analysis and specification of requirements should be a topic especially in weekly meetings together with customer.

- **Development**, task is currently under development by customer and/or Case Company. When technical features are created at Case Company, version control commits should be linked to correct tasks in task management

- **Testing** implementations through integration and unit tests and taking implementations to a separate test environment of the software

- **Validation** of implementations by customer and several people internally in the test environment. Best practice is to validate the implementations internally by the one doing implementations but also by someone else to avoid misunderstandings and mistakes.
• **Ready for deploy** after implementations are validated, tested and agreed by everyone. In this stage, deploy should be coordinated, communicated and agreed with relevant stakeholders.

• **Done** states done and delivered work that can be later reviewed and analyzed what and why has been implemented.

• **Deferred** states work items that has been declined and/or agreed to not provide enough value in some stage of development process. It can be later reviewed what and why something has been deferred, and whether those work items could provide value later.

To support the need for having an overview of individual’s and market team’s tasks, a specific hierarchial structure and linking the tasks from projects to teams and individuals should be maintained. Our suggested hierarchy and structure is presented in Figure 4.8.

![Hierarchical structure of Kanban boards](image)

**Figure 4.8: Hierarchical structure of Kanban boards**

In the hierarchial structure of Kanban boards and task management, the benefit would be to have easily accessible overview of tasks in individual, team and project levels and manage the large complexity of different projects better. To set it up it is needed to create users, roles and teams for people where each person would have one team and every team and person would have multiple projects under their responsibility. Whenever a person is assigned to a task in a project, that task would be automatically added to
team and individual Kanban boards. Team could then manage all of their
tasks on a single board better, share the knowledge of different projects and
later on also the responsibility and tasks. Thus, it would potentially improve
team collaboration and knowledge sharing. Furthermore, PMs and service
managers would have more available resources to do technical work / busi-
ness configurations when tasks could be done by a team of people instead
of being dependent on a single person, which would eventually decrease the
waste of delay.

Kanban and Lean do not guide to any structured or reoccuring meetings,
but rather self managed teams should analyze the need and value of meetings.
Still, they encourage to implement feedback loops and gather the feedback
actively. In our study at Case Company, we recognized weekly meetings to
be one of the key best practices in project and task management throughout
the projects. This facilitated better monitoring and overview of project’s
progress, but also encouraged project team and customer to be more com-
mitted and collaborative. This was main forum for collecting feedback and
discussing project related issues with the customer. The suggested model for
project delivery and communication is presented in Figure 4.9.

![Figure 4.9: Project delivery and reoccurring meetings](image)

Weekly meetings were recognized to be in key role to analyze, specify
and prioritize requirements in weekly basis. In the future, those discussions
could be based on Kanban board and especially what is the current situation,
what has been delivered latest and what should be delivered next. Retro-
perspectives where team’s work practices, current development and results are analyzed and validated and any concerns regarding those should be raised, is a good practice that is less used currently. Projects and markets having retrospectives claim to have received value from them and found improvement points in work practices. Retrospectives could be organized more often in the future, both internally and with customer. The objective would be to have them once a month in projects, in every fourth weekly meeting, to mirror what has been working well, what has not worked well and what kind of improvement points team could take to improve process and work practices. Therefore, retrospectives could be seen as one organized method for continuous improvement, kaizen.

In addition to project scheduled meetings, many markets recognized market team and cross-market team meetings to be important and good tools to give an overview of markets’ situations and analyze resources, teamwork and work practices within market teams. These, especially market team meetings, are less organized and occur seldomly and discussions are based on rough estimations and not actual data or a visual overview of team’s work. To have a better team management, overview of resources, work done and workload, teams should start to have regular market team meetings every second week, where team level Kanban board and performance metrics can be used as a basis for discussions. Later, the cross-market resource needs and information and knowledge sharing should happen once a month where market team level Kanban boards and KPIs would work as a basis for discussion on each market. The suggested communication models in different levels of hierarchy are presented in Figure 4.10.

In our empirical study, we have recognized a lot of challenges and waste related to people working in both service and project work simultaneously. Therefore, we suggest to separate those two, and manage service customers both from technical and business point of view by different teams of people, and assign a separate team of people to project work so that it can be managed and done in more isolated way. By the time of writing, this was a recognized issue at Case Company and improvement actions had been already taken. Market D had separated technical service work from projects, being managed by a remote technical team. During Summer of 2018, the service team had taken more service customers under their responsibility from various markets and the number of team members was growing as well. We will further discuss the service team’s development in Chapter 4.6.

In this Chapter, we have covered multiple recognized challenges from our empirical study. Our improvements have been suggested so that the impact of these challenges could be potentially mitigated or tackled completely. As a summary of this Chapter, we have gathered the improvement suggestions
CHAPTER 4. EMPIRICAL STUDY

Figure 4.10: Case Company’s project delivery organization’s communication model

together with the challenges they help to mitigate into three different Tables 4.13, 4.14 and 4.15, based on in which area of the study challenges were found. We have further discussed the potential benefits of improvement suggestion in accordance of mitigating challenges.

Finally, we suggest that as a first step in becoming more Lean and customer value focused company, Case Company should take Kanban method accompanied by Lean principles into use gradually in different teams. Case Company should start with less critical teams such as Market D’s remote service TPM team and follow it with smaller project and market teams. With these teams the new methods, tools and processes could be prototyped and improved, and the harmonized process could be crafted iteratively together with different stakeholders. As a result, Case Company would have a harmonized best practice project and task management tools and methods to follow, that should be presented to customers in the beginning of a project as Case Company project model and methodology, that should preferably be followed during the implementation projects.

