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**AGILE PROJECT MANAGEMENT IN ENGINEERING, PROCUREMENT
AND CONSTRUCTION PROJECTS**

A case study of ABB Grid Integration Finland

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ABSTRACT:

This thesis is commissioned by ABB Grid Integrations Finland. The case organization was interested in finding out if agile project management (APM) and particularly the Scrum framework could improve the management of their projects. The research problem of this study is formulated as follows: *could agile project management be used to improve project management in the case organization during the initial phases of its EPC projects?*. In addition to providing guidance to the practitioners in the case organization, the study also aims to make a relevant academic contribution. It became apparent early on in the research process that while there were many academic studies on the use of APM in software development projects, the research on APM in non-software development projects is limited. This study helps fill a gap in the academic literature by making a contribution to this emerging research field. The thesis presents theory on agile project management and its use in non-software development projects. Theory on the Scrum framework and its use in an EPC project is also presented. The study is a qualitative case study. Empirical data is gathered through semi-structured theme interviews (fin: teemahaastattelu) and observations in connection to these interviews. The three interviews with Scrum practitioners working with hardware and software projects within ABB provided an extensive material for analysis. During the research process a pilot project started in the case organization. In this project a hybrid method consisting of Scrum, Kanban and traditional project management practices was piloted. The initial experiences from this pilot project also contribute to the findings of the present study. The results from the study indicate that APM could be implemented in the case organization during the initial phases of its EPC projects, and such an implementation could be beneficial and improve project management. Initial evidence from the pilot project indicates that the benefits which the case organization was hoping to gain from using APM could be achieved. It remains unclear however if the case organization has become more agile through the implementation of APM in the pilot project.

KEYWORDS: Agile project management, Project management, Engineering, procurement and construction, Agile methods, Scrum

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ABSTRAKT:

Denna avhandling har gjorts som ett beställningsarbete för ABB Grid Integration Finland. Företaget intresserade sig för huruvida agil projektledning och framförallt ramverket Scrum kunde användas för att förbättra deras projektledning. Problemformuleringen för avhandling lyder så här: *kunde agil projektledning användas för att förbättra projektledningen i den studerade organisationen under de första faserna i dess EPC projekt?*. Förutom att ge vägledning till praktikerna i organisationen så har avhandlingen även som syfte att tillföra ett relevant akademiskt bidrag. Det stod klart redan tidigt i forskningsprocessen att det lyder brist på akademiska studier av användning av agil projektledning i projekt som inte går ut på att utveckla mjukvara. Däremot finns det många studier som studerar agil projektledning inom mjukvaruutveckling. Därför kan denna studie ses som ett relevant akademisk bidrag till detta nya forskningsområde. Avhandlingen presenterar teori om agil projektledning med fokus på projekt med annat syfte än mjukvaruutveckling. Teori om ramverket Scrum och dess användning i ett EPC projekt presenteras även. Studien är en kvalitativ fallstudie. Data har insamlats empiriskt genom semi-strukturerade temaintervjuer (fin: teemahaastattelu) och observationer i anknytning till dessa intervjuer. De intervjuade personerna arbetar alla inom ABB för mjukvaru- eller hårdvaruprojekt där Scrum används som projektledningsmetod. Intervjuerna genererade ett omfattande material för analys. Under forskningsprocessen drogs även ett pilotprojekt igång i organisationen. I detta projekt implementerades en hybrid metod bestående av Scrum, Kanban, samt traditionella projektlednings metoder. De initiala erfarenheterna från detta pilotprojekt har även bidragit till studiens resultat. Resultaten från studien indikerar att agil projektledning kunde användas i den studerade organisationen under de första faserna i dess EPC projekt och detta kunde vara fördelaktigt och förbättra projektledningen. Initiala resultat från pilotprojektet indikerar att de resultat som den studerade organisationen hade hoppats kunna uppnå genom användning av agil projektledning kunde uppnås. Det förblir dock oklart om den studerade organisationen har blivit mer agil genom användningen av agil projektledning i pilotprojektet.

SÖKORD: Agil projektledning, Projektledning, EPC projekt, Agila metoder, Scrum

1. INTRODUCTION

1.1. Background

Within software development agile project management (APM) has been widely and successfully used; *“Agile innovation methods have revolutionized information technology. [...] they have greatly increased success rates in software development, improved quality and speed to market, and boosted the motivation and productivity of IT teams.”* (Rigby, Sutherland & Takeuchi 2016b). APM is well established within the software industry and the academic field studying APM has started to mature in recent years (Dingsøyr, Nerur, Balijepally & Moe 2012). Now APM is starting to attract interest among practitioners in new industries and functions and initial studies suggest that there might be benefits to gain from adopting agile methods in a non-software development context (see for example Gustavsson 2016). Many agile practices such as daily meetings, visualizing work, communicating in person, putting the customer first and empowering the project team are quite general in nature and could be adapted in most projects. It is therefore worth exploring further whether agile methods could benefit the management of projects in new industries and functions. This thesis sets out to explore the topic of agile project management within a context very different from software development namely engineering, procurement and construction (EPC) projects. These types of projects are typically managed with quite traditional methods. Perhaps it is time to explore the options and hopefully gain benefits from adapting new practices? As the quote above shows agile methods have increased success rates in software development projects, perhaps similar benefits could also be gained in other types of projects?

This thesis is done on behalf of ABB Grid Integration Finland. The case organization had been introduced to the APM framework *Scrum* and was curious to know whether implementing it could help them increase communication in their project teams as well

as between the teams and their stakeholders. The case organization liked the idea that the daily meetings in Scrum would provide formal opportunities to communicate on a daily basis, thus increasing communication and collaboration. They also liked the idea of visualizing the project tasks using a *backlog* and a *Scrum board*, as this would give a better overview of project activities.

The primary motivation for the study is to assist the case organization by conducting the study and answering the research problem. In addition to this, the study also aims to make a relevant academic contribution. Presently there are few academic studies on the use of APM in non-software projects. As such, the present study also aims to contribute to this new research field.

1.2. Research questions and research problem

Due to the fact that EPC projects differ quite a lot from software development projects, the case organization was unsure whether it was even possible to use APM in their projects. The researcher's initial task was therefore to find out whether APM could be used in the case organization. The case organization was mainly interested in using APM during the initial phases of their projects. The first research question was therefore formulated as follows:

Research question 1: Could agile project management be used in the case organization during the initial phases of its EPC projects?

In addition to understanding whether APM could be used, it was also desirable to understand whether it would be beneficial and recommendable to start using APM in the case organization. The second research question was therefore formulated as follows:

Research question 2: Could it be beneficial to use agile project management in the case organization during the initial phases of its EPC projects?

Together, these two research questions form the research problem of this thesis which guides the research work of this study and is formulated as follows:

Research problem: Could agile project management be used to improve project management in the case organization during the initial phases of its EPC projects?

1.3. Introduction to the case organization ABB Grid Integration Finland

ABB is a global company with a long heritage. Today ABB consists of four global divisions: Electrification Products, Robotics and Motion, Industrial Automation, and Power Grids. Grid Integration is one of several business units within the Power Grids division. The case organization in this thesis is the unit Grid Integration in Finland, which offices are located in Strömberg Park, Vaasa. The case organization delivers and services solutions for the electrical grid to the domestic market as well as abroad. The business is project based and the projects focus on the delivery of substation solutions. The substation projects are mainly delivered on a turnkey basis and can be classified as so called engineering procurement and construction projects. The case organization is described more in-depth in chapter four titled *Case description*. (ABB 2016; 2017.)

1.4. Introduction to methodology

This is a qualitative case study. The researchers understanding of case study research is in line with Jensen & Sandströms (2016) who emphasize case study research as “[...] *a research strategy that span across the entire research process, where intuition, curiosity, extensive reading, and bravery are more important than an instrumental attitude and following standardized procedures.*” (Jensen & Sandström 2016: 147, author’s translation from Swedish). After extensive study of secondary data the empirical data is gathered through semi-structured theme interviews (fin: teemahaastattelu) (Hirsjärvi & Hurme 1982) and observations in connection to these. The interview data is transcribed and analyzed systematically as described in the methodology chapter of this thesis. Considerations in connection to the quality of the research have also been made and presented in the methodology chapter. One way of enhancing the quality of the study is providing a detailed description of the research process in the methodology chapter of this thesis.

1.5. Structure and contents

The thesis is structured as follows:

Chapter 1 starts with presenting the background of the study as well as the research questions and research problem. Next, the case organization is presented followed by a presentation of the methodology of the study. Lastly, the structure and contents of the thesis is presented.

Chapter 2 presents theory that relate to agile project management. The chapter puts emphasis on presenting theory on agile project management in non-software projects.

Chapter 3 presents theory about Scrum and explains the main contents in the Scrum framework. This ensures that the reader is able to understand the results from the interviews with Scrum practitioners at ABB. The chapter also presents the use of the Scrum framework in an EPC project.

Chapter 4 introduces the case. The reader is introduced to the case organization, its projects and project environment. The case organizations motivations for using APM in the initial phases of its EPC projects are also presented.

Chapter 5 presents the methodology of the present study. The case study's data collection methods are presented and research quality is discussed. This chapter also describes the research process in detail including empirical data collection and analysis of interview data.

Chapter 6 presents the results from the interviews.

Chapter 7 describes a pilot project where agile project management is implemented in one of the case organizations projects.

Chapter 8 presents the results from the study. The results are presented by answering the research questions based on theoretical material, the results from the interviews as well as based on the experiences from the pilot project. The presentation of the results is followed by a discussion of these results as well as the study in its entirety.

Chapter 9 contains a conclusion that summarizes the study and then presents suggestions for future research.

2. AGILE PROJECT MANAGEMENT

This chapter describes how the use of agile project management has started within the software development industry and how it today can be found in various types of projects across different industries and functional areas. Sub-chapter 2.1. aims to give the reader an understanding of the roots of agile project management as well as a basic understanding of the core elements and values of APM in its original context of software development. A brief introduction to the history of the agile movement is first presented, followed by a presentation of the core elements of agile software development. In sub-chapter 2.2. the term agility is discussed and definitions of the term are presented. Understanding the term agility improves the understanding of agile project management. The remainder of the chapter aims to give an overview of the use of APM outside software development. Sub-chapter 2.3. gives an overview of the use of APM in non-software development projects including benefits and challenges. Lastly, in sub-chapter 2.4., the reader can find a statistical overview of the use of APM in different industries based on data from two large international surveys.

2.1. Agile software development

At the turn of the century several new methods for developing software that share common characteristics had started to appear. In 2001 a group of software developers gathered in Snowbird, Utah in the United States to discuss these new, alternative ways to develop software. The new ways of working were “[...] *an alternative to documentation driven, heavyweight software development processes* [...]” (Highsmith 2001). The participants decided to call the movement “agile” and the meeting resulted in the formation of a “*Manifesto for agile software development*”. Work on the formulation of principles to support the manifesto was also initiated and this work resulted in 12 principles carrying the name *Principles behind the Agile Manifesto* (see

appendix). The contents of the Manifesto for Agile Software Development as well as the contents of the 12 Principles behind the Agile Manifesto together form the basis for the agile movement and are the common core shared by the many different agile methods that exist today. (Highsmith 2001; Rigby, Sutherland & Takeuchi 2016a.)

The Manifesto for Agile Software Development emphasizes human interaction and collaboration, responsiveness to change and the production of working software (Beck et al. 2001).

Manifesto for Agile Software Development

We are uncovering better ways of developing software by doing it and helping others do it.
Through this work we have come to value:

Individuals and interactions over processes and tools
Working software over comprehensive documentation
Customer collaboration over contract negotiation
Responding to change over following a plan

That is, while there is value in the items on the right, we value the items on the left more.

Beck et al. 2001

The following paragraph is the researchers attempt to summarize some of the thoughts in the 12 *Principles behind the Agile Manifesto* (see appendix) with focus on the content in these principles that is not software specific. According to these principles the ideal is self-organizing teams of motivated individuals who share information through face-to-face conversations. The teams should receive support and be trusted to get the job done. The team works in a sustainable manner maintaining a constant speed indefinitely. The team reflects regularly on how to improve efficiency and adjust their behavior accordingly. Simplicity is also valued and “work not done” should be maximized. Customer satisfaction should be the focus and changing requirements should be welcomed throughout the process in favor of customer competitive advantage. (agilemanifesto.org 2001.)

According to Jansson (2015) the agile methods could be seen as a reaction to both the challenges presented by the traditional way of managing projects where the project is first planned and then carried out, and to the rational view of people as “assets to be controlled” rather than independent actors that are engaged in their work and thus develop successful products. (Jansson 2015: 12.)

Jansson (2015) attempts to identify what the “agile in agile methods” is and he identifies and lists the following strategies within agile methods:

- “Demands and solutions will change during a project,
- Feedback and learning is emphasized,
- Incremental and iterative development,
- Need for comprehensive, close, transparent and informal communication between involved parties,
- Self-steering/self-organizing development teams,
- Frequent reflection and improvement of work processes,
- Striving for minimal documentation and simple solutions.”

(As written in Jansson 2015: 31, authors translation from Swedish)

After further discussion Jansson (2015: 34) summarizes the “agile in agile methods” into two components:

- “Incremental and iterative development in order to allow the learning during the process to be utilized in the project,
- Self-steering individuals and teams in close and transparent work arrangements.”

(As written in Jansson 2015: 34, authors translation from Swedish)

The Manifesto for agile software development (Beck et al. 2001) and its supporting principles as well as the work by Jansson (2015) presented above gives insight into

some of the core ideas that agile methods are based on. Next the chapter continues by discussing the term *agility* which is central to APM.

2.2. Agility

The APM [agile project management] approach, which considers methods, tools and techniques, was created to improve the performance of the project by promoting “agility”. (Conforto Amaral, da Silva, Di Felippo and Kamikawachi 2016: 660)

Agility is central in APM as the quote above shows. As one step in understanding the topic of agile project management it would therefore be relevant to understand what *agility* is. The Agile Alliance, a non-profit organization established by pioneers of agile software development, defines *agile* as: “*The ability to create and respond to change in order to succeed in an uncertain and turbulent environment.*” (Agile Alliance 2017). Within the academic field there is a lack of a commonly accepted definition of *agile* in the contexts of software development and project management (Jansson 2015: 9). Conforto et al. (2016) have also recognized and responded to the need for a proper definition of agility within the academia. According to these co-authors “*Definitions of agility found in the project management (PM) and agile project management (APM) disciplines are inconsistent, incomplete and lack clarity.*” (Conforto et al. 2016: 660).

As a response to this lack of definitions of agility, Conforto et al. (2016) conducted a study. They studied 59 different definitions of agility, out of which 5 related to project management in software development projects. The majority of these definitions were from manufacturing and organizational theory. The term agility was originally known in the context of manufacturing (agile manufacturing) before it eventually was used in the area of project management, and soon became popular in this area through the emergence of the agile software development methods. (Conforto et al. 2016: 661, 670.)

Through their study Conforto et al. (2016: 667) were able to propose a “complete definition of agility” that can be read below:

Agility is the project team's ability to quickly change the project plan as a response to customer or stakeholders needs, market or technology demands in order to achieve better project and product performance in an innovative and dynamic project environment. (Conforto et al. 2016: 667)

Conforto et al.'s (2016: 671) study also indicates that (1) *rapid project planning change* and (2) *active customer involvement* might be core elements of agility in **project management** that in combination can have an effect on agility performance in this context.

2.3. APM in non-software development projects

The topic of agile project management within a software development context has been extensively researched (Dingsøyr et al. 2012). Research on APM within other contexts is however a new research field. For the purposes of this thesis an attempt has been made to find as many academic publications on this new research topic as possible. The results are limited, most likely due to the limited existence of publications at this time. Many of the publications found are quite recent and based on this knowledge, it is predicted that more research on the use of APM in domains other than software development is likely to be seen in the near future. Outside the academic field more examples of pioneers adopting APM in various contexts can be found.

In a recent article in Harvard Business Review titled *Embracing Agile*, Darrell K. Rigby, Jeff Sutherland and Hirotaka Takeuchi (2016b) talk about how agile methodologies, which have traditionally been used for software development, are spreading to many

new industries and functions. And this spread of agile methods to functions outside IT offers substantial opportunities according to the co-authors (Rigby et al. 2016b). They list a set of examples worth quoting here in order to give the reader an understanding of the broad spectrum of the new uses of agile methods:

National Public Radio employs agile methods to create new programming. John Deere uses them to develop new machines, and Saab to produce new fighter jets. Intronis, a leader in cloud backup services, uses them in marketing. C.H. Robinson, a global third-party logistics provider, applies them in human resources. Mission Bell Winery uses them for everything from wine production to warehousing to running its senior leadership group. And GE relies on them to speed a much-publicized transition from 20th-century conglomerate to 21st-century “digital industrial company.”

(Rigby et al. 2016b)

However, Rigby et al. (2016b) also write that the implementation of agile is easiest and most effective when conditions resemble the context of software innovation. These conditions are listed below:

- “The problem to be solved is complex;
- solutions are initially unknown, and product requirements will most likely change;
- the work can be modularized;
- close collaboration with end users (and rapid feedback from them) is feasible;
- and creative teams will typically outperform command-and-control groups.”

(As written in Rigby et al. 2016b but reformatted into bullet points)

Functions in which the authors (Rigby et al. 2016b) have found these conditions to exist are marketing projects, resource allocation decisions, product development functions, supply-chain challenges and strategic-planning activities. The above listed conditions

are less common in routine operations, examples of which include sales calls, purchasing, accounting and plant maintenance (Rigby et al. 2016b).

According to an Executive Report of the *Project Management Agility Global Survey* published by MIT and co-authored by Conforto, Rebentisch and Amaral (2014) agile methods are slowly expanding to other product types beyond software. Citing Conforto, Rebentisch & Amaral (2014: 15) *“Agile Project Management (APM) practices, tools, techniques that were originally created for software development projects are being applied elsewhere, especially in projects that require a certain degree of innovation.”*. The same year Conforto and Amaral in co-operation with Salum, da Silva and de Almeida, researched the existence of APM in new product development projects *“[...] that do not formally adopt or recognize the use of agile project management theory [...]”* (Conforto, Salum et al. 2014: 21). New product development projects were studied *“[...] due to similarities with the projects from the software industry, such as creativity and the development characterized by continuous cycles of prototyping and testing.”* (Conforto, Salum et al. 2014: 21-22). Based on the results from the study the researchers could propose the following hypothesis: *“[...] the APM approach could be adapted to non-software companies, or more traditional industry sectors, at least for innovative projects or even for some parts of the project that require a more flexible management approach.”* (Conforto, Salum et al. 2014: 31).

