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Managing the Agile Scalability to implement Agile Project Portfolio Management

A Case Study within the Automotive Industry

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by

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Master of Science Thesis TRITA-ITM-EX 2019:379
KTH Industrial Engineering and Management
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Hanteringen av den Agila Skalbarheten för en Agil Projektportföljstyrning

En fallstudie inom Fordonsindustrin

av

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Examensarbete TRITA-ITM-EX 2019:379
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2019-06-10	Bo Karlsson	Anna Jerbrant
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Abstract

Emerging markets, development of new technologies, sustainability policies and change in customer demand are dramatically changing today's economies. The business environment is more dynamic than ever before. One particular industry that is currently influenced by significant transformational forces is the automotive industry. These transformational forces, such as autonomy, connectivity and electrification, are driving the change towards a future state where shorter lead times and closer customer interaction will be essential in order to satisfy the needs of the changing market.

To deal with external changes, organizations are increasingly focusing on agility as a way to gain new forms of competitive advantage. The benefits of agile methods at the team level has inspired the use of agile practices at a larger scale, all the way up to the portfolio level. Project portfolio management (PPM) connects the strategy of the organization with the distribution of resources across projects in the portfolio. There is little empirical evidence on the agile methods performed in PPM, thus of interest to study. Due to the high complexity at the portfolio level, it becomes increasingly difficult to scale agile methods.

This thesis is based on a single-case study within the automotive industry to gain a better understanding of how a mature automotive company can manage the agile scalability to become more agile in their project portfolio management. An abductive approach was applied with gathering methods comprising interviews, documents and observations. The results of this thesis highlight the major deficiencies with the case company's current PPM, as well as their performance in scaling agile.

Key-words: Agile, Agile Project Portfolio Management, Agile Scalability

KTH Industriell teknik och management

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Sammanfattning

Tillväxtmarknader, utveckling av ny teknik, hållbarhetspolitik samt förändring av kundkrav påverkar dagens ekonomi dramatiskt. Affärsmarknaden är mer dynamisk än någonsin tidigare. En viss industri som för närvarande påverkas av bemärkta förändringar är fordonsindustrin. Trender som autonomi, elektrifiering och uppkopplade fordon driver förändringen mot ett framtida tillstånd där kortare ledtider och närmare kundinteraktion kommer att vara nödvändiga för att tillgodose marknadsbehoven.

För att hantera externa förändringar fokuserar organisationer alltmer på att arbeta agilt. Fördelarna som agila metoder har på teamnivå har inspirerat användningen av dem på en större skala, hela vägen upp till portföljnivå. Projektportföljstyrning (PPM) förenar organisationens strategi med fördelningen av resurser på projekt i portföljen. Det existerar lite empiriskt bevis på användandet av agila metoder på portföljnivå, därav intresse att studera. Den höga komplexitet som portföljnivån utgör gör det svårare att skala upp agila arbetssätt.

Denna avhandling bygger på en fallstudie inom fordonsindustrin för att skapa en bättre förståelse för hur ett moget fordonsföretag hanterar den agila skalbarheten för att bli mer agila i sin portföljstyrning. En abduktiv metod användes med datainsamlingsmetoder som omfattade intervjuer, dokument och observationer. Resultatet av denna avhandling belyser bristerna med företagets nuvarande PPM, samt deras prestanda i agil skalbarhet.

Nyckelord: Agil, Agil Projektportföljstyrning, Agil skalbarhet

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Abbreviations

APPM	Agile Project Portfolio Management
R&D	Research & Development
DAD	Disciplined Agile Delivery
LeSS	Large Scale Scrum
SoS	Scrum of Scrums
SAFe	Scaled Agile Framework
SPM	Strategic Portfolio Meeting
PPM	Product Planning Meeting
PM	Portfolio Meeting
DOL	Design OnLine
PD	Product Development

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Charlott Kapic
Stockholm, June 2019

1. Introduction

This chapter aims to introduce the thesis by firstly presenting the background and problematization. The purpose and research questions are subsequently presented, followed by a description of the delimitations and expected contributions. Lastly, a brief outline of the report is explained.

1.1 Background

Emerging markets, development of new technologies, sustainability policies and change in customer demand are dramatically changing today's economies (McKinsey&Company, 2016). Globalization and greater transparency are changing the business environment more than ever before. The volatility of business operating margins has more than doubled itself since 1980 (Reeves & Deimler, 2011) and the delisting rate among public companies is six times larger than it was 40 years ago. Yet, many companies still pursue traditional approaches to strategy (Reeves, Levin, & Daichi, 2016).

Compared to small start-ups, large and well-established companies have it more difficult to adapt to the fast-changing business environment (Rigby, Sutherland, & Noble, 2018). One reason for this is that established firms struggle to manage the rapid shift to new technologies and customer requirements, and ultimately loosing market shares (Sandström, Magnusson, & Jörnmark, 2009). Large and mature organizations have it more challenging to adapt to changes due to their large size and well-established structures (Ulrich & Eppinger, 2012). Established firms are being challenged by the ever-changing environment and find it particularly hard to enforce the new requirements because they often come at the expense of existing products (Winkelhake, 2018).

One particular industry that is currently facing several changes is the automotive industry. The automotive industry is undergoing a massive transformation due to the emerging of new market needs, new technologies and changes in customer behaviour (Winkelhake, 2018) The electrification of vehicles, autonomous driving and connectivity play a key role in the transformation (Speranza, 2018). These trends highlight the fact that the automotive industry needs to reinvent itself.

Traditionally, companies in the automotive industry work according to the waterfall process model. The development in this type of model is structured in a sequence of phases without iterations. The first phase focuses on the requirements, followed by analysis, design, implementation and testing. The requirements that are defined must remain unchanged throughout the entire development process. This strategy is not appropriate for firms in the automotive industry considering today's dynamic business environment, since it is not a sufficient approach for managing rapid changes.

Furthermore, the incorporation of changes in a waterfall model usually requires a lot of time and money (Roy, Balszun, Heurung, Chakraborty, & Naik, 2018).