The goal is not to change the project model, but start with the current model managing the tasks and work more visually in a new unified tool with a set of best practices. The short-term goal is to improve knowledge sharing, communication and collaboration in market teams and together with the customer in projects. In a long run, using Lean principles and Kanban
method should start the movement of focusing more on providing value for the customer and reduce the amount of unnecessary work and waste in a process. Kanban and Lean should guide teams and individuals to follow, analyze and improve best practices, prioritize the requirements and needs based on the value, urgency and importance and still deliver value fast for customer with a good quality. Through continuous improvement teams could evolve the process according to their needs, but the main best practices and suggestions mentioned in this Thesis should work as a backbone for the teams in the future.

Table 4.13: Challenges, improvement suggestions and potential benefits in project management

<table>
<thead>
<tr>
<th>Challenge</th>
<th>Improvement suggestion</th>
<th>Potential benefit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information is scattered to numerous systems and it is hard to have an overview</td>
<td>Purchase a tool for project and task management to be used in all Case Company’s projects</td>
<td>Find information faster, have better overview and avoid waste of searching for new tools in every single project and maintaining information in many systems</td>
</tr>
<tr>
<td>No good tools that could be shared with the customer to better manage the project together</td>
<td>Share project and task management tool for customers</td>
<td>Better collaboration with the customer when there is a shared tool to manage the project</td>
</tr>
<tr>
<td>Delays in technical implementations</td>
<td>Project plan and schedule should be automatically created and updated based on current tasks in project</td>
<td>Recognize delays earlier when project status is based on current tasks and not high level rough estimates</td>
</tr>
</tbody>
</table>
Table 4.14: Challenges, improvement suggestions and potential benefits in task management

<table>
<thead>
<tr>
<th>Challenge</th>
<th>Improvement suggestion</th>
<th>Potential benefit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large amount of different tools in different projects</td>
<td>Manage the tasks and all project information in the same tool and avoid scattering information under many systems</td>
<td>Avoid overhead of updating and maintaining tasks in multiple systems</td>
</tr>
<tr>
<td>No set task management tools that could be shared with customer</td>
<td>Share project and task management tool for customers</td>
<td>Have a better shared overview of tasks and ongoing development, and avoid issues of not having task lists shared with customers in projects</td>
</tr>
<tr>
<td>Task status is not always transparent and some tasks remain open and are forgotten</td>
<td>Create general template of Kanban board, development process and best practices to be used</td>
<td>Kanban board would improve transparency, and tasks would have visual different status on a board in separate columns. All the tasks are visible and are harder to be lost</td>
</tr>
<tr>
<td>There is no overview of work and workload within project teams and internal teams</td>
<td>Create hierarchies of projects and teams to collect team tasks together in a single Kanban board inside the tool</td>
<td>Easily accessible overview of tasks in individual, team and project levels</td>
</tr>
<tr>
<td>No visibility of what is in progress on customer side and vice versa</td>
<td>Create general template of Kanban board, development process and best practices to be used</td>
<td>High visuality and transparency of Kanban board would improve shared knowledge and overview of project status</td>
</tr>
<tr>
<td>There is no documented process or best practices for development and configuration work</td>
<td>Create general template of Kanban board, development process and best practices to be used</td>
<td>Kanban board created through value stream mapping would guide to follow a certain process and best practices</td>
</tr>
<tr>
<td>Development process is not clear internally or for customer</td>
<td>Create general template of Kanban board, development process and best practices to be used</td>
<td>Better defined and visually represented development process on a Kanban board</td>
</tr>
<tr>
<td>Misunderstandings in logic and implementations</td>
<td>Create general template of Kanban board, development process and best practices to be used</td>
<td>Better defined process of analyzing and specifying requirements, and maintaining them in shared place with customer</td>
</tr>
</tbody>
</table>
Table 4.15: Challenges, improvement suggestions and potential benefits in teamwork and communication

<table>
<thead>
<tr>
<th>Challenge</th>
<th>Improvement suggestion</th>
<th>Potential benefit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service work and old projects occupying project resources</td>
<td>Separate project and service work from each other and dedicate separate teams for both</td>
<td>Avoid waste of task switching between project and service work, and therefore decrease delays in projects</td>
</tr>
<tr>
<td>Projects depending on single person and not having shared knowledge or responsibility</td>
<td>Manage market team’s projects together as a team of TPMs and guide towards shared knowledge and responsibility through market team level Kanban boards</td>
<td>Improved shared knowledge, collaboration and communication, and projects not being dependent only to one TPM</td>
</tr>
</tbody>
</table>

4.6 Evaluation of Lean and Kanban and their benefits

In our empirical study, we recognized that the projects that had already been delivered to the customer and moved to support and service phase, were still highly dependent on TPMs. This caused a lot of task switching and urgent issues, that were often prioritized over project work. This eventually was one of the factors of delays in technical implementations. The challenges and waste were especially found from TPM teams that had most continuous service customers.

Thus, during Spring 2018 a TPM team started to pilot a model, where a technical team managed Market D’s service customers and technical tasks separately from project work, goal being to let project teams to focus on important project work and not being interrupted by service tasks. At first, tasks were managed through excel sheets and each customer in a separate document. As the team lead for the given team stated: “Every customer has its own sheet and in separate file. I thought that at first it could be like this, but when people learn to work together this might be forgotten a bit. Then the management works mostly through chat and people’s own memory”.