Orrell (2017) who has worked with APM, specifically Scrum, in EPC and EPCM projects sees value in applying the Scrum framework outside the software industry regardless of the domain. He also emphasizes the importance well-functioning teams for business success. *“[...] the Scrum framework is equipped to help organizations, teams, and people solve common problems-- regardless of the domain. The success of organizations, their products, and projects lies in their teams and how they work together.”* (Orrell 2017: 1).

Gustavsson (2016) has systematically reviewed cases of APM implementation in non-software development projects. His study shows that there is an interest in using APM outside software development: *“As this research work has shown, there is a vast interest for using agile project management in areas not even close to software*

development. Several articles were identified that showed successful case studies where agile project management had been applied.” (Gustavsson 2016: 9). Finding this study provided a good starting point in the search for cases of APM implementation outside software development. Gustavssons literature review included 21 cases from 16 articles within a number of very varying contexts. (Gustavsson 2016.)

In addition to the cases included in the systematic literature review by Gustavsson (2016), the author of this paper has found the following studies that study the use or potential use of APM in different types of non-software development projects; *engineering, procurement and construction* (Orrell 2017), *public events* (Gustavsson & Rönnlund 2010), *sales* (van Solingen, Sutherland & de Waard 2011), *venture capital group/use in all parts of the organization* (Sutherland & Altman 2010), *construction* (Owen, Koskela, Henrich & Codinhoto 2006; Streule, Miserini, Bartlome, Klippel & Garcia de Soto 2016) *mechatronics engineering in machinery and plant construction* (Klein & Reinhart 2016), *real estate developments* (Olsson, Østbø Sørensen & Leikvam 2015) *product development* (Conforto, Salum, Amaral, da Silva & de Almeida 2014; Gustavsson & Rönnlund 2013; Ovesen 2012).

The topic of hybrid models consisting of the Stage-Gate model and agile project management methods seems to be a research trend within APM research in non-software contexts, the author of the present paper has found the following studies that study hybrid frameworks consisting of the Stage-Gate model and agile project management: Cooper and Sommer 2016a, 2016b; Sommer, Hedegaard, Dukovska-Popovska and Steger-Jensen 2015; Conforto and Amaral 2016.

Next a few of the cases found are exemplified in order to show that APM can be applied in very varying contexts. Notable from some of these cases is that existing agile methods such as Scrum have been altered to fit the new contexts. Gustavsson and Rönnlund (2010) have studied a company that organizes public events, such as music festivals. One characteristic of event projects is that the event is scheduled for a certain date, and thus the projects have a set deadline. These researchers have found several agile techniques and principles to be applicable in the management of public events. (Gustavsson & Rönnlund 2010). Public relations planning is another area in which

APM, specifically Scrum has been experimented with. According to van Ruler (2014: 187) the context of modern public relations is complex and thus would require more flexible planning. Van Ruler (2014: 187) presents a new agile method named *The Reflective Communication Scrum* that she has developed based on the Scrum framework and built on using theory on communication, change and reflectivity, and enriched with evaluation. Olsson, Østbø Sørensen and Leikvam (2015) discuss agile methods in the context of real estate projects. They view the iterative nature of APM as relevant for real estate development since surprises are encountered as projects progress thus creating a need to re-define projects (Olsson et al. 2015: 524). Pope-Ruark's (2015: 117) interest has been on agile in general and Scrum in particular, she has introduced APM when teaching technical and professional communication courses with the purpose of increasing the quality of team work in the courses. She cautions that Scrum is not useful in all situations, she recommends using agile in more complex and collaborative projects and not in short projects that require the coordination of individual work (Pope-Ruark 2015: 129).

2.3.1. Benefits and challenges of APM in non-software development projects

Tomas Gustavsson (2016) from Karlstad University in Sweden has conducted a recent and systematic literature review titled *Benefits of agile project management in a non-software development context –A literature review*. This literature review systematically looked at cases where APM was used outside a software development contexts and identified experienced benefits and challenges of using APM. Figures 1 and 2 on the next page are taken in original format from Gustavssons (2016) paper and show the reported benefits and challenges that were identified in the 21 cases studied by Gustavsson.

Reported benefits from the case studies		
Number of occurrences	#	Reported benefits
11	1	Better collaboration in the team
9	2	Increased customer interaction
8	3	Increased productivity and speed
7	4	Increased flexibility , coping with change
6	5	Better understanding of goals/tasks/requirements
6	6	Increased transparency and visibility
5	7	Increased quality
5	8	Customer-centered value-add priority process
4	9	Increased knowledge sharing
3	10	Increased cross-organizational collaboration
3	11	Better focus
2	12	Impediment removal process
2	13	Increased individual autonomy
2	14	Decreased customer complaints
2	15	Increased motivation
1	16	Clear sense of progress
1	17	Improved resource allocation

Source: author's construction based on identified benefits in the analysed articles.

Figure 1: Reported benefits from the cases studied (as shown in Gustavsson 2016: 7)

Reported challenges from the case studies	
Number of references	Reported challenges
3	Changing mindset to allow flexibility
3	Lack of process visibility
2	Buy-in from managers
2	Difficult to see benefits early in the project
2	Inadequate knowledge sharing
2	Individual work, lack of communication
2	Long-term planning
1	Lack of stakeholder engagement
1	Scope creep
1	Insufficient resource allocation
1	Redundant work

Source: author's construction based on identified challenges in the analysed articles.

Figure 2: Reported challenges from the cases studied (as in Gustavsson 2016: 7-8)

In summary, the four main benefits reported related to team collaboration, customer interaction, productivity and speed, and flexibility/coping with change, while the two

main challenges are *changing the mindset to allow flexibility* and *lack of process visibility*. In comparison to the number of benefits there were few challenges reported. Gustavsson acknowledges that the results are initial and need more backing before generalizations can be made. (Gustavsson 2016: 7-9.)

2.4. APM in different industries

This sub-chapter aims to shed light on in which industries APM is used and more importantly in which **functional areas** APM is in use within these industries. Several large surveys show that agile project management is spreading outside the software industry. However, these surveys do not always state **what types of projects** APM is used for within these industries which is good to keep in mind when reading these statistics. In this sub-chapter results from two large international surveys are presented and compared.

The 10th annual State of Agile™ survey is a commercial survey that is conducted by VersionOne Inc. a commercial company that produces software that supports agile methods (VersionOne 2016). The survey had around 3880 respondents (VersionOne Inc. 2016: 2.). It is good to keep in mind that this study is produced by a commercial organization, with possible interests, and not by an academic institution. Another large survey is *The 2015 State of Scrum Report* that is published by the non-profit association *Scrum Alliance* (Scrum Alliance 2015). *The 2015 state of Scrum Report* had 4452 survey respondents in 108 countries (Scrum Alliance 2015: 2). While the study by VersionOne (2016) presented above researched the use of agile, *The 2015 state of Scrum Report* is mainly targeted at researching the use of Scrum, with 95% respondents saying Scrum is their organizations agile approach. Interestingly when asked which agile approach(es) were used this survey allowed multiple answers and this showed that 54% of respondents organizations use Scrum in combination with other practices while 42% exclusively use Scrum. The report however did not reveal if they were used

simultaneously or in different teams, since the question was on an organization wide level. (Scrum Alliance 2015:10).

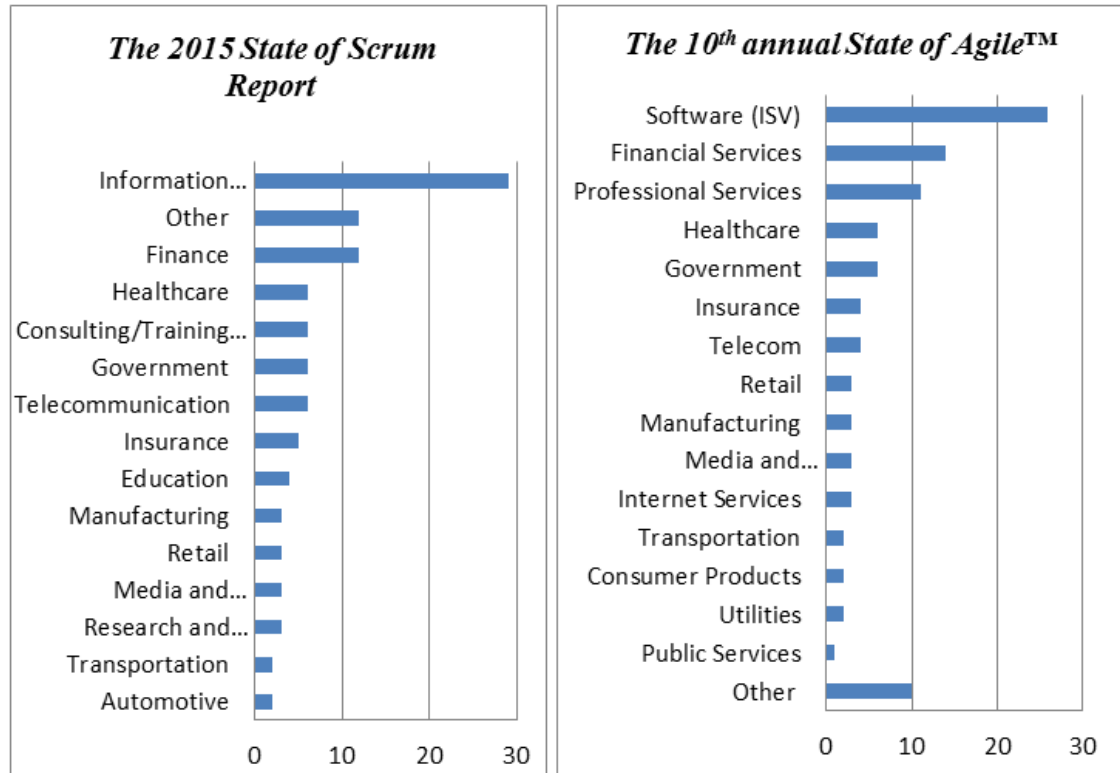


Figure 3: Employment of respondents according to industry, a comparison of results from two surveys (Figure based on statistics by Scrum Alliance 2015: 9 and VersionOne Inc. 2016: 5)

The respondents of *The 10th annual State of Agile™* survey worked in the following industries as also shown by figure 3 above: Software (26%) Financial Services (14%), Professional Services (11%), Healthcare (6%), Government (6%), Insurance (4%), Telecom (4%), Retail (3%), Manufacturing (3%), Media and Entertainment (3%), Internet Services (3%), Transportation (2%), Consumer Products (2%), Utilities (2%), Public Services (1%) and Others (10%) (VersionOne 2016: 5).

The respondents of *The 2015 State of Scrum Report* are employed in the following industries as can also be seen in figure 3 above: Information Technology (29%),

Finance (12%), Other (12%), Healthcare (6%), Consulting/Training/Coaching (6%), Government (6%), Telecommunications (6%), Insurance (5%), Education (4%), Manufacturing (3%), Retail (3%), Media and Entertainment (3%), Research and Development (3%), Transportation (2%) and Automotive (2%) (Scrum Alliance 2015: 9).

Interestingly, the *The 2015 State of Scrum Report* also asked which functional area within their organization respondents worked within, and the results showed that **roughly one fifth of the respondents worked outside software development and IT**, more exactly Product Development (11%), Other (5%), Operations (3%), Sales and Marketing (2%) and C-Level (1%) (Scrum Alliance 2015: 7.). To summarize some results from the survey: 29% of respondents work in the information technology industry, however when it comes to functional areas, as much as 44% of respondents work with software development and 33% with IT (Scrum Alliance 2015: 9, 7.). **This shows that although the Scrum framework has spread to new industries, the functional areas within which it is used in these industries are still mainly software development (44%) and IT (33%).** However, roughly one fifth of the respondents work in functional areas other than software development and IT, and this is an interesting trend to follow. As the use of agile methods is present in various industries it is likely that it will spread to new functions within these industries. Perhaps in the future an increase in the use of agile methods in **functional areas** other than software development and IT can be seen.

One thing to note is that these results are in percentages, that is comparisons, so as long as the popularity of the methods rise similarly within all work areas a difference cannot be noted in the statistics. If the number of respondents in the survey increases and the percentages stay the same this could indicate that there is an increase in the number of teams adopting agile methods within all functional areas, or it could simply mean that the popularity of a particular survey has risen. Statistics can give an indication of the state of things, however there are many factors that need to be taken into account when evaluating statistics and forming a picture of reality based on them.

3. SCRUM

The work on what would eventually result in the Scrum framework was initiated by Jeff Sutherland in 1993. His work was inspired by many but especially by the 1986 paper by Takeuchi and Nonaka titled "*The New New Product Development Game*" (Takeuchi & Nonaka 1986). From this paper Sutherland also inherited the term Scrum that originally comes from the sport rugby. Together with his colleague Ken Schwaber, Sutherland continued the work on Scrum and the two officially presented the method to the public at a conference in 1995 (see Schwaber (1995) for this conference paper). In 2001 Schwaber and Sutherland were a part of the group of developers that created the *Manifesto for Agile Software Development* described in the previous chapter. (Rigby, Sutherland & Takeuchi 2016a; scrumguides.org 2016.)

Although it is only one of many agile methods the Scrum framework has been put in focus in this thesis because the case organization was particularly interested in this agile method and because it is so widely used. According to Diebold and Dahlem (2014: 1) Scrum is one of the most commonly used agile methods. According to Dingsøyr et al. (2012) the academic community's attention seems to be on researching Scrum. A large commercial survey by VersionOne (2016: 9) described in the previous chapter, found that 58% of practitioners surveyed use Scrum as their agile method. In addition to this 10% use a hybrid of XP and Scrum, 7% use "Scrumban" which is a hybrid of Scrum and Kanban and 8% use custom hybrids that might include Scrum. This study indicates that the use of Scrum dominates among practitioners. Scrum also seems to be generally applicable in non-software development projects as described in the previous chapter.

3.1. The Scrum framework

This sub-chapter is mainly based on is the newest version of *The Scrum Guide* from 2016 by Ken Schwaber and Jeff Sutherland (2016) who are the originators of Scrum and are involved in developing and teaching Scrum since its beginnings. The purpose of this sub-chapter is to give the reader a basic understanding of the Scrum framework in order to be able to follow the results from the interviews and subsequently the final results of this thesis.

Scrum is a process framework within which various processes and techniques can be used. The Scrum framework is intended for the development and sustaining of complex products. The Scrum framework consists of roles, events and artifacts bound together by certain rules. Each of these components of Scrum has a purpose and all components are important for the successful use of Scrum. The Scrum framework is described as lightweight and simple to understand, but difficult to master. (Schwaber & Sutherland 2016: 3.)

The five core values of Scrum are **commitment, courage, focus, openness** and **respect**. Citing Schwaber & Sutherland (2016: 4) “*The Scrum Team members learn and explore those values as they work with the Scrum events, roles and artifacts. Successful use of Scrum depends on people becoming more proficient in living these five values.*”. The three pillars of **transparency, inspection** and **adaption** are also fundamental in Scrum. Transparency means that important aspects of the process shall be visible and the observers must share a common understanding of what they see. The Scrum artifacts shall continuously be inspected and necessary adjustments must be made as soon as possible. The Scrum events are formal opportunities for inspection and adaption. (Schwaber & Sutherland 2016: 4.)

SCRUM FRAMEWORK

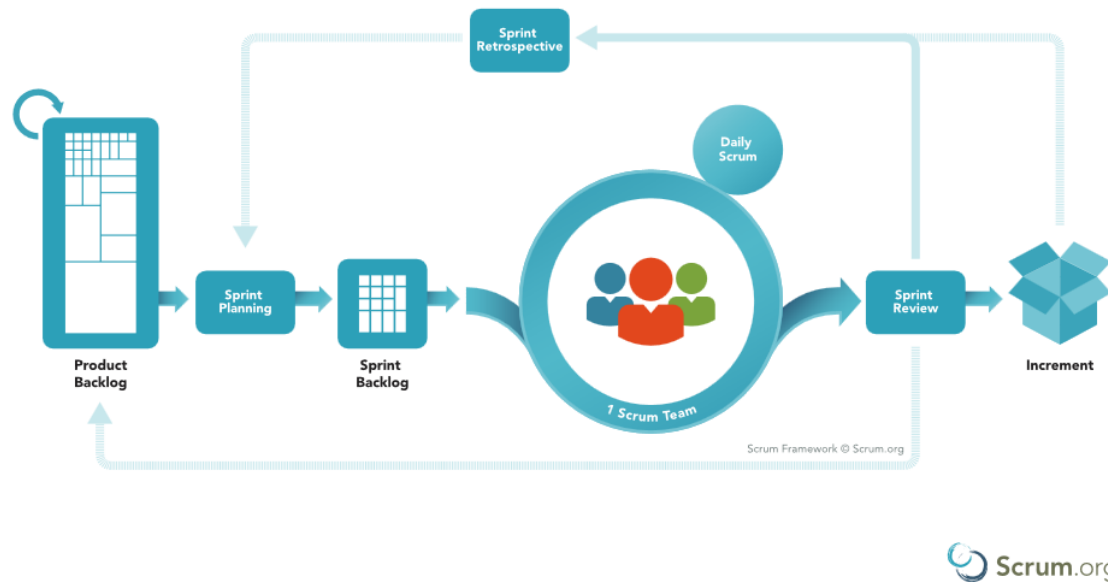


Figure 4: The Scrum framework poster (Scrum.org 2017, used with permission)

Figure 4 above illustrates the Scrum framework. The Scrum team is illustrated in the center and consists of the following three Scrum roles: a Scrum master, a product owner and the development team. They work in iterations called sprints illustrated by the circle surrounding the team. The iterations start with a sprint planning and end with a sprint review and retrospective that give input into the next sprint planning as illustrated. The Scrum team takes part in a daily meeting called the daily Scrum. Together, the sprint, sprint planning, sprint review, sprint retrospective and daily scrum make up the Scrum events. Scrum also contains artifacts; the work of the project is listed in prioritized order in the product backlog and part of this work is selected for a sprint during planning and forms the sprint backlog. At the end of a sprint an increment will be ready. The backlog, sprint backlog and product increment are collectively called Scrum artifacts and it is important to ensure their transparency. The rest of this sub-chapter will explain these components of the Scrum framework more in-depth, starting with the scrum team. (Schwaber & Sutherland 2016; Scrum.org 2017.)

3.1.1. The Scrum team

“The team model in Scrum is designed to optimize flexibility, creativity, and productivity.” (Schwaber & Sutherland 2016: 5).