Due to the dynamic business environment organizations are forced to adapt new structures, strategies and policies to survive (Nerur, Mahapatra, & Mangalaraj, 2005). To deal with external changes, organizations are increasingly focusing on flexibility as a way to gain new forms of competitive advantage. Flexibility can generally be described as the company's ability to cope with uncertainty. The need for firms to develop flexibility at strategic level is crucial in order to manage changing market trends, actions of competitors and new customer demands (Singh & Sing Oberoi, 2013).

Flexibility is strongly associated with the term agility (Wells, 2014). The concept of agility emerged in the 1990s based on ideas found in product development in the software industry. Agile methods are significantly different from activities in traditional projects. They are mainly based on recurring activities such as iterative delivery of results. Compared to small businesses, larger organizations have it more challenging to adopt agile methods due to well-established structures and routines (Stettina & Hörz, 2015).

The benefits of agile methods at the team level have inspired the use of agile practices at a larger scale (Turetken, Stojanov, & Trienekens, 2016). There is an industry trend towards implementing agile methodologies at higher levels within the organization, and larger companies have specifically found the potential benefits attractive (Dikert, Paasivaara, & Lassenius, 2016). Little research exists on the impact that agile approaches have on the management of the project portfolio. Project portfolio management (PPM) connects the strategy of the organization with the distribution of resources across projects in the portfolio. These types of portfolios provide an opportunity to make companies more agile outside of small projects (Stettina & Hörz, 2015). However, due to the high complexity at the portfolio level, it becomes increasingly difficult to scale agile methods (Sweetman & Conboy, 2018). These methods are mainly considered for small co-located projects executed by individual teams and the transition from the agile project to the agile portfolio has proven to be challenging (Sweetman, O'Dwyer, & Conboy, 2014).

1.2 Problematization

The dynamic business environment is pressuring organizations to be more responsive and adaptive. Agile methods and techniques can be very effective at the project level. However, the complexity and the need for adaptiveness is significantly higher when they are applied at the project portfolio level (Sweetman & Conboy, 2018). If agile approaches are solely used at the project level, higher management can lose control over projects due to the misalignment between the business strategy and the prospects of the projects (Stettina & Hörz, 2015).

There exists abundant research on agile project management and the interest of it continues to grow. However, there is little empirical evidence on the agile methods performed in PPM (Stettina & Hörz, 2015; Sweetman & Conboy, 2018). Due to the lack of research in this field it is of interest to study different approaches to scale agile to the portfolio level. Furthermore, on the basis of current trends and changes in the automotive industry and the fact that larger organizations have it more difficult to respond to changes (Winkelhake, 2018), this study has been conducted at a large and well-established firm within the automotive industry.

1.3 Purpose

The purpose of this thesis is to gain a better understanding of how a mature automotive company can manage the agile scalability to become more agile in their project portfolio management.

1.4 Research Question

The purpose of this report will be answered through the following research question.

RQ: How can a mature industrial company become more agile in their PPM?

In order to answer the main research question, two sub-questions have been developed.

rq1: What major deficiencies exist within the company's current PPM?

rq2: What critical factors need to be taken into consideration to facilitate the agile scalability?

1.5 Delimitations

In order to achieve the purpose of this thesis during the limited time of four months, this study was delimited. The study focuses on the project portfolio of the product development at the R&D department at the case company.

1.6 Expected Contribution

Agile project portfolio management (APPM) is a relatively unexplored territory for research. Existing literature emphasizes the challenges of incorporating agile methods into project portfolio management. However, not many have given special attention to how to achieve it. There exist different approaches to scaling agile in organizations, but its connection to PPM is not as well-written in literature. Due to the lack of research in this field, this thesis contributes to existing literature by filling this gap (Alvesson & Sandberg, 2011).

1.7 Disposition

Chapter 1: Introduction

This chapter aims to introduce the thesis by firstly presenting the background and problematization. The purpose and research questions are subsequently presented, followed by a description of the delimitations and expected contributions. Lastly, a brief outline of the report is explained.

Chapter 2: Methodology

This chapter aims to describe the research method of the study. Firstly, a brief explanation of the research design is outlined. Secondly, an extensive description of the methods that were used for the data gathering and analysis is presented, followed by a discussion about the quality of the data collected. Ethical considerations are highlighted at the end of the chapter.

Chapter 3: Literature Review

This chapter presents existing literature on the topic of this thesis. It begins by explaining traditional approaches to project portfolio management, followed by an introduction to agile within projects and at the portfolio level. Lastly, common denominators across APPM literature are outlined.

Chapter 4: Findings

This chapter presents the results of the empirical material obtained through the different data gathering methods, including interviews, observations and documents. An analytical framework comprising two major categories is used to enable guidance for the reader.

Chapter 5: Discussion

This chapter aims to analyse and discuss the findings of this thesis. The chapter begins by presenting challenges with the company's current PPM, followed by a discussion about the APPM at the company where focus lies within the two major categories presented in Chapter 4.

Chapter 6: Conclusion

This chapter aims to summarize the discussion of the thesis in order to answer the research question. The first two sub-questions are answered, followed by the main research question. Suggestions for future research are presented at the very end of this chapter.

2. Methodology

This chapter aims to describe the research method of the study. Firstly, a brief explanation of the research design is outlined. Secondly, an extensive description of the methods that were used for the data gathering and analysis is presented, followed by a discussion about the quality of the data collected. Ethical considerations are highlighted at the end of the chapter.

2.1 Research Design

The study is founded in the interpretivist paradigm, where there is a belief that social reality is shaped by people's perceptions, thus highly subjective (Collis & Hussey, 2013). The study fell naturally under this paradigm as the findings were derived from qualitative methods. Furthermore, the study has produced results with low reliability, but high validity, which is a typical feature of interpretivism (ibid).