Three months after the first interview we presented our suggestion of using Kanban and Lean, and especially a single Kanban board, in managing the work in Case Company for service TPM team lead. He saw many possibilities
in Kanban method in his service TPM team, especially after the team had started to grow in numbers of people and service customers. Due to this growth, team and tasks were becoming harder to manage. Also a business manager from Market A stated that: “I think Kanban sounds really good, especially for service customers’ small development mode”.

Especially WIP limits got TPM team lead interested: “I like the idea of the work in progress limits in Kanban. Then we can better show where the bottlenecks are and solve them accordingly. Like ‘validation is full, please solve that before we can continue’. This would also help in having more predictable and better estimated work”. Furthermore, TPM team lead was by the time missing a tool to have an overview of the work of the team. Therefore, he also mentioned that: “I would like to have an overview of workload, open tasks etc. of my team to better manage it”. He saw a big benefit in having all the team’s tasks collected under a single Kanban board where the team would easily have an overview of current situation.

He also argued that with Kanban board and visualization of an actual development process, people could be better guided to follow the best practices in development work. One best practice that was part of Kanban board was analysis of requirements. TPM team lead stated that analysis may take multiple hours and sometimes even weeks in demanding tasks and that should be clearly stated as one step in a process then. Analysis would stand for further analysis and design need, but also for a need for better specifications and discussions on the matter. Only if the task is well specified, designed and agreed, it should be moved forward on board. By the time of writing, team had not yet specified a measurement or definition of inclusion criteria, i.e. when tasks are considered to be ready for development. They rather analyzed tasks case by case in analysis stage on Kanban board.

During early Summer of 2018, service TPM team began to implement the first version of Kanban board as presented in this Thesis. They used an online tool to manage all the tasks from several customers of the team. The tool did not have possibility to add WIP limits, but rather it was done more manually by TPM team lead who followed the amount of tasks in columns. He found it to be important to have tool where tasks and workload could be seen on team, customer and individual team member levels. He also argued that with a small team and smaller amount of customers and tasks, managing WIP manually was doable, but later as the team would grow they would want to start use actual hard WIP limits. They did not have Kanban cumulative flow diagram or performance metrics such as lead time and throughput available in the tool either. The goal for using the first version of Kanban board was to visualize the development process, manage it as a team and follow a set of guidelines and best practices in their work. Furthermore it facilitated
managing all the service team’s customers tasks in a single board giving a better overview of team’s work, but also communicating process towards the customer and service managers, who would eventually validate and give feedback on the tasks.

After two weeks of using new Kanban board, TPM team lead stated that the team was more content with more visualized process and clearer steps for creating features and changes. The biggest benefits was seen in ability of discussing and coordinating the tasks through Kanban board and limiting the amount of tasks of a person and activities. This had also increased the level of knowledge of other people’s tasks and handing over tasks to others. Furthermore, team lead stated that with new Kanban board, he had a better overview of team’s work which also helped him in resource management.

Team had also setup a weekly meeting where they went through tasks on a board and discussed current workloads, what everyone has done, were there any issues or did people need help and what would be the next tasks and prioritizations. This was one of the improvement suggestions in our Thesis as well. One additional goal of weekly meeting was also to see that the board is used and updated and team members are committed to use it.

Three months later, team had recognized that there was special type of work, that should be separated from other tasks. These were urgent tasks that had high urgency and cost of delay. These were highlighted with different color on a card and followed an expedite class of service, where urgent tasks were prioritized over others. In addition there were tasks that were especially non-urgent, time-consuming and that should be handled and highlighted separately from others. These were taken under a new column on Kanban board, separating them from others. To later manage these better, use of swim lanes could be experimented. Swim lanes are horizontal rows on Kanban board, where each row stands for different type of tasks and where tasks go through the same columns of Kanban board from left to right.

Team lead also discussed that to measure the flow, team could start to investigate how to set and measure SLA and lead time, and later analyze how well team performs against set SLAs. These, highlight the continuous improvement, kaizen, aspect of Kanban, where team continuously evaluates their work processes, experiments changes and make concrete improvements.

We have summarized the found benefits of Lean and Kanban in pilot team to Table 4.16, and further linked found benefits to Kanban practices and Lean categories as discussed in Chapter 3.

As can be seen, Kanban practice of visualization and Lean category of value stream, empower all of the found benefits. Thus, mapping of value stream on Kanban board could be argued to be the major and most prominent practice of Lean and Kanban in our case study. Found benefits are all
also heavily linked to teamwork and how work is managed within a team. Therefore, Kanban and Lean provide a good tool for team and task management to facilitate team’s work together.

The initial results from pilot team, speak for a set of potential benefits discussed in Chapter 4.5. In addition to applying Lean and Kanban in a service team, use of Lean and Kanban should be evaluated in teams delivering new projects. Therefore, it could be further analyzed, are the potential benefits able to be found from technical project teams and project delivery work.

<table>
<thead>
<tr>
<th>Benefit of Lean and Kanban</th>
<th>General practice of Kanban [7]</th>
<th>Lean category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Better understanding of whole process and following best practices</td>
<td>Visualize</td>
<td>Value stream</td>
</tr>
<tr>
<td>Better overview of team’s work and resource management</td>
<td>Visualize</td>
<td>Value stream</td>
</tr>
<tr>
<td>Improved transparency, knowledge sharing and collaboration</td>
<td>Visualize, manage flow</td>
<td>Value stream, knowledge, people and team</td>
</tr>
<tr>
<td>Limiting amount of tasks and recognizing bottlenecks</td>
<td>Visualize, limit work-in-progress, improve collaboratively, evolve experimentally, manage flow</td>
<td>Value stream, waste and value</td>
</tr>
<tr>
<td>Analyzing and improving process</td>
<td>Visualize, improve collaboratively, evolve experimentally</td>
<td>Value stream, continuous improvement</td>
</tr>
</tbody>
</table>
Chapter 5

Discussion

In this Chapter we will discuss the research questions and objectives defined in the beginning of this Thesis work, and analyze how well this study answered those. Furthermore, we will analyze the limitations and validity threats of this study.