There are three different roles within Scrum, these are: **the Scrum master**, **the product owner** and **the development team**. Together these three roles form the self-organizing and cross-functional **Scrum team**. Scrum Teams independently choose how to carry out the work as opposed to being directed by non-team members. A Scrum team should have the competences needed to carry out the work without depending on others outside the team. (Schwaber 2004: 6; Schwaber & Sutherland 2016: 5.)

The Scrum masters responsibility is the Scrum **process**. He or she is the servant-leader of the Scrum team, a facilitator who’s authority “[...] is largely indirect; it springs mainly from the ScrumMaster’s knowledge of Scrum rules and practices and his or her work to ensure that they are followed.” (Schwaber 2004: 25). The Scrum master is responsible for understanding Scrum and how to apply it correctly in the given context. The Scrum master teaches Scrum to the people involved in the project and makes sure that Scrum is understood and enacted. The Scrum master also helps non-team members understand how they can interact with the team in such a way that their interaction is helping to maximize the value that the Scrum team creates. The Scrum master implements Scrum “[...] so that it fits within an organization’s culture and still delivers the expected benefits, [...]” (Schwaber 2004: 7). (Schwaber 2004: 7, 16, 25; Schwaber & Sutherland 2016: 6.)

“The Product Owner is responsible for maximizing the value of the product and the work of the Development Team. How this is done may vary widely across organizations, Scrum Teams, and individuals.” (Schwaber & Sutherland 2016: 5). A main responsibility of the product owner is the management of the product backlog. (Schwaber & Sutherland 2016: 5.)

The Scrum Guide instructs organizations to structure and empower their development teams so that they organize and manage their own work. This will then result in a

synergy that optimizes efficiency for the team (Schwaber & Sutherland 2016: 6). The development team ideally consists of 3-9 members. If the team is larger than this, coordination will be difficult and the team will generate too much complexity. If the team is smaller there is a decrease in interaction, and less productivity gains. A small team might also lack the needed skills within the team. A development team has the characteristics of being self-organizing and cross-functional. The team has a collective responsibility for the success of the project, meaning that the team as a whole is accountable for the success of each iteration and the project in its entirety. (Schwaber 2004: 7; Schwaber & Sutherland 2016: 6.)

3.1.2. Scrum events

When working with Scrum the work is carried out in so called **sprints**. A sprint is a time-box lasting for a month or less with the goal of creating a potentially releasable product increment. The sprint is the heart of Scrum and contains all the other events within Scrum. The Sprint starts with an event called a **sprint planning** and ends with two events called **sprint review** and **sprint retrospective**. During the sprint the Scrum team gathers on a daily basis for a 15-minute event called the **daily Scrum**. (Schwaber & Sutherland 2016.)

One characteristic all the events have in common is that they are time-boxed with a maximum duration. The events create regularity. They also create *continuous improvement and learning cycles*, although these terms (in italics) specifically are not used in The Scrum Guide (Schwaber & Sutherland 2016), instead the authors talk about inspection and adaption. (Schwaber & Sutherland 2016: 7-12.)

Other than the Sprint itself, [...], each event in Scrum is a formal opportunity to inspect and adapt something. These events are specifically designed to enable critical transparency and inspection. Failure to include any of these events results in reduced transparency and is a lost opportunity to inspect and adapt. (Schwaber & Sutherland 2016: 7)

Sprint planning

During the sprint planning meeting the members of the entire Scrum team jointly plan the work that will be performed during the sprint. The planning focuses on figuring out what can be done in the sprint and how this work can be achieved. The development team assesses what it can achieve during the upcoming sprint and chooses the number of items that will be worked on during the sprint. After this the entire Scrum team comes up with a sprint goal. *“The Sprint Goal is an objective that will be met within the Sprint through the implementation of the Product Backlog, and it provides guidance to the Development Team on why it is building the Increment.”* (Schwaber & Sutherland 2016: 9). The development team decides how the functionality will be built so that a “done” product increment is achieved during the sprint. All the planning will result in a **sprint backlog** which consists of the selected product backlog items and the plan for delivering them. At the end of the meeting the development team should have a good picture of what they will be working on during the upcoming sprint. (Schwaber & Sutherland 2016: 9-10.)

Daily Scrum

“The Daily Scrum is a 15-minute time-boxed event for the Development Team to synchronize activities and create a plan for the next 24 hours.” (Schwaber & Sutherland 2016: 11). It is basically a short daily meeting that allows the development team to gather regularly and talk. The meeting is held in the same place at the same time every day to keep things simple. During the meeting the development team members talk about what they did yesterday, and what they will do today as well as bring up any impediments that might affect the work. The meeting allows the inspection of how the team is progressing towards meeting the sprint goal and completing the work in the sprint backlog. The development team has the responsibility of conducting the Daily Scrum, but the Scrum Master is the one making sure that the development team holds

daily Scrum meetings. *“Daily Scrums improve communications, eliminate other meetings, identify impediments to development for removal, highlight and promote quick decision-making, and improve the Development Team’s level of knowledge. This is a key inspect and adapt meeting”* (Schwaber & Sutherland 2016: 11). (Schwaber & Sutherland 2016: 11.)

Sprint review

At the end of each sprint two events take place and the first one is the sprint review. The purpose of the sprint review is to inspect the newly created increment and to do adaptations to the product backlog if needed. The sprint review is attended by the Scrum team and key stakeholders who are invited by the product owner. Together they all collaborate on reviewing what was done during the sprint and thinking about what should be done next to optimize value. The meeting results in a revised product backlog where the probable items for the next sprint are defined. (Schwaber & Sutherland 2016: 11-12.)

At the review meeting the product owner talks about the current product backlog and what items have been “done” and which are yet to be “done”. The development team discusses the ups and downs of the sprint: what went well, which challenges they faced and how they solved the problems that they encountered. The development team demonstrates the work they have completed during the Sprint and answer related questions. Environmental factors such as marketplace or product usage changes are reviewed. Timeline, budget and capabilities are also reviewed. All attendants of the meeting participate in discussion and collaborate on figuring out what to do next. The sprint review provides input for the planning of the following sprint at the sprint planning meeting. (Schwaber & Sutherland 2016: 12.)

The total work remaining to reach a goal can be summarized at any point when working with Scrum. The product owner’s role includes tracking the progress of the project by at least once a sprint, at the sprint review, track the total work remaining and use this

information to assess how the project is progressing by comparing it to previous information on total work remaining. The information on a projects progress should be transparent so that all stakeholders can access it. (Schwaber & Sutherland 2016: 14.)

Sprint retrospective

The sprint retrospective is held after the sprint review and concludes the sprint. The sprint retrospective is followed by the sprint planning meeting of the next sprint. The sprint retrospective provides the Scrum team with an opportunity to inspect itself and plan improvements. During the meeting the Scrum team *“Inspect how the last Sprint went with regards to people, relationships, process, and tools [...]”* (Schwaber & Sutherland 2016: 12). The team looks at what went well and what should be improved and comes up with a plan for the implementation of improvements. Once the sprint retrospective meeting is over the Scrum team should know what can be improved and implement these improvements in the following sprint. (Schwaber & Sutherland 2016: 12-13.)

3.1.3. Scrum artifacts

This chapter presents the Scrum artifacts which are the product backlog, the sprint backlog and the increment. After this artifact transparency will be discussed including the definition of “done”, an important concept within Scrum. According to Schwaber & Sutherland (2016: 13) *“Artifacts defined by Scrum are specifically designed to maximize transparency of key information so that everybody has the same understanding of the artifact.”* (Schwaber & Sutherland 2016: 13-16.)

Product backlog

The product backlog which is managed by the product owner

[...] is an ordered list of everything that might be needed in the product and is the single source of requirements for any changes to be made to the product. [...] The Product Backlog lists all features, functions, requirements, enhancements, and fixes that constitute the changes to be made to the product in future releases. (Schwaber & Sutherland 2016: 13)

The product backlog is constantly changing and adapts to keep the product relevant and competitive in the constantly evolving market. When the product backlog is first developed it only consists of some initial requirements, but it will expand and change as long as the product exists. The product backlog refinement is an ongoing collaborative process involving the product owner and the development team. The items of the product backlog are reviewed and revised by adding details and estimates and ordering the items. Maximum 10% of the development team's capacity is usually consumed by product backlog refinement. The clarity of product backlog items usually increase with their order, so that the highest priority items are quite clear and ready to be selected for the work in the next sprint. (Schwaber & Sutherland 2016: 13-14.)

Sprint backlog

The sprint backlog is an artifact that belongs to the development team and is a part of their daily work routines throughout a sprint. The sprint backlog can only be changed by the development team, who can add and remove work from the sprint backlog as necessary. The sprint backlog is constantly modified throughout a sprint. The sprint backlog provides a visible real time picture of the work to be completed within the sprint in order to reach the sprint goal. As the development team completes work, the estimate of remaining work is updated in the sprint backlog. The total work remaining

should be tracked by the development team at least at every daily Scrum. This gives a real time picture of the project progress and helps the team manage its progress. (Schwaber & Sutherland 2016: 14-15.)

Increment

The increment is defined as follows “*The Increment is the sum of all the Product Backlog items completed during a Sprint and the value of the increments of all previous Sprints.*” (Schwaber & Sutherland 2016: 15). According to Schwaber and Sutherland (2016: 15) a new increment has to be in useable condition and meet the Scrum team’s definition of “done” at the end of a Sprint.

3.1.4. Artifact transparency

Artifact transparency is a crucial part of Scrum since the perceived state of the Scrum artifacts serve as a basis for decisions. The Scrum master plays a central role in ensuring transparency. He or she works together with the team members and other relevant parties to understand whether the artifacts are completely transparent as well as works to increase the transparency as necessary. (Schwaber & Sutherland 2016: 15.)

It is important that everyone in the Scrum team have “[...] *a shared understanding of what it means for work to be complete, [...]*” or in other words what “done” means (Schwaber & Sutherland 2016: 16). If an item in the product backlog or an increment is described as “done” the whole Scrum team must have the same understanding of what this means. (Schwaber & Sutherland 2016: 16.)

Every sprint the development team delivers an increment of product functionality that is useable and can be released immediately if the product owner chooses to release it. Using the definition of “done” the team can assess when the work on the increment is completed. (Schwaber & Sutherland 2016: 16.)

3.1.5. Additions to the framework

Schwaber and Sutherland (2016: 3) describe Scrum as a process framework within which various processes and techniques can be used. There are many tools which are common among practitioners that are not described in the latest version of *The Scrum Guide* (Schwaber & Sutherland 2016). For example the use of a visual board to show the sprints tasks is one tool that seems to be common. In the description of the pilot project in chapter seven an example of the use of a Kanban board to support the daily meetings can be found. Another common tool is the burndown chart which is described by Lacey (2016: 273) as an essential tool that can give clues about a projects progress. The burndown chart provides “[...] a graphical, real-time picture of what work is remaining in the sprint.” (Lacey 2016: 431). The chart is updated daily to show progress in the sprint and a steady slope is ideal (Lacey 2016: 273). Figure 5 below shows an example of an ideal burndown chart where the actual work remaining has been close to the desired trend throughout the sprint (Lacey 2016: 273).

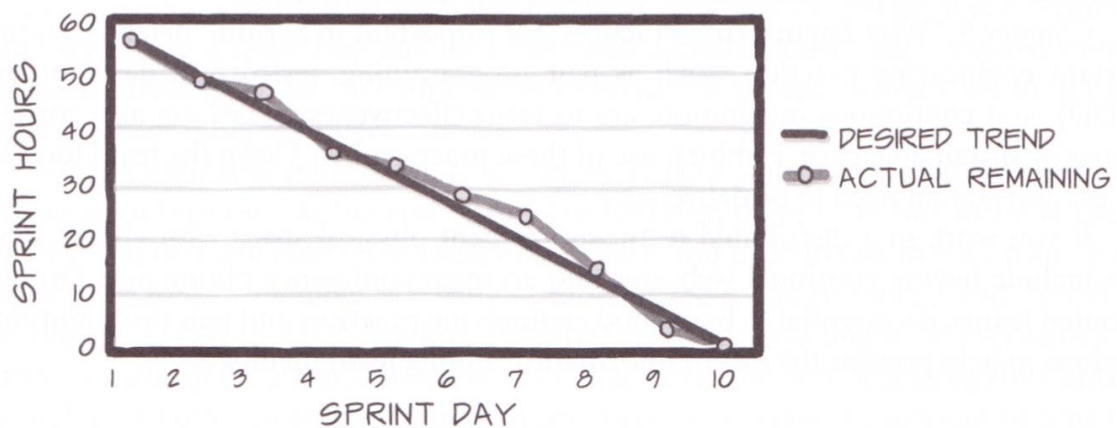


FIGURE 23-4 Example of an ideal burndown chart

Figure 5: Example of an ideal burndown chart (Lacey 2016: 273).

3.2. Critical considerations

According to The Scrum Guide (Schwaber & Sutherland 2016: 16) *“Scrum’s roles, artifacts, events, and rules are immutable and although implementing only parts of Scrum is possible, the result is not Scrum. Scrum exists only in its entirety and functions well as a container for other techniques, methodologies, and practices.”* Jansson (2015: 28) sees a paradox here since the agile principles encourage self-organizing teams to adjust and develop their ways of working to their environment. The principles seem to encourage the teams to think for themselves, reflect on what is best for them and then do adjustments that can improve the team’s efficiency (agilemanifesto.org 2001). Diebold and Dahlem (2014: 2) write that in reality there are few companies that apply Scrum as described in literature *“Most often they either omit specific parts of the original agile method, change them, or replace them with traditional aspects. The most prominent adaptation is the so-called “ScrumBut” method, which uses Scrum to some extent.”* (Diebold & Dahlem 2014: 2). Diebold and Dahlem (2014: 2) distinguish between agile methods (such as Scrum) and agile practices (such as small cross-functional teams) and according to the co-authors, most companies are in fact using a set of agile practices and not an agile method in its entirety.

3.3. Scrum in an EPC project

After extensive search for examples of applying APM in EPC projects, one case surfaced. Simon Orrell (2017) had successfully applied APM, specifically Scrum, in a large scale EPC project as well as three subsequent engineering procurement and construction management (EPCM) projects and documented his experiences in an experience paper he shared with the author of the present thesis. The large scale EPC project focused on building a natural gas processing plant in Canada. (Orrell 2017: 1-2.)

In this EPC project the Scrum framework was applied including scrum roles, events and artifacts. Work was performed iteratively. The project manager took the product owner role and in addition a Scrum Master role was established with the title *Team Facilitator*. In this new context the sprint review and the understanding of the product increment had to be reconsidered. The sprint review gave the team a picture of what had been actualized in the project schedule and which deliverables were completed. During the project the product increment took several forms. The product increment could for example be a 3D model of the plant that could be reviewed iteratively based on design documents and engineering. The model was also analyzed for constructability and changes in design or procurement were made as needed. Artifact transparency was ensured through a Kanban board and other visual tools. Mind maps helped in visualizing progress toward goals not related to the schedule. If someone could not be physically present in the situation room (daily meeting room) conference calling was used, and the person calling in looked at pictures of the Kanban board. (Orrell 2017 4-6.)

Orrell compares the software development industry and EPC(M) projects; in EPC projects the schedule and budget are the main reasons for correcting the course of a project, as opposed to functionality in a software development project. In EPC projects progress can be measured by looking at completed engineering and procurement deliverables and comparing these against the schedule to understand performance against schedule and budget goals. (Orrell 2017: 17.)

3.3.1. Benefits of Scrum in the EPC project

Several benefits were noted from applying APM, specifically Scrum, in the EPC-project. One benefit gained in this case was that the team regularly understood which project priorities needed to be prioritized over their respective discipline priorities. Another benefit was that progress could be seen on a daily basis based on empirical evidence of completed deliverables, rather than just believing the project was on track. Thirdly, problems could be surfaced on a daily basis which allowed for more time to address them. Yet another benefit was that by limiting work in progress (WIP), items were

continually completed, compared to having many things going on at the same time without any being completed. The team composition experienced changes due to the new ways of working making some team members uncomfortable. Orrell however emphasizes that this led to a team consisting of people with similar values who could agree on how to work together, and he thus saw this as a benefit. (Orrell 2017: 7.)

4. CASE DESCRIPTION

This chapter introduces the case organization. This presentation is followed by a description of the substation projects the case organization delivers. Next, the project team and relevant aspects of the project environment are described. This is followed by a general description of the work performed in the early phases of a substation project. The later phases such as construction and commissioning are not explained since the implementation of agile project management is aimed at the early stages of a project. Lastly, the motivation for implementing agile project management is presented.

4.1. ABB Power Grids, Grid Integration Finland

ABB is a global company with a long heritage of over 130 years. The company describes itself as follows “*ABB is a pioneering technology leader that works closely with utility, industry, transport and infrastructure customers [...] we are a leader in digitally connected and enabled industrial equipment and systems [...]*”(ABB 2016). ABB employs around 132 000 people in more than 100 countries and has its headquarters in Zürich Switzerland. The company was formed in 1988 when the Swedish company ASEA and Swiss company BBC merged. In Finland, ABB Oy:s roots go back to Strömberg, a company that was founded by Gottfrid Strömberg in Helsinki in the late 19th century. Strömberg Oy became a part of Swedish ASEA in 1986 and subsequently a part of ABB in 1988, when the company was formed. Today ABB consists of four global divisions: Electrification Products, Robotics and Motion, Industrial Automation, and Power Grids. These divisions again consist of specific business units that focus on particular industries and product categories. Grid Integration is a business unit within the Power Grids division. The case organization in this thesis is the unit Grid Integration in Finland, which offices are located in Strömberg Park, Vaasa. (ABB 2016.)

Grid Integration Finland delivers solutions for the electrical grid to the domestic market as well as abroad (ABB 2017). The business is project based and the projects focus on the delivery of substation solutions. An electrical substation can be described as follows: *“Electrical substations are an important part of the power grid. Their main tasks are to control, monitor, direct and protect the grid, as well as work as links between the different networks by transforming the voltage level from a higher to a lower or vice versa.”* (Nyberg 2014: 6). This thesis will not go further into the technical aspects of a substation, but the interested reader can easily find a lot of information online about the functionality and components of a substation. Instead, the focus of this thesis is the project environment and work processes within a substation project. In addition, other relevant knowledge that helps to understand the focus areas is of interest.

4.2. Substation projects

Substation projects can be classified as so called engineering procurement and construction projects. The content of a substation project delivery differs. The most comprehensive project type is the so called *turnkey project*.