Due to the lack of knowledge in the research field, an exploratory research approach was chosen. An exploratory purpose entails a subject that has not previously been scientifically studied to any great degree (Blomkvist & Hallin, 2015). To fully take advantage of existing theory and the empirical data collected, an abductive approach was chosen, meaning that the author seeks explanations for the empirical data in the literature, and vice versa (ibid).

A case study was conducted at a company within the automotive industry in order to make the thesis question researchable. Additionally, a case study is an appropriate tool in early phases of new theory, when relationships and variables are being explored (Gibbert, Ruigrok, & Wicki, 2008). Due to the lack of knowledge in the research field, a case study was chosen. Case studies are associated with interpretivism (Collis & Hussey, 2013), thus another reason it fell into that paradigm. The company can be considered traditional, thus interesting case for the chosen topic of this thesis.

Figure 1 shows an overview of how the study was conducted. The activities on the y-axle have been classified according to colour where blue represents the period of data gathering, green refers to the period of analysis, yellow illustrates the writing process and the red column represents the final preparation for presentation.

Each activity was conducted iteratively throughout the research process. In the gathering and analysis of documents and observations, the author began with observations, followed by documents as a complement.

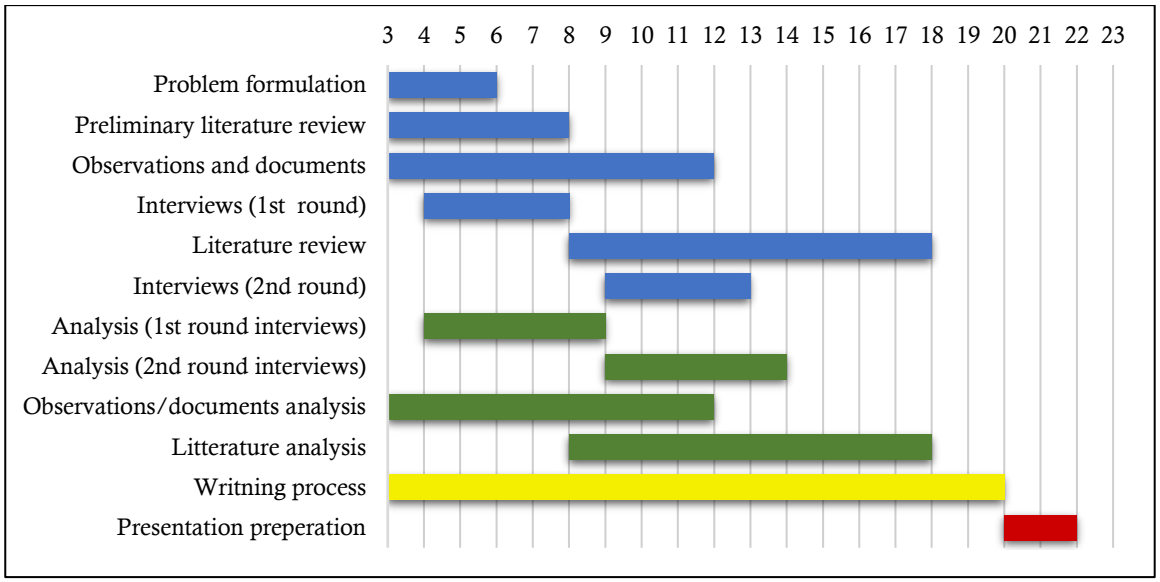

Figure 1. *Research process.*

2.2 Methods for Data Gathering

The data gathering method used in this study includes three types of techniques: interviews, observations and documents. The author of this thesis has applied all three of them, thus used a methodological triangulation. Triangulation of different data sources is claimed to add to the validity of the study (Creswell, 2014). Before these techniques are depicted, the approach to the literature review is first presented.

2.2.1 Literature Review

The literature review was conducted to compile existing body of knowledge relevant to the purpose of the thesis. The literature review is based on previous research on both traditional and agile project portfolio management, as well on agile scaling frameworks. The search for literature on each topic followed an approach similar to snowball sampling, where a subject recruit future subjects among their social network (Collis & Hussey, 2013). In this case, the author followed references in articles in order to find more articles about the topic. To avoid getting too narrow, the author ensured to add new keywords in the search engines.

The gathering of literature was based on the search of keywords on KTH Online Library and Google Scholar for published articles and reports. Books were used as a source of data as well. Examples of keywords that were used are: *project portfolio management, agile, agile project portfolio management, agile scaling frameworks* and *multi-project management*.

The collected sources of data were subsequently rated based on their relevance to the study. They were listed in an Excel-sheet and rated according to colour: green (high relevance), yellow (medium relevance) and red (low relevance). The green sources were gone through in great detail, while those of the yellow and red where, more or less, skim-read. This approach enabled structure and clarity in the process.

2.2.2 Interviews

The interviews were conducted in two different phases. The first phase was based on unstructured interviews which generally involves open-ended questions that are few and intended to evoke thoughts and opinions from the interviewee (Creswell, 2014). According to Blomkvist & Hallin (2015) it is suitable to conduct these type of interviews in the beginning of an empirical study since they enable an unbiased desire to explore a subject field.

The second phase was based on semi-structured interviews. This method was chosen since the objective was to collect soft data in a way where control could be maintained. To avoid the interviewer's frame of reference being imposed, an interview schedule is appropriate (Blomkvist & Hallin, 2015).

To increase the richness of the data different approaches were used to push the interview forward. One approach was to allow moments of silence. According to Blomkvist and Hallin (2015) being silence gives the interviewee the opportunity to reflect upon his or her answers, and that is when the most interesting statements emerge. By nodding and repeating what the informant is saying is another approach that was used in order to push the interview forward (ibid)

All interviews were conducted with one person at a time, face-to-face, during different occasions. A face-to-face approach is considered advantageous since comprehensive data can be collected, as well as it can be useful if sensitive questions need to be asked (Collis & Hussey, 2013). Furthermore, all interviews were audio recorded with the consent from the participants. However, it is not recommended to collect information by solely recording. The interviewer was taking notes in parallel with the recording since it made it easier to follow up on the information that was given (Blomkvist & Hallin, 2015). Also, to secure as much data as possible, pictures where taken on drawings made by the participants (Denscombe, 2010). The information about the conducted interviews are shown in Table 1.