5.1 RQ 1: Benefits of Lean and Kanban

The first research question of this Thesis was: What benefits Lean principles and Kanban method can provide for project and task management? As an answer to this question, we analyzed major characteristics and benefits of Kanban method and Lean principles in existing literature. Furthermore, we studied how those characteristics and benefits map to Case Company’s project delivery and team task management. We later created a model of Kanban method based on Lean categories that we evaluated in one pilot team and analyzed its benefits.

Major benefits that Lean principles and Kanban method are found to provide for task and project management in existing case studies, emerge from Lean categories and six general practices of Kanban. Capability to react fast to changes and defects and fast and continuous delivery were two major benefits, that both stemmed from Lean category of fast delivery. Furthermore, they were related to Kanban practices of visualization of value stream on Kanban board, implementing feedback loops and limiting work-in-progress. Third major benefit found was knowledge sharing, team collaboration and cooperation. This emerged from Kanban practices of visualization and managing of the flow. Value stream, knowledge and people and team were related Lean categories to empower the found benefit.

Most of the analyzed case studies were based on qualitative data such as
CHAPTER 5. DISCUSSION

interviews and observations. Only two of the studies [26, 34] used quantitative performance metrics as an addition to qualitative data. Many of the found benefits are mostly based on analysis of authors and opinions of the interviewees and respondents of surveys. Therefore measurable impacts of Kanban and Lean, such as improved quality of the software were less referred and highlighted. Intangible and immeasurable benefits, such as improved knowledge sharing and team collaboration, were more highlighted as those are highly related to team’s way of working rather than actual measurable business benefits.

We aimed to implement the most prominent Kanban elements from the study of Al-Baik and Miller [4] in the pilot team of this Thesis. These elements were Kanban board, team collaboration, feedback loops, WIP limits and bottlenecks. Furthermore, we focused on Lean categories of fast delivery, knowledge, value stream and people and team.

After four months of using Kanban board in their daily work, pilot team found especially visualization of development process helpful as following up all tasks of the team was then easier and process of implementing features became clearer. When the pilot team had all their tasks on the same board, transparency of tasks between team members was improved as well. Therefore, better knowledge sharing was seen as one of the main positive outcomes of Kanban and Lean, similarly as in existing case studies [2, 19, 23, 26, 28].

In the study of Ahmad et al. [2], team members discussed to be more aware of their own tasks, but also the tasks of others. This eventually led to situations where experts or more senior team members provided assistance whenever they recognized a blocking task [2]. We had similar findings in the pilot team, where the team lead working as a mentor and more senior team member, recognized issues when tasks spent a long time in analysis stage or when tasks were moved back to analysis. Then, he was able to proactively provide help for responsible person of a task.

Therefore, pilot team, and especially team lead, found possibility to recognize and react to bottlenecks and blocking tasks faster as one of the benefits. This finding is in align with results of the studies of Ikonen et al. [19] and Middleton and Joyce [26] where team members found visualization of development process to be major aspect of Kanban in helping team to address problems faster. Similar results could be found from the study of Ahmad et al. [2], where two different maintenance teams switched from Scrum to Kanban, as they were able to react faster to blocked tasks and solve them collaboratively within the team.

Lean category of delivering fast and Kanban’s non-time-boxed way of working enable faster deliveries and reactions to changes. These have been
seen as one of the major benefits in existing case studies [2, 19, 23, 26, 34]. In
the studied pilot team, this was not highlighted. We argue the main reason
for it to be that the team did not have any fixed delivery dates or time-
boxed iterations that would have limited their capability to deliver fast even
before implementing Kanban and Lean. One of the best practices at Case
Company was recognized to be the capability to react fast to changes and
deliver features continuously and fast to the customers. Thus, we argue that
Kanban and Lean did not have significant negative or positive change in this
aspect in pilot team and therefore it still enabled pilot team’s capability to
deliver and react to changes and features fast.

5.2 RQ 2: Challenges and best practices of
project and task management

The second research question was: What are the current best practices and
challenges of project and task management at Case Company? After con-
ducting an interview study in four different markets and interviewing 16
employees with different roles and backgrounds, we were able to conclude a
set of best practices and challenges of task and project management at Case
Company. In this Chapter we will discuss the most critical challenges and
major best practices. The most critical challenges were those that we focused
on mitigating with our improvement suggestions in this Thesis.

The biggest challenges were related to not having unified project and
task management tool that could be shared with customer, and in-
formation of Case Company’s projects being scattered to many dif-
ferent tools and systems, that many times are accessible only for project
team members. Therefore transparency and furthermore knowledge and
responsibility sharing in the projects within Case Company becomes
harder. Similar issues were reported in the study of Ahmad et al. [2], where
lack of visibility between team members and their tasks caused challenges in
completing tasks but also in having a right level of information visible for
management.