In a turnkey project the substation is delivered to the customer in a ready to use state. This means that in a turnkey project the deliverer is responsible for all phases of the project from planning to handing over to the customer. This includes engineering, procurement, construction, installation, commissioning and documentation. Subcontractors are usually used in the projects and the vendor is also responsible for the subcontractors work. The turnkey project is the most comprehensive project delivery option, but there are also other less comprehensive substation project deliveries. (Peltola 2012: 38.)

The projects typically have elements that are very similar from project to project and although all projects are unique, there is comparatively more repetitiveness compared to many software development and new product development projects. This is a difference

which is important to recognize when approaching the topic of APM. This difference can also be an advantage in EPC projects, for example when estimating task lengths.

4.3. The project team and the project environment

In the early stage of a project a typical team consists of a project manager, a lead engineer, and a number of project engineers that do the electrical-, mechanical- and civil engineering. The department also has two controllers who follow all the projects and make sure they go according to plan and stay within budget. The whole purchasing organization takes responsibility for the successful procurement in a project and there is not a specific person assigned to the project (Peltola 2012: 40).

The projects are of varying sizes and the size of the project teams vary depending on the size of the project. The number of engineers in a project ranges from 2-4 engineers in small projects to approximately 7-12 engineers in large projects, which is an appropriate team size for APM use. Aside from the engineers in the Vaasa office, there are additional engineering resources available abroad in India and Estonia.

Characteristic for the project environment is that personnel work on several projects in parallel, a so called multi-project environment. The diverse locations of resources as well as the multi-project environment are the main challenges when considering implementing APM. Agile teams typically work closely together, and co-location as well as focusing on the same project would be the preferred conditions for an agile team.

4.4. The work of the project team –initial work stages in a project

The following text will explain relevant aspects of the engineering and procurement work at the early stages in a project since these are the phases of a project that the implementation of agile project management is considered for. The aim of this text is to provide the reader with a basic understanding of these stages in the project work in order to provide a base for understanding the analysis, results and discussion parts of this thesis. For a more comprehensive explanation of all the different stages throughout a substation project including the later stages in a project such as construction and commissioning, see Peltola (2012).

4.4.1. Engineering

After a tender is won, and the project is handed over from sales to the project team the engineering can start. The contents of a project including budget and schedule have been largely defined already in the sales phase and this is a major difference to the context of software development that agile project management methods were originally developed for.

The engineering of a substation consists of creating the relevant drawings and calculations required to successfully construct, commission, take into use and service a substation. After a sales order is won it is important that sales supplies engineering with enough information. This information can then form a basis for the design. (Peltola 2012: 41.)

Firstly, **principal engineering** is done. Once the needed principal drawings are finished they are sent to the customer for approval. When the principal design is approved (and possible corrections done) the detailed engineering can start. By doing corrections and approving the principal drawings, corrections to several drawings at a later stage can be prevented since the detailed engineering drawings are based on the principal drawings. A well done principal design is key to a technically and financially successful project,

since the largest and most important design decisions are made during the principal design phase. (Peltola 2012: 42.)

The **detailed engineering** is as the name indicates more detailed design than the principal engineering. During this phase for example the circuit diagrams are created as well as auxiliary systems, interlocking diagrams and planning of local power distribution. During this phase there is also information which is good to send to the customer for approval. Doing necessary corrections based on customer comments can prevent unnecessary work at a later stage. (Peltola 2012: 42.)

4.4.2. Procurement

Throughout the design phase engineering and purchasing work together. All the material cannot be ordered at the start of a project, but is ordered as the engineering progresses. Some of the main components however have very long delivery times. These components are also critical for the project schedule since they determine when installations can start. In many cases the plans and specifications for these critical components have to be prioritized and done as soon as the contract is signed. Since the schedules are often tight it is good to note the things that need to be done immediately at the the start of a project already in the sales phase. One forwarder is chosen for a project and this forwarding agent is responsible for all the transports of components in a project. (Peltola 2012: 42-43; Pasto 2009, thought Peltola 2012: 44.)

4.5. Motivation for implementing APM

The idea is to use APM to manage projects during their initial phases. The case organization was especially interested in the Scrum framework. One aspect of Scrum that initially was found appealing was the product backlog as it allows the team to see

all the tasks in the project and their priorities. This prioritized task list could for example contain required drawings as well as other tasks such as purchasing of certain materials that need to be bought at an early stage and the project manager's tasks in relation to the project. Another aspect of Scrum that was found appealing was the daily standup meeting. These daily meetings could improve the communication in the project team as well as between the project team and its stakeholders. Meeting daily would allow information to be shared often and problems to be shared with the team and solved quickly. The daily meetings would allow the team to get a daily status update of the progress in the project. The communication between the team members located in Vaasa and the engineers abroad in India and Estonia would also hopefully improve through the implementation of APM. This would however require the use of software instead of a physical board and a product backlog, as well as conference calling during the daily meetings. In short the case organizations motivations for implementing APM are:

1. Increased communication between members of the project team, as well as between the project team and relevant stakeholders.
2. Increased transparency and increased visibility of project tasks.

Additionally, based on the researcher's knowledge of the case as well as of APM theory, the following benefits can be expected:

1. Continuous *process improvement* through regular events with this aim.
2. Organizational learning and increased sharing of best practices and lessons learned. Utilization of these already during a project, as opposed to in future projects.
3. Better estimation of task lengths and work hours. This in turn would lead to better sales estimates, scheduling and resource management.
4. Problems are dealt with immediately as they surface. Individuals get the teams support in solving problems.

In addition to the ones listed above, other benefits with implementing the method might also be discovered. There will likely be challenges as well, but the important thing is that the benefits outweigh the challenges. The idea is that the changes should make the team member's work easier in the long run while at the same time delivering projects of high quality, on time and within budget. Naturally implementing APM is a big change to old ways of working and a change to the existing organizational culture. Changing an organizations culture is not easy and the changes can be met with resistance, which is good to acknowledge when implementing new ways of working.

5. METHODOLOGY

The present study is a case study of qualitative nature that in addition to the study of secondary data gathers primary data empirically through three semi-structured theme interviews (fin: teemahaastattelu) and observations in connection to these. This chapter presents the case study research strategy in general, followed by a presentation of the data collection methods used in the present case study. Considerations in relation to research quality are also discussed. After this the research process is explained in detail; starting with the collection of data and ending with a step by step explanation of the analysis of the interview data.

5.1. The case study

Bent Flyvbjerg writes that when studying human affairs, knowledge seems to always be context-dependent: *“Social science has not succeeded in producing general, context-independent theory and has thus in the final instance nothing else to offer than concrete, context-dependent knowledge. And the case study is especially well suited to produce this knowledge.”* (Flyvbjerg 2004: 8).

According to Alan Bryman *“The basic case study entails the detailed and intensive analysis of a single case [...]”* (Bryman 2012: 66). This short quote captures the essence of a case study. When it comes to the case study as a research design, Robert K. Yin’s writings are widely recognized (Jensen & Sandström 2016). According to Yin (2003: 13) a researcher *“[...] would use the case study method because you deliberately wanted to cover contextual conditions – believing that they might be highly pertinent to your phenomenon of study.”* Yin (2003: 13) also provides a technical definition of the case

study that is widely used to define case studies, the first part of this definition, defines the case study as follows:

“1. A case study is an empirical inquiry that

- investigates a contemporary phenomenon within its real-life context, especially when*
- the boundaries between phenomenon and context are not clearly evident.” (Yin, 2003: 13)*

According to Jensen and Sandström (2016: 103), Yin’s work on case study research strives for linear processes, but in reality there are always iterative moments in a research process. Based on their experiences with case study research Jensen and Sandström (2016) present alternatives to the widely recognized and well established case study practices that are based among others on the work of Yin (see for example Yin 2003). Jensen and Sandström (2016: 95) call their attempt *critical case study research* (swe: *kritisk fallstudieforskning*, author’s translation).

Following a standard as well as improving the use of certain research techniques has traditionally been linked to good case studies, but Jensen and Sandström see this approach to case study research as unfortunate since “[...] *it and the ones who practice it, risk to become rule obeying, instrumental, unreflective and close to trivial.*” (Jensen & Sandström 2016: 147, author’s translation from Swedish). Instead Jensen and Sandström emphasize case study research as “[...] *a research strategy that span across the entire research process, where intuition, curiosity, extensive reading, and bravery are more important than an instrumental attitude and following standardized procedures.*” (Jensen & Sandström 2016: 147, author’s translation from Swedish).

According to Jensen and Sandström (2016: 97) one should not force the case study to be too orderly from the start. Case studies can be chaotic and unsystematic. Even when making detailed plans the researcher is likely to find that the study does not follow a linear path and instead is chaotic in nature. It is hard to match the plan with reality, and one should be cautious not to bend the reality to match the plan. According to Jensen

and Sandström (2016: 104), a research process cannot be forced into a linear model with clear steps to follow. (Jensen & Sandström 2016: 97-104.)

Continuously reading academic material during the research process will generate new ideas and open up new paths. Jensen and Sandström (2016: 133) are convinced that theory has and shall have an active role in case study research throughout the research process, and in the later stages of the process one should be cautious so the reading is not verifying but challenging and multifaceted. (Jensen & Sandström 2016: 103, 133.)

Based on the experiences from the present study the author shares the views of Jensen and Sandström (2016) presented above. The present study explores a new research area and there is not a lot of information available regarding APM in non-software projects. This in turn has made the research process difficult plan from the start. The research has continuously shifted direction as more has been learned and new key sources found. The researcher has accepted this chaotic nature of the present study. The researcher has continuously studied theory throughout the research process and allowed this theory as well as the empirical data to guide the research in new directions.

5.2. Methods of data collection

This sub-chapter presents the methods used for data collection in this study. These are the semi-structured theme interview (fin: *teemahaastattlu*) and observations in connection to these interviews.

5.2.1. The theme interview

The chosen interview method is the *theme interview* (fin: *teemahaastattelu*, author's translation). The theme interview is a type of semi-structured interview that was

developed and named by Sirkka Hirsjärvi and Helena Hurme. These co-authors developed this interview method based on among other things Merton, Fiske and Kendall's (1956) book *The Focused Interview*. The Finnish term for the method is *teemahaastattelu*. This term can't be found in any other language so for the purposes of this thesis the author has taken the liberty of translating the name of this method to *theme interview*. (Hirsjärvi and Hurme 2001: 47-48.)

Hirsjärvi and Hurme (1982: 128) describe the theme interview as a method "softer than usual" that captures the multifaceted nature of reality. Instead of asking detailed questions the theme interview, as the name indicates, revolves around certain themes that guide the interview. The interview guide consists of a list of themes. During the interview questions that relate to the selected themes are then formed spontaneously. The list of themes and their sub categories functions as a support for the interviewer's memory and guides the conversation. This gives the interviewer some liberties while providing room for the interviewee's voice to be heard. The theme interview is not an unstructured interview, since a structure consisting of certain themes is used to guide the interview. It is classified as a semi-structured interview, but differs from most other semi-structured interviews since no questions are formulated prior to the interview. In most other semi-structured interviews the questions and sometimes even their exact wording are defined prior to the interview. (Hirsjärvi & Hurme 1982: 128, 2001: 48, 66-67.)

To ensure the quality of interviews it is advisable to prepare a good interview guide. Also, it is good to prepare for the interviews by reflecting on how to achieve in depth conversations about the themes and to think about different types of additional questions to ask in order to achieve this. (Hirsjärvi & Hurme 2001: 184.)

The theme interview was chosen as the interview method since it was of interest to have the interviewees freely describe their experiences with agile project management, while simultaneously having enough structure to ensure being able to answer the research questions based on the interview material.

5.2.2. Observation

The researcher has had the opportunity to do observations by (1) being present at the company's office during the whole research process (2) visiting the interviewee's premises during one of the interviews and taking part in two of their daily meetings (3) during another interview seeing an online demonstration of the use of a software tool that supports APM. These observations have not been planned or systematic. Observation as a research method has not been studied and planned as a part of this study. But it is good for the reader to be aware that the researcher has had these opportunities to do observations and that these observations also contribute to the study.

5.3. Research quality

Traditionally reliability and validity have been used as criteria for determining the quality of research. These research criteria that have their roots in the quantitative research tradition are often questioned as measures of quality in qualitative studies. Therefore different researchers, there among Lincoln & Guba (1985), have proposed different alternative criteria for evaluating qualitative research. (Bryman & Bell 2011: 394-401.)

According to Bryman and Bell (2011: 401) common techniques today for ensuring the quality of qualitative research are thick description, triangulation and respondent validation. These three techniques, among several others, have their origin in Lincoln and Guba's alternative criteria for evaluating qualitative research (see for example Lincoln and Guba 1985; Guba and Lincoln 1994). Based on several authors, there among Lincoln and Guba (1985, 1994) and Yardley (2000), the co-authors Bryman and Bell (2011: 394-401) discuss alternative research criteria for evaluating the quality of qualitative research. Based on what has been learned from reading this discussion some

considerations that could improve the quality of the present study are presented next and constitute the rest of this sub-chapter.

The researcher has committed to the research topic and engaged herself in the research, devoting time to understanding the different theories and the contexts it relates to, as well as studied the context of the case carefully. The researcher has also aimed for making an academic contribution within a new research area while simultaneously providing results that are of significance for the practitioners in the studied organization.

Good practices such as rigorous analysis of the interview material have been followed. By comparing the interview results to theoretical material as well as observations during the interviews (triangulation) the credibility of findings could be enhanced. Respondent validation would further enhance the credibility of the interview findings, however since the interviewees are quite busy and the material is extensive the researcher has decided not to ask the interviewees to go through the interview results.

The study has been presented in detail to make it easier for other researchers to judge the transferability of findings to other contexts. The researcher has also tried to be objective and strived to not allow her own values, opinions and theoretical preferences to influence the findings. Complete objectivity is impossible in this type of qualitative study, but it is important that the researcher is aware of her influence on the findings and strives for objectivity.

By describing the study, its methodological choices and especially by describing the research process in detail, it is possible for other researchers to make judgements of the quality of the study as well as about the transferability and generalizability of findings. One should however be cautious with generalizing from single case studies.

5.4. Description of the research process

After initial discussions with the case organization, and deciding on the research topic according to their needs, the research process officially started on 20 September 2016. During the whole research process the researcher has had the opportunity to be present in and work from the case company's office.

5.4.1. Initial stages

The researcher was new both to the case organization and the research topic of agile project management, including the Scrum framework. Because of this the initial stages of the research process focused on getting a good understanding of (1) the case organization and (2) agile project management theory. The researcher learned about these two things in parallel and always tried to think about how the theory on APM read could be related to the case organization.

Familiarizing oneself with the case organization has been important in order to determining the suitability of agile methods for the case organization and consequently been important for answering the research questions. The researcher needed to understand the case organizations operations and organizational culture. In addition to understanding the organization the researcher also took a problem oriented approach and tried to understand what challenges the organization was facing and which of these could be addressed with the use of APM. The researcher familiarized herself with the organization through (1) the study of internal documents (2) participation in other development work at the company (3) conversations with company employees in different position and (4) observations through presence in the company office.

During the initial stages of the research process the other main focus has been learning about APM and particularly the Scrum framework. This learning process was done mainly through the study of secondary data in the form of academic and non-academic

literature. As requested by the case company an emphasis was also placed on finding cases of APM use in contexts similar to the case organizations context.

5.4.2. Empirical data collection

Once a good understanding of the case organization as well as relevant APM-theories was achieved, the empirical part of the research could be planned. The thesis advisor at the case company helped with finding and contacting suitable interviewees within ABB. Three interviews were agreed on and the researcher was in contact with the interviewees and scheduled interviews. The interviewees were selected because they all were actively working with the Scrum framework and had been part of implementing it in their organizations. The advantage with interviewing people within the company, but in different departments, was that they had some basic understanding of what the case organization worked with and they understood the company as a whole. Also since the interviews could be carried out between people that all worked for the same organization, conversation could be more free and relaxed without having to worry about confidentiality. Information about the interviews is summarized in table 1 on the next page. The respondents and their respective departments are kept anonymous.

Table 1: Information about the three interviews

	Interview A	Interview B	Interview C
Date	13.2.2017	15.2.2017	23.2.2017
Duration	1h 25 min	1h 33 min	1h 18 min
Type of interview	Skype for business	In person	Skype for business
Recording	Interview recorded with permission	Interview recorded with permission	Interview recorded with permission
Language of interview	Finnish	Finnish	Swedish
Number of interviewees	1	2	2
Work titles of interviewees	Design Manager	B1: Project Manager	C1: Software Program Manager/Software Team Manager
		B2: Project Manager	C2: Manager
Type of teams managed	Software and	Software teams	Software teams
	hardware teams		
Location of interviewees	Finland	Finland	India
Additional comments			Interviewees originally from Sweden, and have previously worked there.

The interviews were all semi-structured *theme interviews*. The interview guide consisted of four main themes that were the same during all interviews. The four themes were:

1. Context
2. Use of APM in the context
3. APM in contexts outside software development
4. Use of APM at the case company ABB Grid Integration Finland

Themes one and two strived to understand the interviewees' context(s) and how APM was used in these contexts. Themes three and four focused on APM in other contexts (with the exception that one interviewee also was working with Scrum in hardware).

In the interview guide these four main themes were complemented with different sub-themes and key words that supported the researcher's memory and also made the topics discussed at the interviews more uniform, without restricting the conversation to the answering of certain pre-formulated questions. The interview guide for interviews one and two were the same, before interview three the guide was edited a little bit to make the guide clearer and faster to use. But after this editing the main themes stayed the same, as well as the majority of the contents.

In addition to the researcher the thesis advisor from the company's side was present at the interviews. The interviews were carried out by the researcher and occasionally the thesis advisor also asked questions that were of interest to the case organization with the possible implementation of APM in mind. Being present at all three interviews allowed the thesis advisor to get a good understanding of APM in an efficient way.

In connection to two of the interviews observations were also carried out. Interview B was carried out at the interviewees office and prior to starting the interview the researcher and thesis advisor had the opportunity to take part in and observe two daily meetings. These teams were distributed to different locations and were using conference calling during the meetings. They used a software tool instead of a physical Scrum board. In interview C the respondents were using the same software tool as was observed at the meetings in interview B. Interview C was done using Skype for business and the interviewees demonstrated the use of this software tool though sharing their computer screen.

5.4.3. Analysis of interview data

The interview recordings were first transcribed using Express Scribe transcription software. This made the transcription easier through shortcuts on the keyboard and the possibility to vary the speed of the recording as desired. Slowing down the recording allowed the researcher to understand bits of the recording that were unclear at normal speed. All recordings were good, however the recording of interview C were the

respondents were located in India was not as good as the other recordings and presented some challenges. The researcher was however satisfied with all the recordings and transcriptions.