Table 1. *Information about the conducted interviews.*

Interview	Position	Length [min]
A	Senior Agile Coach	40
B	Technical Project Manager	60
C	Scrum Master & Agile Coach	100
D	Head of Modularisation	45
E	Project Manager	40
F	Head of Body Builder System	40

G	Head of Air Management	30
H	Business Developer	40
I	Head of Simulation & Test Support & Safety Systems	30
J	Project Manager	40
K	Sub-Project Manager	35
L	Senior Engineer	50
M	Senior Manager	30
Total	**13 interviewees**	**580**

The selected interviewees are mainly working with software at the company. To gain a better and truthful understanding of the subject in study, the author sought to create a spread among the interviewees. This was achieved by selecting participants from different divisions and levels of the R&D department.

2.2.3 Observations

During the thesis process, observations were made to gain understanding of people's daily behaviour and routines at the research site. The author of this thesis took a participant-as-observer role during observations in which the observer develops relationships with the objects of study through time. This role was chosen since the author of this thesis was visiting the case company three to five days a week, for four months. The observer-as-participant is relatively more formal and often used in studies involving one-time visits, thus neglected in this study (Denscombe, 2010).

The observations were mainly done during meetings in order to gain insights on the decision-making process, but also to gather interesting questions that were later raised during the interviews. The types of meetings attended are depicted in Table 2. To collect as much information as possible in the fixed time frame, ethnographic interviews were conducted throughout the study, which are interviews that arise spontaneously during observations. These interviews would mainly take place during meetings, lunch or coffee breaks (Blomkvist & Hallin, 2015).

Documenting the observations systematically is of the utmost importance as this is a matter of scientific legitimacy. Due to this, the documentation of the observations followed a first and second order of construct. The first order of construct refers to the things that are seen and heard and the second order of construct are the observer's own reflections concerning the things that have been seen and heard (Blomkvist & Hallin, 2015). Field notes where taken during observations, both on paper and digitally on a computer.

Table 2. *Information about the meetings for observation.*

Observation	Meeting	Length	Date
A	Section Heads & Group Meeting	60 min	2019-02-05
B	Sub-Sector & Section Heads Meeting	45 min	2019-02-08
C	Central Pulse Meeting	60 min	2019-02-11

2.2.4 Archival data

Archival data include documents, photographs, email exchanges and other artefacts (Shah & Corley, 2006). Various documents were collected from the case company. The author of this thesis also had access to the intranet of the case company during the entire research process where information was gathered. The information collected was used for analysis, but also as a complement to the interviews.

2.3 Methods for Data Analysis

As this thesis has used a methodological triangulation, a more accurate and complete understanding about the phenomenon is acquired (Boyer & Swink, 2008). Thus, the outcomes of the different data gathering methods are intertwined in the presentation of the data analysis, rather than displayed separately.

The data analysis was based on interviews, observations and various documents collected at the case company. In qualitative studies, the analysis and collection of data are overlapping, rather than executed separately after one another (Collis & Hussey, 2013). Thus, the gathering and analysis of the data were initiated simultaneously. Each interview continued to the transcribing stage as soon as it was conducted. In this stage, recordings of the interviews were listened to and documented thoroughly before being analysed.

The analysis of the transcript material included coding, where the qualitative data is separated, compiled and organized (Shah & Corley, 2006). A deductive approach to code the qualitative data was used, in which categories are derived from the literature. Subsequently, codes were created based on these categories and used in the coding of the empirical data.

2.4 Data Quality

Evaluating the data used in a research study can be done in several ways. One way to assess the accuracy of field research is through three criteria: internal validity, external validity and reliability (Gibbert, Ruigrok, & Wicki, 2008).

2.4.1 Validity

Internal validity refers to the data analysis phase, specifically to the causal relationship between what has been studied and the results of the analysis. There exist several measures to increase the internal validity, pattern matching and triangulation are two of them (Gibbert, Ruigrok, & Wicki, 2008). There is no way to ensure internal validity of the data gathered, but actions can be taken to increase it. Triangulation can be motivated to be achieved as this study applies several methods, such as interviews, observations and documents, to verify the same phenomenon.

External validity, also called generalizability, is founded in the belief that the results of a study can be used to predict other settings. There exist two types of generalisabilities: statistical and analytical. To achieve a statistical generalizability, more than one or several case studies is required (Gibbert, Ruigrok, & Wicki, 2008). Likewise, to achieve an analytical generalizability, a cross-case analysis of four to ten cases if often required (Eisenhardt, 1989). Due to the high number of cases needed, and that this study focuses on solely one case, it can be argued that the thesis has low external validity. However, it is of importance to recognize that this thesis provides a more in-depth research, which can be of interest in similar cases.

2.4.2 Reliability

Reliability refers to the absence of random error, specifically to what extent a study's operations can be repeated and result to the same conclusions (Gibbert, Ruigrok, & Wicki, 2008). Whereas reliability usually is high in positivist studies, it can be interpreted differently under an interpretivist paradigm. As it is believed that the researcher influences the study under an interpretivist paradigm, replication would be difficult to achieve (Collis & Hussey, 2013). That would require repeating of interviews and observations, in a constantly changing environment. Thus, the conducted case study has low reliability. According to Collins & Hussey (2013), reliability is also of little importance in qualitative studies.

2.4.3 Ethical Considerations

The author of this thesis has taken ethical considerations into account throughout the working process. Attention has been paid to the four ethical requirements presented by the Swedish Research Council (n.d.) and the ten principles of the Code of Honour of the Swedish Association of Graduate Engineers (n.d.).