Both TPMs and PMs in Case Company have recognized a need for a
model where TPMs have more shared responsibility of the projects and that
projects are not tied to a single person anymore. Projects being depen-
dent on a single person was one of the major challenges. We argue that
this challenge is related to not having a visibility between team members,
since without shared knowledge of projects, it is harder to synchronize and
change people between the projects. Not having overview of work and
workload within project and market teams was recognized as one of the major challenges. Similar challenges were found by Ahmad et al. [2], where not having clear visibility over all the projects and teams caused difficulties in moving people between projects and teams.

To tackle the issue of not having shared knowledge of projects and projects being dependent on a single person, the best practice in Case Company is to have at least two TPMs and business consultants in a single project. Still, as we learned from various interviews, the second TPM is not always aware of other’s projects or tasks, and knowledge is not shared efficiently. Furthermore, in some markets there still were not secondary TPMs and TPMs could not handover their projects for others even during their holidays.

Later on, when a person has multiple projects both in project and service phase, service work and old projects occupy project resources and therefore cause a lot of overhead and delay in project work. This leads to a waste of task switching when TPMs need to switch to more urgent tasks in other projects. This was especially due to unpredictable and urgent nature of maintenance tasks. Ahmad et al. [2] reported similar challenges in their study, where software maintenance teams were struggling with a vast variety of urgent and unpredictable tasks that needed fast responses. Furthermore, they recognized challenge of not having proper means to manage frequently received unpredictable and urgent tasks leading to difficulties in estimating what they are working on in the future [2]. Unpredictability and therefore estimation was reported to be difficult to manage at Case Company also.

All of the above and many times pending and delayed customer activities cause delays in technical implementation phase and later on in whole project. Delays in technical implementations was one of the major challenges found in our study. In addition to encountering challenges in project and task management internally due to lack of visibility, this issue was present also in managing projects and tasks together with customer. In some cases, project teams lacked tools and clear process of managing tasks and projects with the customer. Therefore, the delays in projects were harder to predict, explain and visualize.

Furthermore, current project model focuses on understanding customer requirements to rather deep level already in the beginning of the project. Those are later converted to technical designs and implementations. In some projects, original designs have been recognized to be wrong and then required a lot of changes. Still, many interviewees highlighted the importance and the best practice of working iteratively with the customer and not fearing changes and being able to adapt fast to them. Also, As is - to be workshop was recognized to be one of the most important steps and best
practices in the beginning of a project, where customer’s current processes are analyzed and future objectives are set. This helps in understanding customer processes and their requirements, and in mitigating the challenge of misunderstandings, wrong designs and refactoring later on. Therefore, a balance between constantly learning and improving versus locking to certain designs too early seems to be hard. This has been recognized also in several Lean studies [30–32], where they encourage teams to make the critical design decisions as late as possible, with the best available knowledge. That way the focus should be on experimental smaller deliveries and later iterating and improving those [31].

Iterative way of working with the customer, especially in technical implementation and business configuration phases was recognized as one major best practice. Furthermore, Case Company’s capability to react fast to changes and improvements was seen as one of the main benefits of Case Company’s project delivery work. This iterative work and fast reactions to improvements was seen also as a crucial part in early support phase where software is piloted and later gradually rolled out to different customer units. To manage this fastly paced work, a best practice is to maintain a shared task list with the customer where tasks, their responsibles, deadlines, specifications and status are communicated clearly. Still, we recognized in our empirical study that many projects have been struggling in setting up efficient and working task lists and maintaining tasks together with the customer, eventually leading up to hard manageability of project and tasks.

One of the main best practices and a mean for better manageability of a project was weekly checkups with customer and internally. This enables continuous follow up on project and its tasks and progress, but furthermore a place to discuss schedules, concerns, issues, priorities and specifications of tasks. Many projects and markets mentioned task lists and project schedule to help in weekly meetings as a basis for discussions and listing new tasks and specifications. Furthermore, task lists and other project documentation should be available for everyone in a project in a shared place. The best practice regarding documentation was to create and maintain project schedule, project plan and integration documentations.

Even though we were able to recognize best practice development process in TPM work, this was not always followed in same manner throughout projects and markets. Furthermore, issue in many projects was that the process is not clear for customer or many times even internally. It is hardly discussed or available anywhere and therefore the best practices in TPM work are not always followed. For example, linking code commits to specific tickets and tasks in internal task management tool is a best practice that
is followed in different ways across the markets and projects. Therefore, this is related to a challenge of not having unified process and best practices in development work.

One of the main outcomes of this Thesis work was to do the value stream mapping and analyze the value bringing activities in TPM development process, and map those to a Kanban board. These best practice steps were eventually used as a basis for suggested Kanban board template and a part of our improvement suggestions for the future project and task management at Case Company.

5.3 RQ 3: Improvement suggestions

Finally, the last research question was *What suggestions can be given for improving project and task management at Case Company?* We concluded a set of improvement suggestions in a prioritized order. These were based on different recognized needs and requirements from interviews with different stakeholders at Case Company, together with Kanban and Lean characteristics and benefits, and their possibilities to mitigate the found major challenges at Case Company. In this Chapter we discuss the highest prioritized improvement suggestions.

First, Case Company would need to focus on finding a **common and unified solution for project and task management in all of its projects**. Currently information is scattered to different systems, documents and tools and a lot of effort is lost in individual project teams while trying to find good methods and tools for project and task management. A lot of responsibility is put on customer and trusting that they have already defined systems and methods. In the worst situations where customer has not had ready solution or readiness to find one, projects have struggled with hard manageability, misunderstandings, defects and refactoring. Furthermore, knowledge sharing and handovers become hard when there are no common methods and tools that would be transparent through the company. **Having all the information under one system** and **creating hierarchies of projects and teams to collect team tasks together**, would provide facilities for invi- dual, project, market team and portfolio level management when work would be more visible between different levels. This is also in align with findings of Ahmad et al. [2], where they gathered program level information under same Kanban board, which provided transparency between different parts of the organization and empowered their communication and collaboration.