The three interviews were conducted in the interviewees mother tongues (two in Finnish and one in Swedish) in order to allow the interviewees to best express themselves. The interviewees however used English words for many of the APM and Scrum related terms. The researcher is bi-lingual with both Finnish and Swedish as her mother tongues and thus the interview languages were not a problem to the researcher. During the analysis the language gradually shifted from the interview languages to English in order to be able to write the interview results chapter of this thesis in English. The fact that the interviews were conducted in different languages than the writing of the present thesis can possibly have some effect on the accuracy of interview results through losses in translation. Especially language and culture specific expressions were difficult to translate.

The aim of the analysis was to find out what themes the transcriptions contained. The researcher did this by following her intuition and developing her own analysis tools as described next.

The interviews generated a large material and the researcher therefore first needed to find a way to get an overview of the contents of the material. The first step of the analysis therefore consisted of reading through the transcriptions and writing down all the topics found as short sentences/bullet points in a notebook. The bullet points were color-coded according to the original four themes of the interview guide; this was quick and was done in case this would prove useful later in the analysis process. The page numbers where the different topics appeared in the transcriptions were noted in a separate column next to the bullet points, so that the topics easily could be found in the transcriptions when needed. The bullet points were written in the same language as the transcriptions were made, that is Finnish for the first two interviews and Swedish for the second interview. In total this part of the analysis produced 31 pages of bullet points.

The second phase of the analysis focused on finding out what themes the material contained. The bullet points were read through, and all themes identified were written

on a large paper in random order (see figure 6 below). Once all themes in the material were identified the bullet points were read through once again to find out on what pages in the transcriptions these themes could be found on. Each interview received its own color and letter to make this part of the analysis more clear. Figure 6 below illustrates this part of the analysis. For example (see circled part in Figure 6 below) the theme “Location of teams” was found on pages 9-10 in interview A, page 8 in interview B and page 12 in interview C. This was then marked with a blue A9-10, a pink B8 and a green C12.

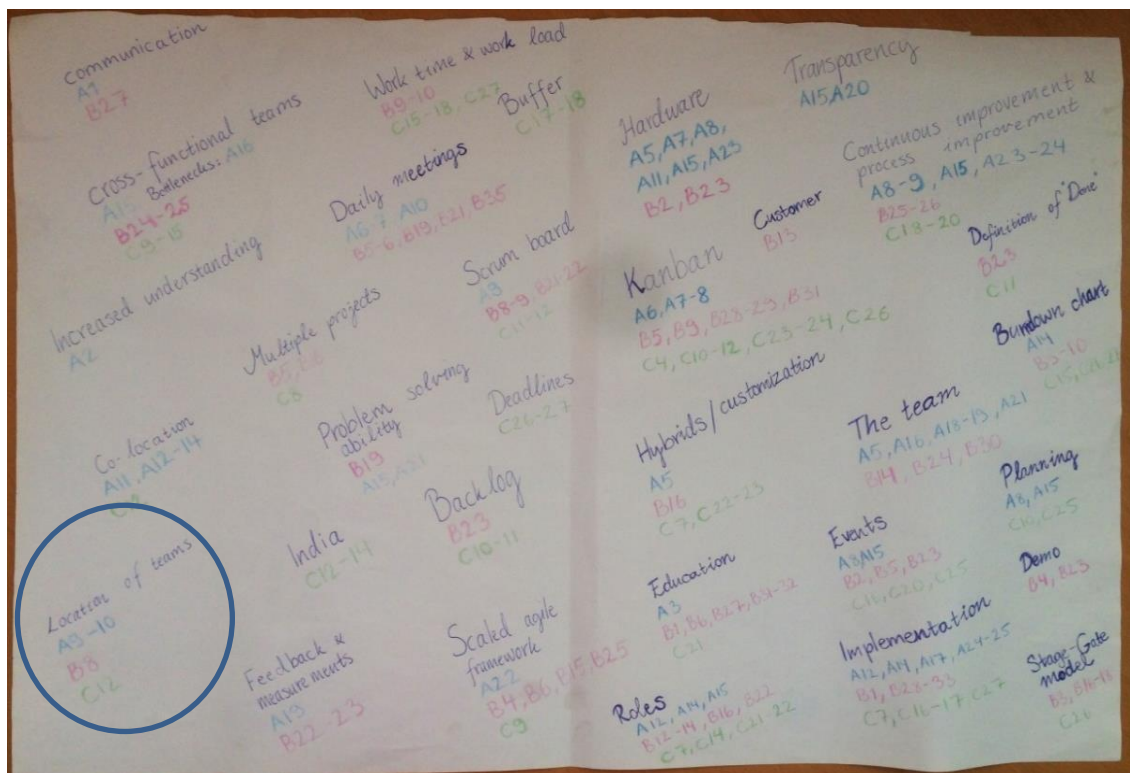


Figure 6: Tool for analyzing the interviews

When all themes were identified and it was clear where in the transcriptions these could be found the analysis moved on to the next step. The themes needed to be grouped in order to make writing about them easier. First all themes were listed in a long list of 32

themes. These themes were then grouped into six groups of similar themes. Figure 7 below illustrates this.

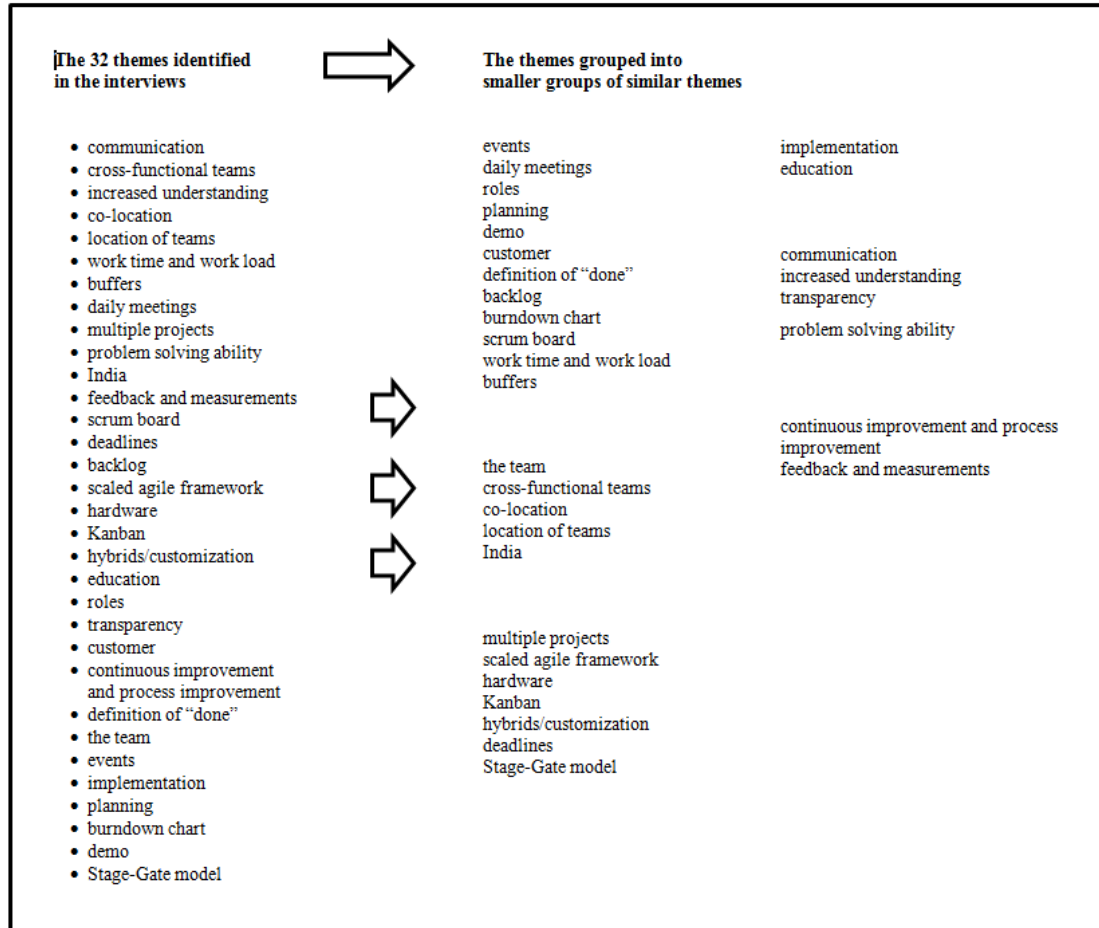


Figure 7: Themes identified in the interviews

The chapter presenting the results from the interviews was written with these groups of themes as a starting point, but the chapter also evolved further during the writing and editing process. When writing the interview results chapter, the analysis tool in figure 6 on the previous page was used to find the pages in the respective interviews where these themes were talked about. The following chapter presents the results from the interviews.

6. RESULTS FROM THE INTERVIEWS

This chapter presents the results from the interviews. The results from the three interviews were merged together to further enhance the anonymity of the respondents. Since many different themes were identified in the analysis of the interview material this chapter also presents a wide range of topics.

6.1. The team and the project environment

General about the team

In one of the interviews the importance of the team is emphasized throughout the interview. One should build knowledgeable and skilled teams that have decision making power and are constantly improving. Things should be built around the team and not around project managers or management.

The same interviewee states that in APM and Scrum the team is “quite holy”. Teams should not be broken, they should remain stable. An employee should not change teams according to his tasks. Instead a team should accept varying tasks, which the team then agrees on how to distribute within the team. When teams are stable the team members learn to work together and people learn each other’s knowledge areas and behavior. According to this interviewee it takes three to six months before a team is efficient.

It is important that the team gets to choose which tasks they are working on and who is doing what. This should be chosen by the team and not by a project manager or superior. When the team chooses which tasks to work on the team also claims responsibility for its work. It is important that people outside the team do not know who is working on what inside the team, since this would break the collective responsibility. The team shall

together report what has been achieved and receive feedback as a team. So if one individual is struggling with a task the others in the team know that they have to help him, or otherwise the whole team will get bad feedback. This way of working enhances team spirit.

In another interview it is similarly told that it is important to understand that the team has collective responsibility and one individual is not responsible for anything alone. There are personal tasks, but all planning is done together by the team. It is important that the need to be agile comes from the team, if management declares “now we shall be agile” but the team feels no need for it and doesn’t want to be agile, then it is never going to work, the interviewee states. It is asked what should be done if the team environment is conservative and some inspiration might be needed to spark interest in APM. They recommend finding a person who is genuinely inspired by APM and who can inspire the other employees.

Multiple projects

We are told by one interviewee that in their environment one team receives work from multiple projects. For them it is not important who the work is done for, they prioritize their backlog and work according to it no matter who has said that they need something done. According to one interviewee a team could be working on several projects that are in different phases. In another interview it is learned that people sometimes do work for two teams. In these situations they have agreed that you only take part in the daily meetings and other events of one team, the one for which you do more work.

Knowledge within the teams

There can be several persons in a team with the same area of expertise. When two persons have the same area of expertise they can swap tasks, as well as check each other's work.

Having a person in the team that can do several types of work can help the team a lot. This can help eliminate bottlenecks and make the project progress faster. In a project there is rarely the exact same amount of work of different types.

In one hardware team some challenges have been experienced since there are divisions within the team according to areas of expertise. There is no exchange of tasks between the team members with different specialization and there is not enough conversation going on. Because of this, the team is not taking collective responsibility for all tasks in the project. Despite this, people in the project team have however reported that they now understand better what is being done in a project beyond their own tasks.

In another interview it is told that currently the different teams focus on certain knowledge areas. They strive to have teams that have a skillset as broad as possible, so that in the future, either team could work on anything. The ideal situation would be that no matter which task is in the backlog, they would be able to give it to either team.

From the same interview it is also learned that individual knowledge should ideally be "T-formed" so that you have something you are really good at but also have a broad knowledge base. They try to encourage people to learn from each other; do pair programming and collaboration in order to learn from each other and get better at each other's work. But there are challenges to this such as time constraints and unwillingness to share information, the reason for the latter challenge is perhaps that people want to feel important by solely having expertise in some area.

In one interview it was learned that during the sprints they try not to assign tasks in advance. Of course some tasks are more suitable for some individuals than others, and often a certain individual takes a certain task because it suits him or her best. But they

try to keep it open, so that the person who has time takes the next tasks as long as they feel it is something they could do.

In one development team a tester was continuously visiting the development team in order to see how to test things. He then took that knowledge with him to his own team (that did not work with Scrum but with Kanban) that developed tests in parallel with the development team. It is added that resources that are there to synchronize do not have to be in the Scrum team full time.

Location of teams

According to one interviewee Scrum theory says that the team members should be located together and have all the capacity needed to finish a task.

One of the teams managed has part of its members in Finland and part of its members in the USA. The time difference makes holding meetings together too difficult, but an attempt at something similar to Scrum is still seen as better than team members not being together at all. This team shares a worklist and a common work rhythm.

An interviewee describes that their design is located in Finland and the testing abroad in Asia and Europe. Through using Scrum he has come to the conclusion that this is not efficient and they are now working towards having design and its testing in the same location. They have already made changes in the organization to achieve this. He says this is important since communication is a huge part of the work and therefore shall work well.

The same interviewee says that it would be a good idea to sit in a common project team room, however there is quite a small space per person in such a room he thinks. They now have a traditional seating order and the designers have said that they would not be enthusiastic about such new arrangements.

In another interview it was discussed whether it would be possible to have the case organization's engineers in India join the agile project teams in Finland. It was told that another interviewee had been strongly of the opinion that the Scrum team members should all be in one location. It was asked if they were of the same opinion. According to one of the interviewees it is not necessary; he had previously experienced working in a team with developers in two locations within the same country. Some were located in his location and some in another city and these team members joined them through telephone every morning.

Working in India or together with team members in India

Since the case organization of this thesis also has resources in India and the interviewees in one interview currently are located in India, it was decided to talk about cultural differences between India and the Nordic countries. The topic of APM use in India or in distributed teams with members both from the Nordic countries and from India, were also discussed.

They say that the cultural differences between the Nordic countries and India are extremely large. When working with Indian employees certain extra controls might have to be added as extra tasks in order to make sure that all work steps are completed. So if Nordic and Indian employees are working in the same team this might be one thing to consider and could perhaps present a challenge.

In India the work place culture is very hierarchical and the responsibilities are divided differently compared to the Nordic countries. The researcher asks if it is difficult for the Indian employees to work with a system such as Scrum that removes hierarchies. One of them answers that in his experience applying Scrum in India has worked well, but he adds that it could be because he is from Sweden and behaves differently than a typical Indian manager. He also says that Scrum is a typical model and according to his observations, Indian employees are better at following a model than Swedes.

In general they think Scrum makes collaboration easier and working with Scrum in India is working quite well.

6.2. The Scrum framework and beyond

The Scrum master

The Scrum master is a servant leader to the team, not a manager. The Scrum master should be someone who the team has approved. It is not advisable to assign someone to the role. Instead the matter could be discussed in the team to see who steps up to the role. In one team they selected the Scrum master through voting.

What should a Scrum master be like? It is said that a suitable personality is important and that it may not suit everyone to be a Scrum master. The Scrum master should be able to get the team engaged. He or she should get along well with both customers and members of the team. The Scrum master should be good at spreading information. Having a good intuition of things and knowing how to steer the project in the right direction is also important. A Scrum master cannot be passive; he or she should be one step ahead and direct the project when needed. The Scrum master is supposed to coach the team and help the team solve problems. However, sometimes the Scrum master has to put on “the management hat” and help in making decisions, getting things to progress and getting things finalized. A project manager could possibly be good for the Scrum master role but this role is more about the daily work and not only about planning.

In one team the idea was that the Scrum master would be an interface between the customers and the developers. This way the developers would get a better chance to concentrate on their tasks. In another interview it is similarly said that the existence of a Scrum master can help the team focus on what is important.

In one interview it is told that one of their scrum masters liked his role so much that he asked if he could work full time as a Scrum master. He has been leading three teams ever since. This was mentioned at a later interview and one interviewee comments that it sounds like a lot. He is Scrum master for two teams and that already feels a bit too much. His colleague adds that it is usually not advisable. Instead one should be Scrum master for only one or maximum two teams.

The product owner

It is emphasized that the product owner should have an understanding of the technical aspects of projects, but also understand the business side of things. It is advised that if one of the case organization's project managers is made product owner this must be a project manager with some technical knowledge. A more business oriented project manager is not a suitable product owner since the product owner must be able to have deep discussions with the team about the technical aspects of the project. The interviewee however adds that this can of course depend on the environment, and perhaps the case organizations projects are a bit different than theirs.

In one of the interviews there are both teams with and without a product owner. In the team where there is no specific person assigned to the product owner role, a part of the team and the Scrum master as well as some others work with the backlog. The Scrum master of such a team says that it would be preferable if the product owner role was centralized to one person who would have an overview of the backlog and what should be prioritized and done next. The product owner should keep an eye at the backlog and raise the priority of items if needed, so that the team is always working on the highest priority items.

An interviewee talks about how in their case a product manager would have been a good choice for the product owner role, but he did not want the role since it meant more work for him. Instead they chose an architect for the role. However an architect does not necessarily understand the business side, but can of course discuss this with the product

manager. In another interviewee's case they did select the product manager to become product owner, but after the first sprint they realized it wasn't working. The reason was that the product manager was not allowed to use enough time for this role. The interviewee estimates that a product owner role for a team of seven should take up 60% of an employee's work capacity. Another example from this case was that senior developers that were of managerial material became product owners. On the hardware side, lead engineers were made project owners. Later they have gotten requests from these lead engineers saying that they would like to be more involved in the design instead of determining requirements.

Events

An interviewee lists how they use all the Scrum events; they have sprint planning, sprint review, sprint retrospective, daily meetings and a weekly backlog refinement meeting. When comparing the interviews it can be noted that the sprint length varies depending on the team, and there are different motivations behind the chosen sprint length. One interviewee's team has a three week sprint which ends with a retrospective and review on a Friday, and the following Monday they plan the next three weeks. Another interviewee says they do one month long sprints; they tried both two and three weeks but then decided on one month long sprints because they thought that the plannings, retrospectives and reviews were too frequent. In contrast, in another interview the respondent says that one surprise when they started using Scrum was that the shorter the sprints, the easier it was. He thinks it is because shorter sprints are easier to plan. The shorter a period to be planned is the easier it is to plan, fewer mistakes are made and you need less information to base the planning on. The longer into the future you plan the harder it gets. In Scrum, the aim is to plan the near future accurately.