During this study, ethical considerations have been addressed across two dimensions, theoretical and practical. In order to gather credible information to the theoretical framework of the thesis, careful evaluation and selection of sources have been made based on several factors, such as the source's publisher, the time it was published, its relevance to this research and its initial purpose. Sensitive information, such as the names of the interviewees and the case company itself, has been left out to avoid

leakage (Collis & Hussey, 2013). This was done with respect to the confidentiality agreements with the company.

The practical dimension of the research process included several interviews with individuals from different parts of the R&D department at the company. All interviewees in the study received information regarding the purpose of the study and how the collected data and information would be used in the paper. Before conducting the interviews, the interviewees had to give their consent to participate in the interview. Furthermore, they needed to approve whether they could be recorded or not. All the collected data and information were treated confidentially and for the purpose that the respondents gave their consent to.

3. Literature Review

The following chapter presents existing literature on the topic of this thesis. It begins by explaining traditional approaches to project portfolio management, followed by an introduction to agile within projects and at the portfolio level. Lastly, common denominators across APPM literature are outlined.

3.1 Project Portfolio Management

Project portfolio management (PPM) is a well-established topic in today's literature and has gained a central position in project management (Meskendahl, 2010). Project management refers to doing the projects right, while portfolio management refers to doing the right projects (Cooper, Edgett, & Kleinschmidt, 2000). There exist many definitions for it, one way to define it is as follows (Moustafaev, 2016):

> *"Project portfolio management is the management of the organization's projects so as to maximize the contribution of projects to the overall welfare and success of the enterprise subject to internal and external constraints by maximizing the project value, balancing the portfolio and aligning it with the overall company strategy."*

Project portfolio management (PPM) is a centralized approach (Kerzner, 2014) that has gained a significant role in the way companies manage their product development efficiently and effectively (Martinsuo, 2012). It helps companies to determine the right mix of projects and it ensures that they are spending their limited resources in the best way possible (Kerzner, 2014). It is also used to maintain the business's competitive position, forge the link between project selection and business strategy and maintain the right balance of projects within the portfolio (Cooper, Edgett, & Kleinschmidt, 2000). PPM encompasses the aggregation of costs, risks and returns of the projects within the portfolio, along with an analysis of the trade-offs among them (Kerzner, 2014).

There are three main goals of PPM (Meskendahl, 2010):

1. The projects must maximize the financial value of the portfolio.
2. The portfolio must be aligned with the firm's strategy.
3. Balancing the projects within the portfolio in consideration of the firm's capabilities.

There are a number of factors that should be considered when determining what projects to start and the appropriate sequence. Kerzner (2014) presents in his book some of the important decision criteria to consider:

- Strategy priority – the level of importance to stakeholders and organizational leadership.
- Window of opportunity – some projects need to be executed and completed within a certain period of time in order to gain the desired benefits.
- Project interdependencies – ensure that all dependencies between projects are identified, such as timing of decisions and budget cycle.
- Resource availability – a projected should not be started until the required resources are available.
- Risk – the level of risk that a project undertakes is very important to consider. High-risk projects should be monitored more closely. Strive for a good balance of high-risk projects and low-risk projects.
- Change – embrace novelty and the amount of change to be introduced when undertaking the projects.
- Cost/Benefit – identify which projects will provide the most benefits for the lowest cost.

To achieve a well-functioning portfolio management is not as easy in practice, as it is in theory. The challenges in portfolio management have been addressed by many researchers. Cooper et al. (2000) highlights four main challenges in portfolio management. The first challenge is resource balancing, which will be presented in more detail in the next chapter section. He claims that management often has difficulty in balancing the desired resources with resource availability. The second challenge emphasized by Cooper et al. (2000) is the prioritization of projects against one another. The difficulty to identify if a project is worthwhile doing in its early days often leads to initiating too many projects. The third challenge refers to the absence of reliable data when making go/kill decisions. The last, and fourth, challenge highlighted (ibid) is the existence of too many minor projects in the portfolio. He claims that there is a lack of larger projects that harvest significant technical and financial breakthroughs.

3.1.1 Resource allocation

The primary theme discussed in multi-project management literature is the issue of allocating resources between projects. It is often described to be a constant competition between different projects regarding personnel and resources (Engwall & Jerbrant, 2003). Traditional approaches to project management considers projects working in isolation. However, in a multi-project environment the majority of the projects compete for the same resources, meaning interrelationships between organizations, individuals and projects need to be realized. A multi-project environment involves new disagreements and conflicts when projects compete against each other for scarce resources that need to be resolved (Laslo & Goldberg, 2008). Many researchers have suggested that the main reason for low completion rates of projects is related to resource deficiencies (Blichfeldt & Eskerod, 2008). The problems concerning resource allocation have been discussed extensively across project management literature. Engwall and Jerbrant (2003) refers to these issues as the *resource allocation syndrome* and

argue that organizations may suffer from this syndrome due to several reasons, such as poor project scheduling, over commitment (i.e. too many projects in relation to available resources) and opportunistic project management behaviour. As multi-project environments become more dynamic, resource allocation becomes increasingly important, especially the allocation of human resources. Human knowledge is considered the most significant and scarce resource in R&D organizations, but also one of the most difficult to manage (Hendriks, Voeten, & Kroep, 1999). There are two fundamental success factors in allocating staff to projects and teams. Firstly, it is of high importance to assign a sufficient proportion of the employees to projects on a full-time basis. Secondly, no individual should ever be spread out among a large number of projects and other tasks due to the great risk of inefficiency and reduction of cooperation between teams (Sebestyén, 2017). Being involved in many projects at the same time often become a burden to people due to project overload. Project overload is associated with poor time schedules, high levels of psychological stress and decreased competence development (Zika-Viktorsson, Sundström, & Engwall, 2006).

The challenge in managing and balancing between resource needs involves the gathering and integration of information of the current status of the company. Decisions made in resource management are based on gathered information, generated at the project and program level. It is often required that the information is in great detail, meaning high level information and status awareness. Resource conflicts is often related to information known in projects and that does not reach the portfolio level, thus the unknown information inhibits the identification of resource inefficiencies. In practice, managing resource information in a multi-project environment is a challenge that many organizations struggle with. Therefore, it is important to ensure that information is quickly collected and compiled to enable effective decision-making (Abrantes & Figueiredo, 2015).