We suggest that the future **project and task management tool should provide a possibility to update projects schedule based on the tasks’**
deadlines and estimates under the project and that way automatically inform of possible delays and issues in project. Current way of manually maintaining project schedule based on high level estimates and not having an overview of ongoing tasks is prone to errors and non-realistic estimates. Having e.g. Gantt chart automatically updated by task deadlines and estimates would eventually improve the overview of project schedule and timeline. Also, when all Case Company’s projects are maintained under same system, it enables better data gathering and analysis of projects. Later this can provide better mean for initial workload and timeline estimates in projects, based on gathered information from previous projects. Jørgensen [20] discusses that this kind of an analogy estimation is one of the good practices to improve accuracy of effort estimates.

We suggest teams to use Kanban method with Lean principles in guiding their task management in projects and market teams. One of the high priority improvement suggestions, a template of Kanban board and development process was created in this Thesis as a results of value stream mapping as suggested by many of Lean [24, 31, 32, 38] and Kanban [4, 5, 9] studies. Lean principles and Kanban method, would guide teams to take shared responsibility over their projects and share the knowledge better [2, 19, 23, 26, 28]. Kanban and Lean would still enable fast deliveries [2, 19, 26, 34]. Fast delivery and reaction to changes was experienced as one of the major best practices at Case Company. Furthermore, Kanban board should provide a better overview of ongoing tasks and bottlenecks, and that way facilitate faster reaction to possible issues early on in a single task level [2, 19]. WIP limits would later on help in prioritization of tasks and analyzing what brings the most value to the customer [33]. Furthermore, when project level Kanban boards inside project and task management tool would be shared with the customer, tasks and development process would be better communicated with the customer.

As recognized by Ahmad et al. [3], Kanban does not work alone but requires supporting practices. We suggest weekly meetings with customer in projects and biweekly meetings in market teams at Case Company. Defining meeting schedules and format in Kanban has been recognized as an important activity [7, 10]. This would secure enough commitment to maintaining the process and tasks updated, as found in pilot team in our empirical study. Furthermore, as in most of the projects studied in Case Company, using a task list in weekly meetings with customer was recognized as a best practice and helpful in communicating the status of the project. This should be continued with Kanban, that provides better visualization of tasks and issues and an interface for communication and collaboration according to Oza et al. [28].
We have recognized a set of potential challenges in applying the improvement suggestions in an organization. Firstly, Kanban leaves space for speculations and is not unambiguously defined [4], and therefore it requires a consideration and thoughtful adaptation [30]. Secondly, Lean is defined in various ways which highlights that there is no pure Lean approach [26] which makes understanding and teaching Lean harder. Furthermore, in the comprehensive literature review of Dikert et al. [12], they recognized 35 challenges in large scale agile transformations. Even though Case Company can be considered agile organization, we recognized some of these challenges already in our interviews, piloting and presentations. Especially, people’s resistance towards change, unwillingness to change unless there is a good reason and skepticism towards the new way of working, as defined by Dikert et al. [12], were challenges recognized in some of our interviews.

In his study of Lean Change, Hui [16] argues that there is no predictable process to get from point A to B in organizational transformation and thus it should be based on experimenting, feedback, learning and improving. Similarly, Dikert et al. [12] recognized piloting as one of the success factors to gain acceptance for change. In this Thesis work, we piloted our improvement suggestions in a single pilot team, experimenting the change and gathering feedback. Still, further study on applying discussed improvement suggestions would be required and good practices and success factors of organizational changes from studies like [12, 16] should be further evaluated.

5.4 Limitations of study

The author of this Thesis has worked at the Case Company for a significant period of time, which can be considered as a potential threat to validity of empirical study. Therefore, it is difficult to separate what has been known before and after the empirical study. To mitigate this validity threat, we defined a comprehensive research process and followed it precisely to avoid an extensive bias in the found results. Therefore, we argue that the results are repeatable while following the research process defined in this study.

We interviewed a set of project managers, technical project managers, service managers and business managers from four different markets at Case Company. These covered just a margin of a big variety of Case Company’s projects, markets and teams. It has to be recognized that especially due to high configurability of the software and not having unified tools and processes, every customer project is unique in nature. Therefore, even though we categorized many of our found results based on markets, it is good to remember that our study covered only a small part of each market’s employees and
projects and every project and employee can only represent their own work methods, processes and challenges. This also highlights the scattered best practices across the company and the challenge of not having more unified tools, methods and processes.

In most of our interviews more transparent task management towards the customer was recognized as a challenge and a future improvement point. Most of the interviewees in all markets claimed that most of the delays are caused in technical implementation phase by the customer. These findings and claims are highly one-sided, and a further study of Case Company’s customers and their opinion on task and project management with Case Company could be conducted. These future findings could be mapped against the ones in this Thesis. Still, Lean and Kanban as collaborative principles and method, would guide customers and Case Company to analyze their common processes and task and project management together, and hopefully address the possible issues faster and together in the future.