One interviewee talks about the sprint planning meeting. For planning they have reserved two and a half hours, but lately they have not used that much time. The reason is that the team has been good at doing preparations prior to the sprint planning. The majority of the work is already pre-planned when the planning meeting starts. At the

meetings they go through things that are unclear. They also look at capacity. If they notice that someone has too much or too little work they try to even out the workloads.

The topic of long term planning is also addressed. In one interviewees' opinion Scrum perhaps doesn't help with detailed long term planning. He continues by saying that in Scrum, a little bit is finalized at a time and the plan is adjusted quite often. In another interview the interviewee explains that he plans one sprint ahead. And a week before the next sprint he starts planning/doing preparations for planning the next sprint. He says that Scrum is really good for ongoing activities.

One respondent says that it is important that when something is finalized it is shown to someone that can give feedback and help you improve the functionality that you have. It is said that continuous feedback is important in the Scrum model. It is told that in the review meeting they strive to demonstrate what they have achieved during the sprint. If there is nothing that can clearly be visualized and demonstrated they at least go through the work achieved to see if it is finalized to their satisfaction, or if the work needs to continue in the next sprint.

At the retrospective one discusses what was good and what could be improved. Retrospectives are good for improving the process, for example if there is discontent with the current ways of working this can be brought up at the retrospective. The retrospective meeting is a good way to find out the team members opinions. Also, if the sprint goal is not reached there might be reasons behind this that the team members are aware of and can bring up at the meeting. This can then be accounted for when planning the next sprint, in order not to repeat the same mistakes. At the end of the retrospective it is decided what improvement efforts should be focused on in the next sprint. The team strives to improve something every sprint. It is said that one aspect of Scrum is that retrospectives are held in order to correct things that have not gone well in earlier sprints.

When starting to use daily meetings, many make the mistake that they start solving problems at the meetings and the meetings then last longer than intended. As a consequence people then become irritated with the new system of daily meetings since they think there are too many meetings. When implementing daily meetings it is

important to make sure they do not last long, in a daily meeting you should only mention what you did yesterday, what you are going to do today and if there are any problems. If problems surface, then the ones who are involved in solving them stay after the meeting and discuss the problems. This way of working eliminates separate problem solving meetings.

Daily meetings create an appropriate amount of social pressure, when you have to meet with the team each day to tell what you have been doing, it is harder be doing other things than working on the project.

Product backlog

The backlogs importance is emphasized in the interviews, a good and updated backlog is important for the team to work efficiently. A central thing in Scrum is having the right things in the sprint backlog and keeping it up to date. The work in the backlog has to be well understood. Also, the work has to be split into small enough tasks and the definitions of “done” also have to be included. If there are unclear items in the backlog it will make the team stand still. If the backlog is managed well, it is easy for the team to know what needs to be done.

An interviewee has heard people say that backlog refinement should be done once a day and they follow this practice. He has put a reminder in the calendar for the team members before every meeting in order to remind them to do updates. They use an electronic board and backlog and in the best case the updates have been made by team members before they come to the daily meetings.

Definition of “done”

The criterion for approving the work need to be clear otherwise there will be problems, arguments and challenges with determining when something is ready. Acceptance criteria are marked on the task notes one interviewee explains. It is important that the information on the task notes such as the task description and the acceptance criteria are updated in order to be able to determine when a task is completed.

Scrum board

One interviewee recommends using a physical board such as a paper or whiteboard. He says the white board is the best option for a Scrum board. He thinks physical boards are easy for everyone to update at the meeting, even simultaneously, in comparison to an electronic board (software) that one person has to update during the meetings. However, when teams are distributed in different locations a physical board has not worked for them and an electronic board is required.

In contrast, in another interview all teams use electronic tools. They have team members in different locations. One interviewee says that he likes the electronic visualization systems. His colleague adds that the visualization that allows one to see the work is one of the most important things in Scrum. He says that the work that is important at a moment should be focused on and visualized well to see the progress on this work. It is mentioned that it is considered to maybe include resources abroad in the daily meetings. The interviewee says that in that case, one should not use a physical board, but an electronic one.

Similarly, in the third interview electronic Scrum boards are used by all the teams and they think it works well. The thing that sets them apart is that they use two separate boards: a Kanban board for long term activities and another board for the iterations. They say that the software tool they use supports jumping between these boards well.

The burn down chart

All of the interviewees' teams have a software tool that automatically generates the burn down chart based on the data provided by the team members. One interviewee says that this chart is not used that much in some of their teams and this is one area they could still improve on. In another interview it is learned that the burndown chart is actively used and that it is important to look at the burndown chart to see if results can be achieved. He continues by explaining that from this chart you can see at an early stage if things start to go off track and something needs to be done. In a third interview, a respondent highlights that the accuracy of the chart depends on how well the team has estimated tasks.

6.3. Duration of work

An interviewee points out that the estimation of task lengths is very individual. With time one learns to better estimate, but sometimes the estimates can be way off. When working with development unpredictable things sometimes happen. Estimation is discussed from the case organizations perspective. It is explained that the case organizations projects are more similar to each other and this might make estimations easier compared to software development. One interviewee answers that it might be the case, but many things can happen anyway that cannot be predicted. The researcher thinks about this and agrees that there are many things apart from the tasks themselves that are hard to predict. Changes can occur no matter what the project's contents are.

In one interview buffers are talked about. One cannot plan work for 100% of the capacity since that is an unrealistic tempo. Buffers are included when planning since there are always unplanned occurrences such as meetings, sick-leaves, technical

problems and so on. In one team planning is done so that they first reserve a certain number of hours for support every sprint (since there is support every month that they don't know about in advance). Next, they take into account all the meetings and other things that they know will happen or think will happen. After that, they add an additional buffer.

An interviewee explains that they have to register the task hours in the agile project management software tool they use. There, their team members have to update how much work is left on each task and how much time has been used on them.

In another interview they talk about how this software program shows them how much work the different team members have, and this allows the Scrum master to see if someone has too much work, which then needs to be reallocated.

In one case a team produces things for other projects in the company. Sometimes they have deadlines for finalizing the work for these projects. If many deadlines collide it is the management's responsibility to make decisions about what the team should focus on, and this is then followed by the Scrum team. These situations however seldom occur and things normally work quite well, says the interviewee. The team itself works by prioritizing things in the backlog. The burndown chart is also a useful tool.

6.4. Benefits

The following sub-chapter consists of parts in the interviews that the researcher has interpreted as benefits gained from using agile project management. These identified benefits are (1) increased communication, (2) increased transparency and visibility, and (3) better problem solving ability. These were the benefits found by the researcher. More conversation on this topic would be needed to verify if these have been perceived as the main benefits of the agile methods by the interviewees. Also, other benefits might

exist that did not come up during the interviews and/or have not been spotted by the researcher during the analysis of the interview transcriptions.

Increased communication

One interviewee says that communication has improved in all teams when they have implemented Scrum. In another interview, it is similarly said that there is more communication now that they are working with Scrum. But of course this depends a lot on the person, it is added. However, it is unsure if the personal communication outside the meetings has increased. At the regular meetings again everyone has to say something at least once a day. Earlier, before implementing Scrum, there could be long periods where a person did not talk to anyone about his work, and just did his work and didn't present it until it was finished.

Transparency and visibility

One interviewee says that it is clear that with Scrum the visibility and ability to follow what the team is doing is at a whole other level. The transparency to others outside the team is close to perfect, people only work on tasks that are on the task list, and these are in a prioritized order. When stakeholders see what tasks are on the task list and what priority their task has in relation to other tasks, they become more patient with waiting for their task to be finished. This again builds better relations between the team and their "internal customers" (between the software team and product managers). With the opportunity to bring forth problems in daily meetings, the transparency has increased a lot.

Problem solving ability

Problems surface quite quickly, allowing them to be solved faster. The problems are often identified by the team. It has been a relief for the project team members to not have to feel alone with a problem. When a problem is brought to the team's knowledge during the daily meetings, others can immediately help with the problem. If there is not a particular person to help with the problem the team can together think about solutions and how to move forward.

A hardware team has confirmed that the reacting to all problems has become much faster. In software again an interviewee talks about the importance of regularly updating the software. When there are many people and teams doing changes to the same software, it is important that they update changes daily. Then, if a change is in conflict with another change it can be spotted as soon as possible. If a problem then surfaces it is easy to find, since only one day's work has to be gone through to find the problem and people still remember well what they have done during the day.

6.5. Continuous improvement

One of the respondents tells us that a project can last for 1.5 years and previously feedback wasn't gathered into a final report until the end of the project. This feedback could then be utilized to improve future projects. Today thanks to Scrum this cycle is much faster and they ask for and discuss feedback continuously. During the project they try to always react to the feedback; some things are easy to take care of while others might need more work.

In the same interview, a respondent says that previously (before implementing Scrum, authors note) process improvement activities were not part of a project. Instead, the focus was only on developing the product and on carrying out the project. Process

improvement had not been reflected on at all. He continues by saying that of course there have been times when a problem has been noticed and then it has had to be fixed, but these situations are such that they have emerged and then been responded to, in contrast to trying to predicting them and improve.

Working with APM has also unified the ways of working. They have noticed that different employees do the same thing in different ways, and certain practices could be agreed on so that everyone would work the same way.

In another interview it is explained that a certain percentage of the work time should be dedicated to business development activities. One of the respondents explains that these business development efforts are then added as stories to the sprint backlog and become a part of the sprint. The other respondent's team has a different approach; he explains that they take into account the business development activities through altering the work capacity appropriately to allow time for business development activities. Similarly, in another interview it comes up that they have through discussions with management agreed on reserving a certain percentage of the worktime for improvement efforts. Now when the designers plan improvement efforts these are put in the task list.

6.6. Feedback and measurements

One interviewee says that productivity has been challenging to measure when using APM and they have stopped trying to measure this. Instead they collect oral feedback from stakeholders and team members to assess how the method is working for them. The feedback from stakeholders has been good. The team has experienced that the method is good and team spirit has improved, but all team members do not confirm that productivity would have increased.

6.7. Changes, extensions and hybrid methods

Customizing the method

As long as one understand the fundamental idea that Scrum should empower the team and the individual designers, then one can go ahead and customize the method to fit one's specific environment. In general one should make sure that the method fits the operations: one cannot blindly decide to do pure Scrum. The method has to fit ones operations and one shall tweak it to fit if needed.

One interviewee tells about a customization they did; they did not have a pure Scrum master role. Instead, they had three teams with group leads and a team lead for all these three groups. In a way four people shared the Scrum master role. The division of responsibilities was done such that the three group leads took care of the daily operations and the team lead did the more administrative work and long term planning as well as had contact with all the group leaders and the product owners. This system worked very well for them.

One interviewee tells us about another customization of the method, or perhaps this could be called a hybrid method. He explains that they have many activities that one cannot plan in sprints, such as purchasing activities. These have been collected in a Kanban board that is not iterative but more long term/continuous. During the daily meetings they look both at the iteration board and at the long term Kanban board with activities that are going on in the background and are not bound to iterations.

The ABB Gate Model

In one of the interviews it is told by an interviewee that they still do some kind of hybrid work, the product development model is still the ABB Gate Model and this

requires the team to use a hybrid model instead of pure Scrum. He continues by saying that his role is more of a traditional project manager than a Scrum master. He describes his role as 30% Scrum master and 70% project manager. In addition to the Scrum master role he also has to report to management. He also does other things that are required from a project manager and that the gate model requires. His colleague adds that the gate model requires that certain things are done at the different gates. There has to be planning before gate two. After gate two more iterative development work can start and they start finishing things, but before gate two they don't get a lot of things finished. The other interviewee adds that especially after gate two the Scrum model is better realized.

Scaled Agile Framework® for Lean Software and Systems Engineering (SAFe®)

An interviewee says that one challenge with Scrum is that it might lead to a decrease in the co-operation outside the team. Scrum makes the team so united that the help to and discussion with other teams decreases. This might lead to the teams making conflicting decisions. Because of this they are now moving to Scaled Agile, that is managing multiple teams.

At another department which was interviewed the Scaled Agile Framework (SAFe) is already in use in some of the teams. An interviewee says they started using SAFe because they had grown so much and had teams in different countries across the globe. He attends a *Scrum of Scrums* twice a week where the Scrum masters representing the different teams discuss and try to figure out the dependencies between the teams. In the SAFe model, the basis is three month *program increments*, and once every increment the teams do a so called *Team held self-assessment* where 25 questions are discussed, and based on the comments a plan is made on how to solve issues and improve. This is in addition to the retrospectives that are part of the regular Scrum model.

Kanban

In one of the interviewed departments they have previously used Kanban. They bring forth that Scrum is not the only agile method, and that for example Kanban is another. They tell us that the software tool they use when working with Scrum can be customized and you can use it whether you work with Scrum, Kanban, or something else. The same tool is used at another of the interviewed departments. They use two boards, which they then switch between: one for iterations and one for long term activities. This is how the interviewee describes this: We mix a little in my team, we use Scrum and then other errands in a Kanban environment. There is a little bit of lean and a little bit of agile and a little bit of everything. We have a lot of activities that can't be planned in sprints such as purchasing. We do not know when these occur so that they could be finalized. We have put this type of activities in a Kanban that is not connected to iterations. In our daily meetings we look both at this board and the iteration based board.

The two interviewees in one of the interviews are told that the elements the case organization likes in Scrum are the daily meetings and the product backlog. These would give a clearer picture of what work is in progress and what should be done next. Things could also be discussed briefly every work day in order to see how the project is progressing. As an answer to this description one of the interviewees says that this doesn't require Scrum; use of Kanban could also achieve this. It is told that perhaps in the case organization's case the Kanban model would be more suitable. If there is nothing to demo at the end of a sprint and if there is no need for cyclical work were you would need to demonstrate something regularly, then the Kanban model could be a suitable option. If work should be done in iterations, then it is advisable to use the Scrum model, but if there is no need to divide the work into certain periods, and larger wholes can also be worked on, then the Kanban model can be used.

The Kanban method is described by the interviewees as follows: when working with Kanban you have a backlog from where work is "pulled" and then moved on a board from one task status to another. When something is ready it is demonstrated, otherwise

it is not demonstrated. In the Kanban model the work is estimated and there is a backlog. In Kanban, WIP limits are used and can minimize multitasking. Daily meetings are also a part of Kanban. There is no sprint planning or sprint review, but retrospectives can be held. It is advised that the case organization could start trying today, by doing a preliminary backlog and then have the team start working based on this backlog.

In connection to this discussion one of the interviewees also comes to think of *Scrumban*. He says that he is not sure how official the Scrumban method is. The method combines Scrum and Kanban. Some of the ceremonies in Scrum are not included. He refers to Scrumban as a method, were an attempt to include the best aspects of Scrum has been made.

One interviewee says that in software development Scrum is talked about a lot, but he is not sure if it is the silver bullet for all contexts. There are many agile methods, and they are all made for some purpose, so you just have to find the one that is the most suitable for you. It is advisable to start with something and then change it as needed. No one looks strictly at one method and how it is done. They don't have a pure Scrum method, or a pure SAFe method, they have their own method.

6.8. Scrum in hardware teams

In one of the interviews we had the opportunity to also learn about the implementation of Scrum in hardware teams. These hardware teams have experienced problems with the demonstrations at the end of sprints. The main reason seems to be that it takes long to produce the hardware. Longer than a reasonable sprint length would be.

In answer to this challenge they have agreed that no physical output is required at the end of a sprint. Instead they agree on what tasks should be done during a sprint and then they try to achieve what has been committed to. Working in this way the output from a sprint is the finalization of the task list, and not a working product increment.

The interviewee calls this type of working model “sprintless Scrum”. Someone could call it Kanban he says, but he prefers to use the term sprintless Scrum. One motivation for using this term is that they have kept the Scrum roles (they have a scrum master and a product owner) and that they follow the Scrum framework with the exception that they have “broken the sprint cycle”.

The hardware teams work with prioritized tasks in a queue. Once one task is finalized another one is brought in (pull system, authors note). They also use work in progress (WIP) limits of three to five tasks, and the team members are not allowed to exceed these WIP limits. Just like in Scrum they use the regularly scheduled meetings, with the difference that they do not commit to sprint targets. For example; when they start to run out of tasks they have a planning. And this is done every three weeks he thinks. They have also noted that the more often plannings are held the easier it is to plan.

6.9. Implementation

In one interview, their implementation of Scrum was described as follows; there has been significant culture change but not any big resistance, one of their teams had some doubts about Scrum but they voted to stay with the method. Their implementation recipe has been the following: first they had a two day long training sessions for everyone so that they understood what Scrum is and what the different terms mean. Then, the superiors formed the teams and assigned the roles as well as the tasks to the teams. Next a consultant was brought in. They had a consultant work eight days with each team, one day per week. The consultant was with the teams during the planning days. Every second week he also talked about a selected topic, which was taught to the team and then discussed. They have also had a “steco” of superiors who worked on solving any problems that surfaced.

In another interview they also described their implementation. This implementation had been more gradual. The two respondents who both are Scrum masters and have received Scrum master training have carried out the implementation gradually by introducing Scrum practices little by little. They say that the fact that they have been able to just start using this method without providing training to the team members is proof that Scrum works. The process started with a “let’s see how this will continue” mentality, it then continued by its own force, and it is still rolling. They say that there have clearly been such elements in the method that the team likes. In comparison, they previously worked according to the Kanban method and the team members also received training for it, but this method just disappeared gradually. They say that the need to work with APM has to come from the team and not from management. If the team doesn’t want to work with APM the methods will not work, but if the team is interested in working with agile methods they are more likely to be successful. They also give some advice based on their experiences. According to them, implementing Scrum the way they did, by having the Scrum masters gradually introduce it, is not the most effective way. They also emphasize the importance of training the team before starting to use the method.

The interviewees also give other recommendations for the case organization’s possible implementation of APM. One recommends being brave and just trying. He says that the training should not be forgotten and that there should be at least one person who is very excited about the new ways of working. Another person says that one team should start as soon as possible. He adds that one has to take a little risk if one wants to try something new. Another person says that it should be remembered that even if something is decided upon in the beginning it can be tweaked and improved later. He says that the ways of working will change along the way as the method is worked with, and that something optimal for the case organization will probably not be found from the start.

One person says that implementing new things can be a challenge; it can be challenging to get everyone on board. They have had challenges with implementing Scrum and it took them about two years before everything worked very well. He says it will take time

before things work well and patience is needed. Things will not work from the first month. Perhaps after half a year things will start to work well.

He also says that agile is something that is learned along the way. The retrospectives provide a formal opportunity to correct things that did not go well during previous sprints. Another person tells us that working with Scrum is often easy in the beginning when there is a lot of work for everyone, and the problems start when the project is going towards the final stages and there might be some areas where there is no work left. Then it has to be decided if a person is moved to another project or if an upcoming project is taken on by the team. The dilemma is if the team should be broken or if the persons are flexible and can do some other work for a while.