3.1.2 Transparency

Transparency of resources is considered of high importance in the pursue of an agile portfolio management as it increases trust among co-workers and improves decision-making (Stettina & Hörz, 2015; Krebs, 2008; Leffingwell, 2007). Furthermore, it can help in improving collaboration between the different roles within a portfolio. Traceability of resources as an enabler for transparency is a recurring theme in literature (Stettina & Hörz, 2015).

Previous research also advocates for one portfolio for the entire organization. However, literature does not reject having multiple portfolios within an organization, instead it emphasizes the risk of untransparent allocation of resources that multiple portfolios engender (Stettina & Hörz, 2015). Cooper et al. (1999) came to the conclusion that the usage of high quality rated portfolio methods fit management well and one of these methods was proven to be the management of all projects as one portfolio.

In addition to projects, companies tend to start other initiatives that consume from the same pool of resources as the projects. One example of such initiatives can be the maintenance of projects. It is therefore of high importance to group other initiatives within the portfolio in order to keep invisible projects away from draining resources originally assigned to the portfolio. Not doing so have shown to decrease transparency and cause great frustration among workers within an organization (Stettina & Hörz, 2015).

It is argued that project visibility can have great influence on the effectiveness of a portfolio. Projects with high visibility refers to its stakeholders being well aware of its existence, status and problems. High visibility can lead to better support from stakeholders, increased effort and commitment of project teams and effective resource sharing on both project and portfolio level. Furthermore, visible information about projects can also facilitate portfolio decisions, thus effectiveness is easier to achieve. Methods of making decisions can be secretive, however, ultimate decisions and the reasons behind them must be transparent. This kind of transparency reflects the integrity in decision-making and encourages a unified and morale organization (Patanakul, 2015).

3.2 Agile

The history of the term *agility* first began in the area of manufacturing. The term was used as a concept and often referred to as *agile manufacturing*. The concept received great attention and was explored from different perspectives. One of those perspectives observed agility at the organizational and strategic level. Ultimately, in early 1990, agility emerged in the project management literature, mainly illustrated in studies involving software development projects. One of the milestones for the dissemination of the term agility in the area of software was the Manifesto for Agile Software Development (Conforto, Amaral, Da Silva, Di Felippo, & Kamikawachi, 2016). The Agile Manifesto was formulated by seventeen software practitioners in order to find a common ground for their viewpoints (Hazzan & Dubinsky, 2014). This resulted into four statements:

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

According to the first statement, one of the first considerations that should be taken into account when making a decision related to the development process, is the impact of the decision's outcome on the employees working in that environment. The second statement highlights the importance of focusing on the main target of software projects, that is to produce quality software products, and to only document essential information. According to the third statement, the perception of the customer role changes in such a way that it becomes significantly important in guiding the projects

in the right direction. Close contact with the customer on a daily basis enables to cope successfully with the frequent changes that characterize agile projects. The fourth, and last, statement considers establishing a process that can easily manage changes that are continuously emerging throughout the development process (Hazzan & Dubinsky, 2014).

Agile methods are deeply rooted in these statements (Cervone, 2011) and have become increasingly common in projects since they address the challenges often associated with dealing with dynamic projects and changing environments. Compared to traditional project management, agile methods are built as to minimize documentation in order to facilitate flexibility and responsiveness (Serrador & Pinto, 2015). From the statements provided by the Agile Manifesto above, there are twelve agile principles that supports them (Measey, 2015):

1. Our highest priority is to satisfy the customer through early and continuous delivery of valuable software.
2. Welcome changing requirements, even late in development. Agile processes harness change for the customer's competitive advantage.
3. Deliver working software frequently, from a couple of weeks to a couple of months, with a preference for the shorter timescale.
4. Businesspeople and developers must work together daily throughout the project.
5. Build projects around motivated individuals. Give them the environment and support they need, and trust them to get the job done.
6. The most efficient and effective method of conveying information to and within a development team is face-to-face communication.
7. Working software is the primary measure of progress.
8. Agile processes promote sustainable development. The sponsors, developers, and users should be able to maintain a constant pace indefinitely.
9. Continuous attention to technical excellence and good design enhances agility.
10. Simplicity – the art of maximizing the amount of work not done – is essential.
11. The best architectures, requirements and designs emerge from self-organising teams.
12. At regular intervals, the team reflects on how to become more effective, then tunes and adjusts its behaviour accordingly.

There are several approaches to implementing agile methods within an organization, Scrum is one of them and also very common. In simplicity, it is an agile, lightweight and iterative process for managing and controlling software and product development in fast changing environments. The iterative process enables control and communication, as well as protecting teams from distractions and impediments (Cervone, 2011). A more thorough description of Scrum is depicted in the next chapter section below.

3.2.1 Scrum

Scrum is an agile method, retaining its roots as a product development process. It focuses more on project management, rather than on the details of coding procedures (Beyer, 2010).

Scrum consists of three important components; roles, process and artefacts. The roles involved are the Scrum master, the development team and the Product owner. The Scrum master can be perceived as a project manager responsible for enacting the Scrum values and practices, acting as a "peace mediator". The team is self-organizing and guided by the Scrum master. The Product owner is usually a functional unit manager who understands what needs to be produced and in what sequence (Cervone, 2011).

The last two major components of the Scrum model are the process and the artefacts including the product backlog and the sprint backlog. The development process in Scrum is organized around *sprints*. Before the sprint is begun, a sprint planning meeting is held to define the product backlog. A product backlog can be seen as a list of project requirements (Cervone, 2011), where each requirement is a unit of work to be completed within a sprint, also called *user stories*. Each sprint is approximately a month long and starts with the prioritization and selection of user stories to be executed during the sprint. This phase is the creation of the sprint backlog. It is of high importance to consider the team's capacity and only select as many stories that can be completed by the end of the sprint. Tasks are created based on the chosen stories, and then executed. At the end of each sprint, there is a review of the results obtained with the product owner and other stakeholders (Beyer, 2010).