Literature review part of this Thesis focused mostly on characteristics of Lean and Kanban as defined by books and literature reviews. Furthermore we studied several case studies and analyzed found benefits. We based our suggested solution of Lean and Kanban at Case Company to those findings. Our suggested solution of using Lean and Kanban in several levels of hierarchy in Case Company and synchronizing several Kanban boards to work together, both for internal individual and team management as well as project and task management with customer, is less studied. However, the initial results from one pilot team using suggested Lean and Kanban model were positive and the team experienced many of the potential benefits. Still, as the pilot team worked in a special setting of software maintenance type of a work, a further study in larger scale and across different teams of Case Company should be conducted to better analyze the potential benefits of Lean and Kanban.
Chapter 6

Conclusions

This Thesis was carried out as a case study in a Finnish software company vendoring a supply chain management software. We studied Lean principles and Kanban method, their characteristics and benefits found in existing studies. Furthermore, we conducted a comprehensive empirical study of current best practices and challenges of project and task management. Finally, we concluded a list of improvement suggestions based on found benefits of Lean and Kanban, and best practices and challenges of project and task management. To find an answer to our research problem “How can Lean principles and Kanban method improve task and project management throughout the lifecycle of SaaS delivery projects?” we chose action research method, with numerous semi structured interviews accompanied by qualitative data analysis practices from contextual design. Main outcome of this Thesis can be summarized to three key conclusions. These are presented in following three paragraphs with short descriptions.

Project and task management processes should be harmonized and all the projects should be maintained under the same tool. The major challenge recognized by most of interviewees was that project information is scattered under too many systems and tools. Having an overview of projects is hard and many times not based on actual data but rather rough estimates. This challenge has been recognized by both single projects as well as team leads trying to have an overview of all projects under a certain team. When the project and task management would be more harmonized under the same tool, gathering data of projects in higher level would be easier. Later the improvement of best practices and processes could be better facilitated, when same processes and practices would be used throughout the projects and teams. In a long run, project timeline and workload estimates could be improved when there would be a bigger source of data where estimates could be based on. Furthermore, individual work would be simpler
and more efficient as there would be less tools to maintain.

**Project and task management should be visualized and shared with the customers.** One of the major challenges has been that tasks are not maintained in all projects in a shared place with the customer. Instead, they are divided between many different systems. Eventually, tasks stay pending and are forgotten when their tracking and management is hard, not transparent or not even properly maintained. Currently there are no guidelines or best practices on how and where to maintain tasks, and vendor often relies on customer having ready solution for it. Furthermore, one of the major wastes in project delivery related to delays in technical implementation work. There, both customer and vendor are responsible of specifying, prioritizing, developing, testing and validating tasks. We argue that better mutual control and process over those tasks would facilitate and lessen delays in project work. The challenge has been that project teams have lacked commonly maintained and visualized development process and task status, and therefore the status of tasks and overall progress of a project is hard to analyze. Furthermore, task responsibilities, specifications and pending issues are harder to communicate when tasks are not properly maintained, which has led to misunderstandings, defects and delays in projects.

**Kanban and Lean provide a good method and principles for rapidly changing project, task and team management.** Based on the current needs, challenges, best practices and development processes, we suggest using Kanban and Lean as method and principles for task management. These could be used both with customer in projects as well as internally in individual, team and portfolio levels for better overview of projects and teamwork. Kanban and Lean have been found to be good methods for managing rapidly evolving and changing requirements as they enable fast delivery and capability to react fast to changes. Furthermore, the pilot team of this Thesis study has recognized potential benefits while managing several customer projects collectively through a single Kanban board. Kanban has been found to provide a better knowledge sharing, collaboration and communication within a team. One of the big challenges in current teamwork and resourcing has been that projects are tied and dependent on a single person, resulting to task switching, heavy handovers and eventually defects. We suggest that teams would take shared responsibility of their projects and start managing their work through Kanban boards. Later on, project level Kanban boards would work as a visualization of work processes and common task management with customer. Kanban and Lean has been found to help in communicating possible issues and bottlenecks in project, and facilitate reacting to them faster. This would help especially in technical implementation phase, that has been recognized as challenging and delayed in many
projects.

In future, more case studies on using Kanban in different levels of organization and synchronizing the tasks between those levels for better individual, project, team and project portfolio level management would be needed. Based on this Thesis, there are several potential benefits in using Lean and Kanban in several levels of the organization and synchronizing Kanban boards together but those should be still further studied and analyzed in practice. Especially, how to set and synchronize WIP limits in different levels of hierarchy would require further follow up and analysis.

Furthermore, more quantitative research on the impacts of Kanban and Lean should be conducted. Qualitative results, such as the initial results from pilot team in this Thesis, many times have been speaking for intangible and immeasurable benefits of Kanban and Lean. To further strengthen those benefits, more quantitative studies measuring system performance would be required.