Education

One respondent took a two day course about Scrum that was arranged internally. He says that later on, all their software developers took part in a similar course. In another interview, both interviewees took a two day certified Scrum master course. One of them also uses the SAFe model, and he and the teams took a course about the SAFe model.

The interviewees advise that training is important. In one interview they say that at least the Scrum master should be sent to training, if there is no one who has previous experience of Scrum. Another person says he thinks it is very fundamental and important that some type of basic training is provided to everyone, no matter what the chosen method is. His colleague agrees and adds that this is true, whether the method is Scrum or Kanban or something else, in any of these cases some basic training should be provided to the teams. His colleague adds that the training should not be forgotten and that the experiment can be a failure if the right mentality is not present from the start. The training should consist of at least a one day basic training where the basic values and other relevant theory is gone through, and where the participants have an educator who can answer their questions.

7. TESTING AGILE PROJECT MANAGEMENT IN A PILOT PROJECT

During the research process a suitable pilot project appeared and it was decided to implement agile project management in this project. The researcher helped in planning and carrying out the implementation and began coaching the team on a daily basis.

The pilot project was a small domestic project, and comparatively smaller than many other projects the case organization worked with. It was judged that it would be easier to test the method in such a project. The core-project team consisted of three team members; the *project manager* who was in charge of carrying out the project, the *lead engineer* (electrical engineer), and the *mechanical engineer*.

The researcher (here referred to as the coach) carried out the implementation with the support of the Operational Excellence and Quality Manager, who is also the advisor of this thesis. Since the project team members were all quite busy the coach made it a priority to make the implementation as efficient as possible in order for the new method to not consume too much of the participants' time.

7.1. Planning the method

The method to be implemented first had to be planned. Based on the knowledge gathered during the research process and especially the advice received from the interviews, it was decided to implement a hybrid of Scrum, Kanban and traditional project management practices. The most suitable elements would be taken from all these methods. The researcher decided to simply use the term “agile project management” to describe the hybrid method. From the interviews it was also learned how important it is to empower the team and engage them in shaping the method. The

method was likely to change and evolve as we worked with it. Whereas some initial planning was required to make the implementation smooth it was agreed from the start that nothing would be set in stone and that the method would evolve to best suit the project team as the team members worked with it. The team would also be encouraged to change the method according to their needs.

7.2. Introducing the method to the team

After some planning the implementation started. The method was introduced at the projects kick-off meeting. First a 15 min theoretical introduction provided the team with some background information and terminology. Both the project manager and the lead engineer had however been introduced to the topic prior to this, through conversations with the coach. After this brief theoretical introduction the task planning started. Prior to the meeting the coach had prepared a Kanban board and backlog for the team to use. The team was asked to think about what tasks they would be performing in the project during the following two weeks and then write these tasks on notes. Next these notes were put in a prioritized order in the backlog. Since the three team members did not have any shared activities they all had their separate columns in the backlog, and to make things clearer they each had their own note colors (see figure 8 for an example of the backlog).

Next the coach explained how the Kanban board worked. She asked what the team thought of the board and whether they would like any changes to the template provided. The team wanted to stay with the suggested version of the board. The concept of work in progress (WIP) limits and their purpose of minimizing multitasking were also introduced and the team agreed on WIP limits for the different columns. It was also discussed what other information to include on the task notes. Examples included task length estimation and task deadlines. This additional information was however not included at this point.

Next the daily standup was introduced. The possible contents of these meetings was discussed and the importance of keeping the meetings short was emphasized. The concept of time boxed meetings was also introduced. The team agreed on what time in the morning they wanted to hold their daily standup meetings. After this it was discussed what other meetings would be held, in addition to the daily standups. It was agreed on holding a regular meeting that would include both review, retrospective and planning. This meeting was scheduled to be held after two weeks. Lastly it was discussed the roles and responsibilities within the team. The concept of collective responsibility was brought up, although the project manager still had the formal responsibility of the project. Scrum roles were not implemented. The project manager kept his traditional role. The product backlog was edited by all team members since they had their own separate columns in it. The researcher would be coaching the team (acting in a role similar to the Scrum Master) with the support of the Operational Excellence and Quality Manager.

In total the introduction of the method took 45 min, out of which 15 minutes was a theoretical introduction and 30 minutes were interactive work in the form of task planning, discussions and agreements on how to work with the method. Thus the introduction of the new method was very efficient. This meeting took place on a Friday and the first daily meeting was scheduled for the following Monday.

7.3. Working with the method: the first two weeks

During the following two weeks daily meetings were held each day. They ranged from 5-15 minutes in length and were led by the coach who taught the team how to do daily meetings and coached the team together with the OpEx and Quality Manager. The coaching focused on practical things such as making sure tasks were split into appropriate sizes and that WIP limits were held. The coach also tried to spark conversation by asking the team members questions such as if they had encountered

problems while working or whether there was any additional information they would like to share with their team mates. In the beginning the coach led the meetings and taught the teams how to hold them, but as the days progressed the team became more and more independent and during the second week they started claiming ownership of the process and the coach began taking a more observatory role, observing and asking questions as needed.

The daily meetings were held in a designated space in the office where the Kanban board and backlog were displayed on the wall. Gradually additional documents and tools were also added to the space. For example a sheet of paper displaying important dates, and one sheet of paper displaying the team member's absences and vacations were added. Also the project schedule (Gantt chart) was displayed next to the board. It also became a habit to display relevant meeting documents on the wall such as feedback from the retrospectives. Below in figure 8 a picture of the teams backlog and Kanban board are shown. For confidentiality reasons the notes have been edited blank. The team members names have also been covered so the team members can stay anonymous.

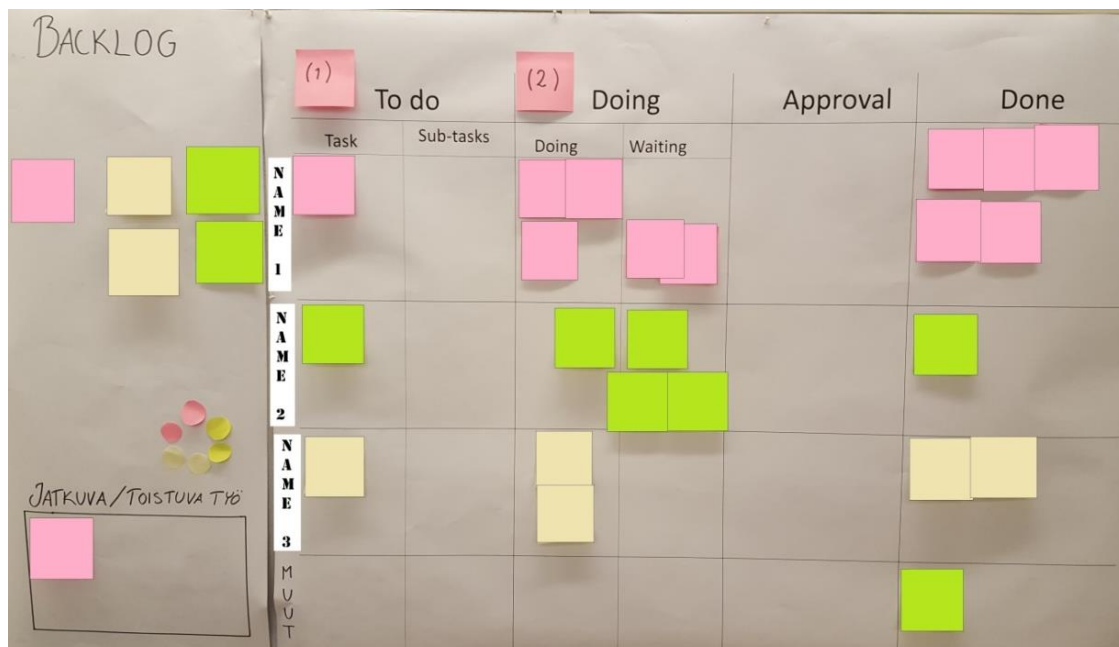


Figure 8: The backlog and the Kanban board

In the backlog (see figure 8 on the previous page) the team members each have a separate column of tasks in a prioritized order, the highest priority task is at the top. At the time of this picture there were few tasks left so soon more tasks had to be planned. The box drawn at the bottom of the backlog displays work that is continuous, so tasks of continuous nature can be kept there and then moved back to the board when it's time to work on them again. The little circle of colorful dots in the backlog is another tool. The dots are utilized to mark that a note has been moved on the board outside the daily meetings. While it is preferable to move the notes at the daily meetings, the dots have proven to be a useful tool in some circumstances.

The team members each have their own row in the Kanban board, a so called “swim lane”, where they move their tasks by “pulling” them forward from one column to the other, creating an even flow of tasks. The WIP limits of the “To do” and “doing” columns are displayed at the top of the column, note the the WIP limit for “doing” does not include the sub-column “waiting”. The engineers usually have one or maximum two tasks in their doing column, but the project manager (pink notes) sometimes exceeds the WIP limit since some of his tasks are very short, the rule of thumb is that the tasks in the “doing” column should be about one day's work taking into account the multi-project environment. The waiting column has proven useful and is used a lot for different reasons; sometimes tasks wait for input and sometimes tasks wait for other tasks to finished before sending the tasks collectively for approval. There is no WIP limit for the waiting column, but the tasks in this column are continuously reviewed at the daily meetings with the aim of making sure that they are progressing as soon as possible. The row at the bottom is marked “Muut” which is a Finnish word and means “others”. This row is used in case someone outside the core team takes part in the project work. In that case they may participate in the daily meetings and use this row. Another option is that the team members track the external participants' task progress and visualize it using this row.

When working with the board it is important that all team members have the same understanding of what the different statuses of the tasks mean. There has been discussion and learning in the beginning regarding for example when a tasks status is “waiting” and when it is “approval”. Although the concept of *artifact transparency* has

not been introduced, the coach acknowledges its importance and has kept this in mind when coaching the team. The board is only effective as a communication tool for the team if all team members understand it the same way, in order to prevent misunderstandings it is important that the team members discuss the tasks as they move them on the board, and question the choice of column they are placed in if needed.

7.4. The first sit-down meeting

The first sit-down meeting was held two weeks after the kickoff meeting and it started with theoretically introducing the purpose of review, retrospective and planning activities. The review focuses on the project, the retrospective on the process, and the planning looks ahead and plans the work of the coming weeks up until the next regularly held sit-down meeting. The review consisted of the project manager providing a brief update about the project status. The retrospective was held by the coach; feedback about the new ways of working was given by the team members and written on a whiteboard by the coach. The feedback was divided into three categories “Like/important”, “Do not like/unnecessary” and “Ideas/things to try”. The feedback in the last category was implemented following the meeting. For example: it was agreed that the daily meetings on Fridays would be removed since one team members was not present on Fridays. Table 2 on the next page shows the feedback gathered at the first retrospective. After the meeting the coach also displayed the feedback in the daily meeting space. During the planning the tasks for the upcoming weeks until the next regular sit-down meeting were planned. One task was also planned based on the feedback from the retrospective. After all the tasks for the following weeks were planned the time of the next regular sit-down meeting was confirmed and the meeting ended.

Table 2: Feedback from the team gathered at the first retrospective

Like/important	Did not like/unnecessary	Ideas/Things to try
Can see what other team members work with	No negative comments said, someone commented that feedback should be constructive	Splitting tasks into smaller sub-tasks
Get an overview of the project		Add procurement plan to the daily meeting space
See the project status, what is being worked on and what is coming up next		Remove the daily meetings on Fridays (so that everyone in the team has a chance to be present at all daily meetings)
Good that things surface		
Daily meetings are quick		
Team work has increased "Team spirit"		

As can be seen from table 2 above, the team's feedback has been positive and constructive. Based on this table as well as the coach's observations the team seems to like the new method and find it useful. One team member mentioned that team work has increased and that there is a sense of "team spirit". The team members also have a better overview of project activities, who is working on what and what is coming up next. One positive thing is also that the daily meetings have been quick. Splitting tasks into smaller sub-tasks is one thing that requires more practice according to the feedback.

The coach sees the first two weeks of the implementation as a success story. The implementation has been surprisingly efficient with very little time required to get started and the daily meetings being very short and never exceeding the time boxed 15 minutes. The team members have adopted the new method well and taken ownership of

the process and they are now running the daily meetings independently. The coach thinks that the method has increased communication, visibility and transparency. Consequently project quality could be predicted to increase and project risks decrease.

7.5. Overview of the agile project management method

At the moment of writing the implementation has been going on for three weeks. The method that has evolved is still a hybrid of Scrum, Kanban and the traditional practices. The method was formed based on the researcher's theoretically and empirically gained knowledge about agile project management, but following her intuition of what would be best for the team. The team has also been encouraged to take part in shaping the method and make decisions on how to alter it, but since they are new to the method many of the changes have been made on the researcher's initiative.

The team does not commit to a sprint goal, and thus no task estimations are made and there is no burndown chart to track progress. The efficiency is achieved through WIP limits and optimizing work flow on the Kanban board. The multi-project environment however decreases the benefits that could be gained from minimizing the multitasking.

There is no separate backlog and sprint backlog, only one backlog. The tasks in the backlog are mainly planned during the planning sessions but the team members are allowed to add tasks or refine the backlog at any time. Scrum events are used with the difference that the review, retrospective and planning are held as one meeting.

Scrum roles have not been implemented. The product owner's tasks are shared by the project manager who holds the review, and the team members who manage the backlog. The coach has taken a role similar to the Scrum master. It is possible for the team to manage without a coach, but the existence of a coach likely improves the use of the method.

8. RESULTS AND DISCUSSION

8.1. Results

The research problem of the present study is as follows: *“Could agile project management be used to improve project management in the case organization during the initial phases of its EPC projects?”*. In order to address this research problem the following two research questions have been formulated: (1) *“Could agile project management be used in the case organization during the initial phases of its EPC projects?”* and (2) *Could it be beneficial to use agile project management in the case organization during the initial phases of its EPC projects?* In this chapter these two questions will be answered, one at a time. The answers are based on the material gathered within this study consisting of (1) theoretical material presented in the theory chapters of this thesis, (2) empirical data gathered at the interviews and analyzed as described in the methodology chapter and (3) experiences from the pilot project described in chapter seven of this thesis. This material is summarized and compared in order to answer the research questions.

Research question 1: Could agile project management be used in the case organization during the initial phases of its EPC projects?

As the theory presented in chapter two indicates the use of agile methods is spreading outside the software industry and into non-software development projects. The findings presented in chapter two (see for example Gustavsson 2016) indicate that it is possible and beneficial to use APM to manage various types of non-software development projects. One should however note that there are few studies on the use of APM in a non-software context to date and the results of the initial studies made need to be

verified by further research. Also, many initial studies seem to put an emphasis on positive results, which leads to the suspicion that there might be reporting bias present. Only one example (Orrell 2017) of an EPC project where APM was implemented, could be found during the study. In this case Scrum was successfully implemented in a large scale EPC project that focused on building a natural gas processing plant.

The theoretical material presented in this thesis indicates that it could be possible to use agile project management in the case organizations EPC projects during the initial phases of these projects. The successful use of APM in the pilot project confirms this.

As discussed previously in chapter three of this thesis, The Scrum Guide (Schwaber & Sutherland 2016: 16) states that Scrum only exists in its entirety. This has been pointed out as paradoxical by Jansson (2015: 28) who point to the agile principles which encourage the team to reflect and adapt their ways of working as needed. It is learned from Diebold and Dahlem (2014: 2) that most companies that adopt Scrum alter the framework *“Most often they either omit specific parts of the original agile method, change them, or replace them with traditional aspects. The most prominent adaptation is the so-called “ScrumBut” method, which uses Scrum to some extent.”* (Diebold & Dahlem 2014: 2). From reading cases on APM use in non-software development projects (see sub-chapter 2.3. for examples of cases studied) as well as based on what has been learned at the interviews it is clear that among practitioners in both software and non-software projects it is common to alter the Scrum framework to best fit one’s own projects. This is even advisable according to the practitioners interviewed. In the pilot project this advice was followed and APM was implemented in a way that best fits the case organization’s needs.

Identified challenges and ways to address them

The case organizations project environment presents several challenges to APM implementation. This is natural since EPC projects differ a lot from software

development projects. Next these challenges are discussed, one at a time, in order to answer the research question more in depth.

In the case organizations project environment people work on multiple projects. This is a challenge for APM implementation since people shouldn't attend many daily meetings every morning. In an interview it is emphasized that keeping the teams stable is important so people can learn to work together. When people learn to work together, teams become efficient. It was also learned from the interviews that a team can receive work from multiple projects. So if APM was used in the case organizations projects it should aim to keep teams stable, and have the same team work on multiple projects. This might be possible in the case organizations project environment but would require long term planning from management to coordinate so that the same people could make up stable teams.

In the case organizations projects the team members have different areas of expertise. From the interviews it was understood that team members ideally should be able to do any task that is in the backlog. Knowledge that is "T-formed" should be strived for. This means that a person is really good at something while also having a general understanding of several topics beyond his or her core expertise. Learning from each other should also be encouraged. Multi-skilled individuals can help eliminate bottlenecks and thus make projects progress faster.

Having "silo'd activities" can mean less collective responsibility and less communication between people with different areas of expertise. If looking positively at the scenario APM could benefit the team members by improving their understanding of each other's work. In the pilot project it could be seen that having "silo'd activities" was not a barrier to APM use. However it is good to keep in mind the ideas stated above. It is important that team members show interest in each other's work and are interested in learning about what the other team members are working on, so that everyone understands the project as a whole and the team can take collective responsibility for the success of the project. In larger teams where there are several individuals with the same area of expertise these team members should share tasks. Also, management could consider how to establish a system that could quickly give the teams extra resources that

could for example eliminate bottlenecks and make sure the project is kept on schedule, and/or make sure individual team members do not have too much work. This type of system that would be coordinated by management could be beneficial for all teams.

Co-location would be an ideal condition for agile teams, but this is not always possible. One main challenge related to APM implementation that the case organization is facing is having additional resources abroad in Estonia and India. At two of the interviews it was learned that it is possible to work with teams that are not co-located if one uses electronic tools and boards. Interviewees were either actively doing this or they had previously successfully done this. Within these teams the cultural differences were however not large, since the team members were all located in Europe. From the Swedes interviewed who were currently located in India it was learned that working with APM in India works well. However, there were some discussion about the cultural differences between the Nordic countries and India that were considered large. These cultural differences could maybe lead to some challenges if working with a team consisting of members from both India and Finland. At another interview, co-location was recommended. It was seen as efficient since communication is such a big part of the work performed, according to this interviewee. His organization had made and were continuing to make changes in the organization in order to enable the agile teams to be co-located. In summary it can be learned from the interviews that while co-location is advisable it is also possible to work with team members in different countries through the use of electronic tools. The real challenge might be having a team with members who have different cultural backgrounds and thus different workplace cultures.