3.3 Agile Project Portfolio Management

The emergence of agile project management revolutionized the way projects are organized and executed (Stettina & Hörz, 2015). The integration of agile methods in project management has shown to be very successful in terms of speed and adaptiveness, therefore many companies have used agile project management to cope with the challenges associated with traditional project management (Azanha, Argoud, Camargo Junior, & Antoniolli, 2017). Agile methods can be extremely effective at the project level, whereas they impose significant complexity at the portfolio level. This is due to the increased number of interactions caused by the need for reconciliation between customer needs and organizational strategy. Furthermore, due to the inherent autonomy and flexibility of agile projects implications arise at the portfolio level. Greater coordination between the projects is needed to ensure alignment with the overall business strategy. In addition, the need for adaptiveness at the portfolio level increases with the usage of agile approaches (Sweetman & Conboy, 2018). Figure 2 provides an illustration of the impact that agile projects have on the portfolio level. The graph on the left side shows the relationship between the portfolio and plan-driven projects, which is very stable. The graph on the right side with agile projects, however,

shows the opposite. Insufficient coordination and control between projects result in a disjointed and incoherent project portfolio.

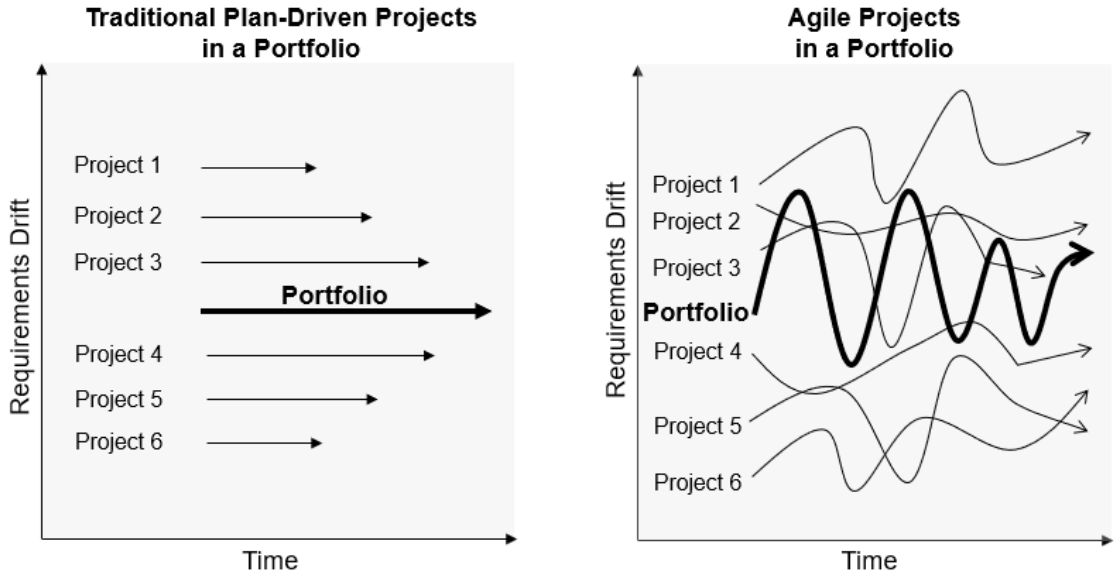

Figure 2. *Differences between portfolios of plan-driven projects and agile projects (Sweetman & Conboy, 2018).*

Traditional approaches to project portfolio management mainly describe it as a linear process of steps where the projects are *identified*, *prioritized*, *allocated*, *balanced* and *reviewed*. The inherent flexibility and the iterative nature of agile methods might affect existing practices of portfolio management. Recent studies argue that the current approaches to PPM are not sufficient enough to cope with the current complex setting of project work (Stettina & Hörz, 2015). The success of individual projects has improved with the adoption of agile practices, however, this has not led to improvements at the portfolio level (Sweetman & Conboy, 2018).

There exist different frameworks and approaches to agile project portfolio management, some more mature than others. However, researchers have yet not found a common ground for APPM and the existence of empirical evidence is lacking. Some researchers have made attempts in describing agility in portfolio management (Vähäniitty, 2012; Krebs, 2008; Leffingwell, 2007). These are portrayed in the next section below.

3.3.1 Frameworks

While the iterative nature of agile methods is not completely compliant with the established portfolio management literature, there have been some attempts to describe agile methods in project portfolio management. For example, one approach proposed by Krebs (2008) suggests a dynamically managed portfolio based upon agile principles. According to this approach, the portfolio management is divided into project, resource and asset portfolio management. He further emphasizes the need for

a project management office and a dashboard to assess and monitor the situation of the portfolio. He states that one of the key factors to agile portfolio management is transparency (Sweetman, O'Dwyer, & Conboy, 2014). The challenges addressed by Krebs (2008) are mainly related to the large number of projects, the unbalanced mix of projects and the lack of resources.

Another approach to agile portfolio management can be found in the dissertation of Vähäniitty (2012). He discusses agile product and portfolio management in the context of small software organizations by promoting a framework based on three key processes; development portfolio management, product road mapping and release planning. He concludes that the establishment of an agile portfolio is built on three steps. Firstly, visible prioritized lists of current activities need to be established. Secondly, it is of high importance to ensure that incentive systems do not promote local optimization. Thirdly, a steering committee should be appointed to decide upon project prioritization and resources (Stettina & Hörz, 2015). In his dissertation he remarks on the importance of controlling the workflow through *floating backlogs.* The term 'floating' in this context means that the backlog is not related to any specific business area or time horizon. Instead, it refers to a prioritized list of tasks merged from product/release backlogs of multiple business areas (Vähäniitty, 2012).