Future steps at Case Company would be to find a shared and common project and task management tool that would support the list of requirements found in this Thesis together with suggested model of Kanban and Lean. Furthermore, studying Case Company’s customers and their opinions on processes and task and project management would be needed to construct the future project and task management tools so that they meet also needs from customer side. Also, a further study of different departments at Case Company, and their needs for project and task management tool should be conducted to have a comprehensive list of the most important requirements that the future tool should fulfill. Later the rollout of use of Kanban and Lean in smaller teams and projects should be continued. Only after a proper use of Kanban and Lean in unified project and task management tool, we would know the actual benefits and value they would bring in project and task management throughout the lifecycle of SaaS delivery projects.
Bibliography


Appendix A

Interviews

A.1 Interviews of technical project managers

In this Appendix, the interview questions used with technical project managers in Thesis are presented. The interviews were executed as semi structured interviews. The list of initial interview questions are as follows:

1. How long have you been working at Case Company?
2. What is your current role?
3. In which team and country office you work in currently?
4. How many members you have in your current team?
5. How many projects your team has at the moment?
6. To how many projects are you assigned to at the moment?
7. How are tasks managed currently in your team?
8. How do you currently manage and track your work in following different levels:
   (a) Independent work
   (b) Project team work
   (c) Team work
   (d) If you work with the customer, where you track your work with them?
9. How tasks are created?
10. How do you prioritize tasks?
11. How task status is tracked and managed?
12. How task is communicated?
13. When task is done, how is that communicated and closed?
14. What kind of tasks do you usually have?
15. From which projects you receive most of the tasks?
16. When you have a task to do, do you feel like you know what activities you need to perform to complete the task?
17. Are you happy with how the work is managed currently?
18. What works well?
19. Could task management be improved somehow, how?
20. How many simultaneous tasks you currently have?
21. Could there be less or more?
22. Do you recognize having been in some of the following situations:
   - Creating features that were not used
   - Waiting extensively long times for customer and/or other team members input before when implementing new features
   - Switching often between tasks and getting interrupted
   - Multitasking and doing many simultaneous tasks at the same time
   - Doing things that do not create or add value for the customer
   - Having partially implemented functionalities that are not used
   - Doing hand-offs
   - Fixing bugs
23. With whom do you interact mostly in your current position?
24. What are your main communication channels with others currently:
   - Face to face
   - Flowdock
In this Appendix, the interview questions used with business side project managers in Thesis are presented. The interviews were executed as semi structured interviews. The list of initial interview questions are as follows:

1. How long have you been working at Case Company?
2. What is your current role?
3. In which team and country office you work in currently?
4. How many members you have in your current team?
5. How many projects your team has at the moment?
6. To how many projects are you assigned to at the moment?

7. Could you describe the different phases of your customer projects?

8. What are the objectives and activities of these phases?

9. Who are responsible of the activities in these phases?

10. How do you track the status of a project? Do you use any KPIs or other charts and metrics?

11. What are your main communication channels in project work?

12. Do you somehow analyze your work practices and improve them throughout the project?

13. What tools do you use for project management?

14. What documentation do you have in your projects?

15. Do you believe that the current tools, documentation and templates facilitate your work?

16. What would you see as the main reasons for project being delayed in general?

17. What works well in project management?

18. What could be improved in project management?

19. How are tasks managed currently in your team?

20. How tasks are managed in different phases of the projects?

21. How tasks are created?

22. How do you prioritize tasks?

23. How do you allocate the tasks?

24. How task status is tracked and managed?

25. How task is communicated?

26. When task is done, how is that communicated and closed?

27. Are you happy with how the work is managed currently?
28. What works well?

29. Could task management be improved somehow, how?

30. When new tasks or changes are requested, how those are communicated and with whom?

31. Do you measure the value that these new changes or tasks may provide before implementation?

32. Do you measure the value that created features have provided after implementation?

33. Do you recognize having been in some of the following situations:
   - Creating features that were not used by customer
   - Waiting extensively long times for customer and/or other team members input before when implementing new features
   - Switching often between tasks and getting interrupted
   - Multitasking and doing many simultaneous tasks at the same time
   - Doing things that do not create or add value for the customer
   - Having partially implemented functionalities that are not used
   - Doing hand-offs
   - Fixing bugs
Appendix B

Affinity diagram groupings

In this Appendix, we represent the four different market’s affinity diagrams, and illustrate the different groupings of data we concluded.

B.1 Market A

Affinity diagram groupings

- Project management
  - Project milestones, phases and activities
  - Project model
  - Project status and monitoring
  - Project documentation and templates
- Task management
  - Characteristics of work
  - Work flow
  - Task status and transparency
  - Task management tools
  - Service vs project work
- Teamwork and communication
  - Teamwork and team management
  - Knowledge sharing
  - Communication
  - Responsibilities
- Waste
- Future improvement needs

Figure B.1: Affinity diagrams grouping of market A
B.2 Market B

Affinity diagram groupings

- Project management
  - Project milestones, phases and activities
  - Project model
  - Project status and monitoring
- Task management
  - Work flow
  - Task status and transparency
  - Task management tools
- Teamwork and communication
  - Team work and team management
  - Task and responsibility sharing
  - Resource allocation
  - Team work
  - Knowledge sharing
  - Communication
  - Responsibilities
- Waste

Figure B.2: Affinity diagrams grouping of market B
B.3 Market C

Affinity diagram groupings

- Project management
  - Project milestones, phases and activities
  - Project model
  - Project status and monitoring
  - Project management tools, documentation and templates
- Task management
  - Characteristics of work
  - Work flow
  - Task status and transparency
  - Task management tools
- Teamwork and communication
  - Teamwork, team management and resourcing
  - Knowledge sharing
  - Responsibilities
- Waste

Figure B.3: Affinity diagrams grouping of market C
### B.4 Market D

**Affinity diagram groupings**

- Project management
  - Project milestones, phases and activities
  - Project model
  - Project status and monitoring
  - Project documentation and templates
- Task management
  - Characteristics of work
  - Work flow
  - Task status and transparency
  - Task management tools
- Teamwork and communication
  - Teamwork and team management
  - Remote service team
  - Communication
  - Responsibilities
- Waste

![Affinity diagrams grouping of market D](image)

Figure B.4: Affinity diagrams grouping of market D