Agility can for example be defined as *“The ability to create and respond to change in order to succeed in an uncertain and turbulent environment.”* (Agile Alliance 2017). A more comprehensive definition of agility by Conforto et al. (2016: 667) defines agility as follows:

Agility is the project team's ability to quickly change the project plan as a response to customer or stakeholders needs, market or technology demands in order to achieve better project and product performance in an innovative and dynamic project environment. (Conforto et al. 2016: 667)

As can be seen from the definitions above, responsiveness to change seems to be central in agility. The contents of the case organizations projects are pre-defined already in the sales phase. The projects are based on fixed contracts with fixed schedule, budget and scope. The question then arises whether there are a lot of changes going on in this type of projects? And whether being agile is a competitive advantage in this type of projects? The interviewees with whom this was discussed pointed out that there are many types of changes going on within projects that are not connected to the project tasks. These changes might for example be related to administration, technical problems or employees' personal lives. Looking at change this way it can be concluded that being responsive to changes is something that is beneficial in any project, no matter the nature of the project tasks, output or contract type.

Considerations related to the use of APM in the case organization

This part of the results concerns how APM could be used in the case organization and which considerations have to be made when using APM in the case organizations context. From the interviews it is learned that one should make sure the method fits one's operations. One should not blindly follow a method but instead do alterations to make the methods fit one's own projects. It is advisable to start with something and then do changes according to one's needs. All the interviewees talk about changes that they have done to the Scrum framework; they have all adapted it to their own needs while still having the majority of the elements of Scrum in place.

From an experience paper (Orrell 2017) it is learned that all Scrum roles can be implemented in an EPC project. In this case (Orrell 2017) the project manager took the product owner role. The team also had a Scrum master titled *Team facilitator*. In the pilot project the researcher was acting in a role similar to the Scrum master while the team members together with the project manager shared the responsibilities of the product owner. This worked well since the project was small with a short and clear product backlog consisting of tasks that were not shared but assigned to people

according to their areas of expertise. In larger projects, with more tasks in the product backlog and more shared tasks, the product owner role might have to be reconsidered. From one of the interviews it is learned that just like in the pilot project they did not have a product owner in some of their teams, instead this role was shared by the scrum master, the team and some other people. They would however have preferred to have a product owner.

An important part of Scrum is to be able to create and demonstrate a potentially releasable product increment at the end of each sprint (Schwaber & Sutherland 2016). In a software development context this refers to a product increment of working and tested software, but in other contexts this has to be reconsidered. For example it was learned from an interview that hardware development teams were not able to demonstrate hardware at the end of every sprint due to long production times. Instead, they finalize a number of tasks during a sprint.

From the EPC case found (Orrell 2017), a possible approach to the product increment for the case organizations projects was learned. In this case (Orrell 2017) the product increment took several forms during the project. The product increment could for example be a 3D model of the plant that could be reviewed iteratively based on design documents and engineering. The model was also analyzed for constructability, and changes in design or procurement were made as needed. In the same case they used the sprint reviews to look at the things that had been actualized in the project schedule as well as looked at which deliverables were completed. (Orrell 2017: 4-6.)

Through the interviews it was also learned to question the need for cyclical work. The elements in Scrum that the case organization liked the most were the product backlog and the daily meetings and it was learned from an interview that these components also could be found in the Kanban method. It was told that if there is no need for cyclical work with demos at the end of each sprint then Kanban could be a suitable method, but if work should be done in iterations then it would be advisable to use the Scrum framework. They also mention the Scrumban method (a hybrid of Kanban and Scrum) and refer to it as a method, where an attempt to include the best aspects of Scrum has been made.

The hardware team that was talked about in an interview seemed to be working in a less cyclical way than Scrum. It however remained unclear from the interview whether they commit to finalizing a certain number of tasks during a sprint (sprint goal). They hold planning meetings with certain intervals but it remains unclear from the interview material whether these are scheduled regularly or held when tasks start to run out. They call this model “Sprintless Scrum”.

Based on what had been learned from the interviews about Kanban and about the hardware team’s way of working with “Sprintless Scrum” a custom APM method was formed for the pilot project. This model could perhaps be called Scrumban or it could be said to not be a method but a set of APM practices from Scrum and Kanban combined with traditional project management practices already in use in the case organization. The author has chosen to simply refer to the new ways of working with the general name *agile project management*. This new way of working is more continuous than cyclical. The work is performed in a continuous, Kanban like, manner without committing to sprint goals. However, sit-down meetings (consisting of the Scrum events: review, retrospective and planning) are scheduled regularly. The fact that the planning follows directly after the review and retrospective means that what has been learned at the review as well as the retrospective actions agreed on can be taken into account when planning the tasks for the next sprint. So there are some cyclical elements to this way of working. The understanding of the review meeting in the case organization’s context is based on what has been learned from the EPC case found (Orrell 2017), and it was decided that in the pilot project the reviews would among other things be used to review the project status and the team’s progress in the schedule. It would be a formal opportunity to look at the project in a more holistic and long term perspective, as opposed to looking at daily and short term activities at the daily meetings.

Since the pilot project is relatively small and not so complex, it makes sense to use a simpler method that includes practices from Kanban (and not only from Scrum as originally intended). If APM is implemented in larger EPC-projects with more tasks and more complexity, then the implementation of more Scrum practices such as sprint goals

and iterative work might further improve project management in the case organization, but the only way of knowing this is through practical experiences.

Implementation

During the interviews, some advice on how APM could be implemented at the case organization was received. We were advised to be brave and just try: we should start with one team as soon as possible and could change the method as we work with it. It was told that we would probably not find anything optimal at the start. It was also learned that it can take time before everything works well and patience is needed. It was also told that APM is something that is learned along the way.

From the interviews it was learned that training the team members prior to implementation is highly recommendable. In one interview it was learned that their implementation was very well organized (and probably required a lot of resources). They provided training to the team members and had support from a consultant. In another interview a different experience was learned about. There, two project managers had received Scrum master training, after which they carried out the implementation of Scrum gradually. These Scrum masters however thought it was not the most efficient way to implement Scrum.

In the pilot project the advice of providing formal training (in the form of a formal course) to the team members was not followed. Instead APM was piloted after a brief theoretical introduction of 15 minutes provided by the researcher. For this type of pilot project this proved to be enough introduction for the team. The method was very intuitive and since the researcher was aware of APM theory she could correct the course as needed and coach the team in the right direction. The “sit-down meetings” every two weeks also provide an opportunity to present relevant pieces of theory as necessary. This type of implementation required very little resources, but was made possible through the understanding of APM gained through this thesis work.

In conclusion

It was learned through this study that APM can be successfully implemented in various non-software projects including EPC projects. Several challenges the case organization should consider when implementing APM have been discussed above. None of these challenges are such that they would prevent the organization from implementing APM, but they have to be considered and addressed as needed. It seems that the best way to learn about APM is trying it out in the organization with the attitude that things can be changed along the way as the new method is worked with. When using APM in practice, challenges will appear and should then be addressed, and the method adjusted as necessary. The pilot project has shown that at least in small projects it is easy to start using APM with only a brief introduction needed before working with the new APM practices.

Research question 2: Could it be beneficial to use agile project management in the case organization during the initial phases of its EPC projects?

As described in the theory chapter, a literature review by Gustavsson (2016) found that (1) *better collaboration in the team* was the most frequently reported benefit when using APM in non-software projects. The following benefits were also frequently reported: (2) *increased customer interaction*, (3) *increased productivity and speed*, (4) *increased flexibility, coping with change*, (5) *better understanding of goals/tasks/requirements* and (6) *increased transparency and visibility*. Out of 17 benefits identified by Gustavsson (2016) these were the most frequently reported benefits, with each benefit being reported by more than five cases (out of 21).

Were these benefits also noted in the case organization? And were they noted in the interviews? In the pilot project better collaboration in the team could also be noted: when people are interacting and communicating on a daily basis, this creates “team

spirit”. One interviewee talked about the possibility of developing teams of people who work well together and become better and better at co-operating and thus also become more efficient in their work. By trying to keep the teams stable, the benefits of better collaboration in the team could be gained. In the pilot project *increased transparency and visibility* could be noted as well as *better understanding of goals and tasks*. Similarly, in the interviews visibility and the ability to follow what the team is doing as well as increased transparency to others outside the team were noted benefits. From the interviews it was learned that one way transparency had increased was through the opportunity to bring up problems at the daily meetings. One interviewee said that it is beneficial that problems surface quickly so that there is more time to deal with them. He also mentioned that team members can feel relief knowing that they can share problems with their team and are not left alone to solve them.

The *customer interaction* has probably not increased in the pilot project, the focus has been on how the team has been collaborating internally and the customer has not been involved in the pilot project. However the author has not been able to see or compare if the customer interaction has changed so this is just an assumption that is not based on actual evidence. From one interview it was learned that the relation to stake holders has improved through the use of APM. The reason is that stake holders can now see how their interests are prioritized in the team’s backlog in relation to other tasks the team is working on. This means that if the team has a lot “on their plate” the stakeholders are more understanding and patient since they now can see this and why their task is taking longer than expected to complete.

At this point in time it is hard to tell whether the *flexibility and coping with changes* has increased in the pilot project. However, the researchers thinks that having regular communication practices in place makes the team better at dealing with challenges and this might also be done in a more collaborative way. Whether *productivity and speed* has increased is also hard to tell, all projects and tasks are individual and the multi project environment also affects these factors. From one interview it was learned that it is challenging to measure productivity when working with APM. In his case he had instead gathered oral feedback about experiences with the Scrum method.

In the EPC-case described by Orrell (2017) benefits that were gained from the implementation of the Scrum framework included (1) *understanding project priorities and prioritizing these over discipline specific priorities* (2) *seeing progress on daily basis based on completed deliverables* (3) *problems could be surfaced on daily basis allowing more time to solve them* (4) *by limiting WIP items were completed continuously* (5) *team composition experienced changes that resulted in a team with members with similar values who could agree on how to work together*.

Have these benefits also been noted in the case organization? In the case organization, prioritizing the project over discipline specific priorities has not been an issue and therefore this benefit is not noted. However, understanding the priorities within the project and when important dates are coming up could be of benefit to the team, and this could be improved through APM. Seeing progress on a daily basis and being able to bring up problems as they surface can be predicted to be beneficial in the case organization's projects. In the case organization, people are working on several projects, so the limiting of WIP is not as effective as when working on a single project since the real multitasking is the switching between projects. However, not multitasking within a project is of course good to strive for and therefore WIP limits are included in the pilot project. WIP limits also help keep the board more readable by limiting the number of tasks displayed. Benefit number five has not occurred in the case organization.

One benefit mentioned in the interviews was that communication had improved. In one interview it was mentioned that it is unclear if communication has increased outside meetings, but at least the meetings ensure all team members share some information about their work on a daily basis. In the pilot project team members communicate on a daily basis and this means that the whole team is constantly aware of the project's status and progress as well as about difficulties that are encountered. One benefit noted from the increased communication in the team was an example where the team requested information from the customer in a more efficient way through first communicating within the team. The researcher has tried to ask questions during the meetings to further spark conversation and believes that communication at the daily meetings can be further improved by learning to use the opportunity to bring forth things.

From one interview it was learned that working with Scrum has made their feedback cycle faster: feedback is gathered continuously during a project as opposed to at the end of projects. Thanks to this, feedback can be utilized already during a project (and they try to always react to it) and not only to improve future projects. Working with Scrum has also led to focus on improving the *process* of projects and not only the output of projects. APM provides a framework for carrying out business development activities, these activities can be put as tasks in the backlog and prioritized together with the other backlog items. In one interview it was learned that working with APM has unified work practices since differences can be noted and discussed and practices unified as needed.

According to the researcher the main benefits noted from the pilot project are the increased communication and increased sharing of information. The daily meetings provide opportunities to communicate, they are an efficient routine that is not very time consuming (5-10 minutes/day) and allows the team to bring up things that are on their mind while they are still in fresh memory. Thanks to APM the project manager can keep track of project progress in an efficient way and communicate with the team about the progress as well as inform them about important milestones well in advance in order to ensure meeting these.

To the team members APM provides an overview of one's own tasks as well as the other team member's tasks and gives an understanding of the project as a whole, beyond one's own area of expertise. With time, this will likely result in the team members better understanding of the other areas of expertise within the project.

In conclusion

It could be beneficial to use APM at the case organization during the initial phases of its EPC projects. The main benefits seem to be increased communication, increased transparency and increased visibility. Another benefit is having a framework that provides the opportunity to continually improve processes. The realization of these benefits will likely improve project quality and reduce risks.

8.2. Discussion

The results from the study indicate that it is recommendable to implement APM in the case organization during the initial phases of its EPC projects. Now when the study has been finalized it seems obvious to the author that APM could be implemented and could improve project management in the case organization's projects. This was however not obvious at the start of the study, the author doubted the applicability of APM in the case organization in the beginning of the research process since the case organizations projects are in many ways very different from typical software development projects. As cases of APM implementation in very varying types of projects were encountered during the study of literature and finally an example from an EPC context was found, the researcher gained more confidence that APM could be implemented in the case organization. The pilot project finally confirmed that it was possible and could be beneficial and advisable.

At the time of writing this discussion a second pilot project has started in the case organization. This project is larger and more complex and challenging, which will also make the APM piloting more challenging; hopefully the benefits from using APM will also be larger as a consequence. As discussed in the results there will be new challenges ahead if APM is implemented in all projects at the case organization. The multi-project environment as well as the resources abroad will bring new challenges to be solved. Structural changes as well as software tools and online meetings could be considered as possible solutions to these challenges.

The case organization's initial motivation for adopting APM was not to become more agile. Instead the case organization wanted to improve communication in the project team and between the project team and its stakeholders as well as gain a better understanding of project tasks and their status at any point in the project. They correctly predicted that APM practices could help them improve in these areas. From the case organization's perspective improving *agility* was not the main goal, but the researcher has been puzzled with the question if the pilot project team has become more agile thanks to the use of APM. Could it be possible that APM has been piloted and relevant

benefits have been gained but improved agility has not been achieved? According to Conforto et al. (2016: 671) the core elements of agility in project management that effect agility performance might be (1) *rapid project planning change* and (2) *active customer involvement*.

The researcher has not been able to observe if the customer involvement in the project has improved, but it is likely that it has not changed since this has not been a focus in the pilot project. Whether changing the project plan has become faster cannot be told based on the pilot project at this point in time. However, working with APM can improve the team's collaboration and provides frequent opportunities to discuss project related matters. So this would at least provide opportunities to discuss changes collectively as soon as they appear. It is possible that agility has been improved without this being noticed, since it has not been a focus of the study.

As long as there is no need to focus on improving agility in the case organization there is no reason to fundamentally change the ways of working in order to achieve improved agility. If new challenges start to surface that indicate the need to become more agile, then it might be relevant to reconsider how APM is used. It seems that APM practices have helped the case organization improve in the areas where they were hoping to improve, but it is unclear whether the case organization has become more agile through the use of APM practices in the pilot project.

9. CONCLUSION

This study was commissioned by ABB Grid Integration Finland. The case organization's project based business focuses on the delivery and service of substation solutions for the electrical grid. Their projects can be classified as engineering, procurement and construction projects. The case organization had heard about agile project management and was interested in knowing whether APM, specifically Scrum, could be used to improve project management during the initial phases of their projects. They were looking to improve communication in the project teams as well as between the teams and their stakeholders. In addition they wanted to increase transparency and visibility of project tasks. The study's research problem is formulated as follows: *Could agile project management be used to improve project management in the case organization during the initial phases of its EPC projects?*

The first phase of the study focused on understanding APM through studying literature. Empirical data was gathered through semi-structured theme interviews (fin: teemahaastattelu) with Scrum practitioners at ABB. Towards the end of the research process a pilot project was also initiated where APM was tested in a small project. The method implemented in the pilot project consisted of APM practices from both the Scrum framework and the Kanban method that were mixed with traditional project management practices already in place in the organization.

The results from the study indicate that APM could be implemented in the case organization during the initial phases of its EPC projects, and such an implementation could be beneficial and improve project management. Initial evidence from the pilot project indicates that the benefits that the case organization was hoping to gain from using APM could be achieved. It remains unclear, however, if the use of APM in the pilot project has made the organization more agile. This was however never the main motivator for the organization to adapt APM. The use of APM continues to be piloted in the case organization and the APM practices will continue to adapt to the organization's needs as the team members continue working with them.

Suggestions for future research

There is little research on APM in non-software projects to date. Thus further research within this field is encouraged. The use of APM in EPC projects is a new research area that needs to be further explored. One possible research topic could be the identification of challenges and enablers to the use of APM in an EPC context. How to achieve agility in fixed contract projects could also be an interesting research area. This study has only focused on the initial phases of EPC projects, and as such, studies researching the use of APM in all phases of EPC projects including the construction phase could be another research opportunity.

In the interviews, the cultural differences between India and the Nordic countries were discussed. Many companies have additional resources in Asia and thus collaboration in distributed agile teams with members with different cultural backgrounds could be an interesting research topic. When studying theory on APM in non-software projects it seemed like research on Agile-Stage-Gate hybrid models is an upcoming research area, and if product development is an area of interest this could be an interesting research topic.

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APPENDIX: Principles behind the Agile Manifesto

We follow these principles:

Our highest priority is to satisfy the customer through early and continuous delivery of valuable software.

Welcome changing requirements, even late in development. Agile processes harness change for the customer's competitive advantage.

Deliver working software frequently, from a couple of weeks to a couple of months, with a preference to the shorter timescale.

Business people and developers must work together daily throughout the project.

Build projects around motivated individuals. Give them the environment and support they need, and trust them to get the job done.

The most efficient and effective method of conveying information to and within a development team is face-to-face conversation.

Working software is the primary measure of progress.

Agile processes promote sustainable development. The sponsors, developers, and users should be able to maintain a constant pace indefinitely.

Continuous attention to technical excellence and good design enhances agility.

Simplicity--the art of maximizing the amount of work not done--is essential.

The best architectures, requirements, and designs emerge from self-organizing teams.

At regular intervals, the team reflects on how to become more effective, then tunes and adjusts its behavior accordingly.

(agilemanifesto.org 2001)