Other frameworks to agile portfolio management advocate scaling agile practices to the entire organization, all the way up to the portfolio level. These models and frameworks have emerged in recent years and become of large interest of the agile community (Laanti, 2014). Current models for scaling agility vary in maturity and their suitability depends on the size of the organization. Examples of frameworks are Scaled Agile Framework (SAFe), Large Scale Scrum (LeSS), Scrum of Scrums (SoS) and Disciplined Agile Delivery (DAD), where SAFe, LeSS and SoS are considered more mature (Kalenda, Hyna, & Rossi, 2018).

The Scaled Agile Framework (SAFe) proposed by Dean Leffingwell (Alqudah & Razali, 2016) is a collection of practices of agile development for large enterprises and it is structured and built upon agile development, lean product development and systems thinking (Scaled Agile Inc., 2019a). It is a complex framework that provides a large set of templates and process elements (Ebert & Paasivaara, 2017), and it is suitable for any size of organization. The SAFe architecture is based on four levels: Portfolio level, Value Stream level (also called Large Solution), Program level and Team level. The Portfolio level guides the company in a strategic direction. The Program level implements the strategic goals by managing and supporting agile teams within the organization. The Team level is the lowest level in the architecture and it describes how agile teams work with agile practices such as Scrum, Kanban and XP techniques in the product development process (Kalenda, Hyna, & Rossi, 2018). Initiatives taken at the portfolio level, so called *epics*, are found in the portfolio backlog and decomposed to *capabilities* (value stream backlog), then further divided into *features* (program backlog) and all the way down to the team level where they are called *stories* (team backlog). The teams are constantly pulling tasks from upper levels of the

enterprise (Scaled Agile Inc., 2019a). These backlogs are claimed to ensure strategic alignment within the organization (Stettina & Hörz, 2015). Early adopters of the Scaled Agile Framework have reported considerable improvements in terms of productivity and quality (Laanti, 2014). An overview of SAFe is shown in Figure 3 below.

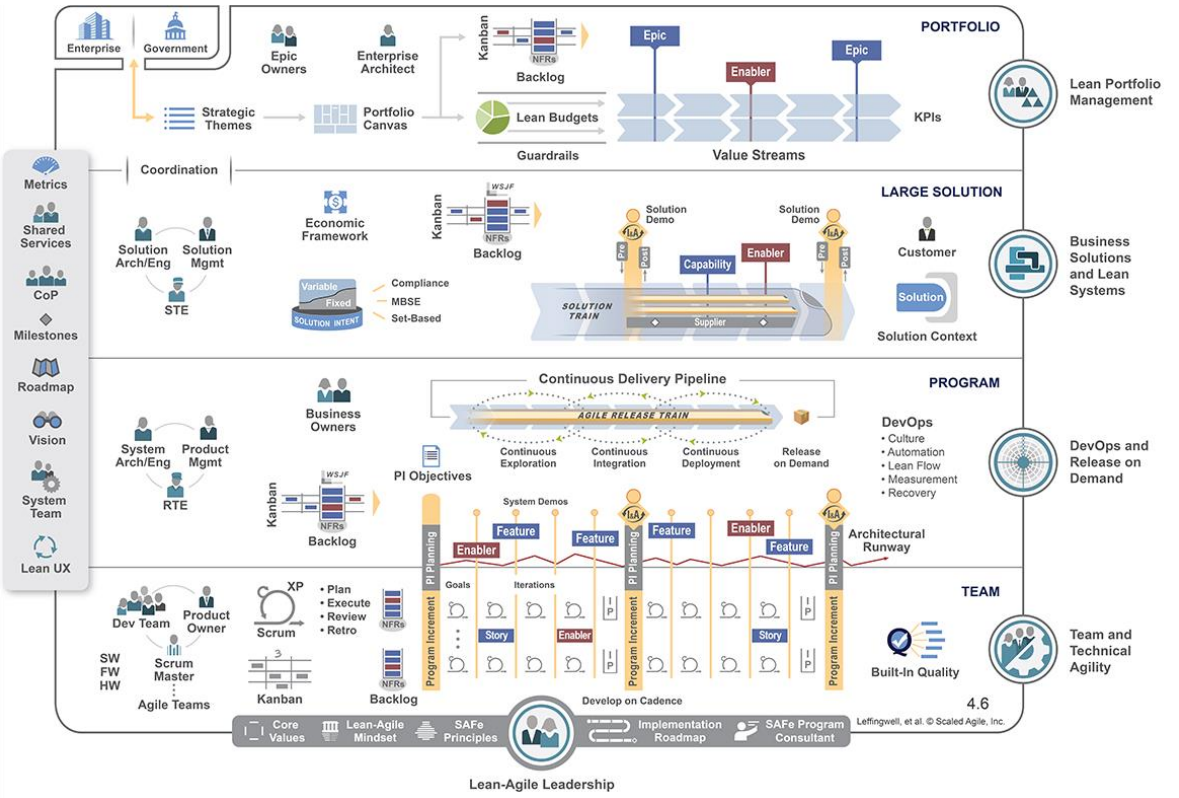

Figure 3. *The Scaled Agile Framework (SAFe) (Scaled Agile Inc., 2019a).*

One vital factor to consider in the adoption of SAFe is to educate and train personnel well in advance. It is also important to inform and engage people in the transformation from the beginning to ensure that everybody understands the reason for change and its importance to the organization, especially managers. The lack of communication at the start of the transition can impose great challenges further down the road (Scaled Agile Inc., 2019a).

Large Scale Scrum (LeSS) is a framework based on applying the principles, purpose, elements and elegance of Scrum in a larger context (Larman & Vodde, 2016). Compared to SAFe, it is much more lightweight as there is no need for overcomplicated processes. It is less strict in the descriptions of practices and emphasizes the mindset and values of agile to a greater extent (Kalenda, Hyna, & Rossi, 2018).

The different scaled agile frameworks consider diverse aspects of agility, therefore it may be difficult fully comprehend its core purpose. Laanti (2014) provides a list of scaled agile principles, derived from studying several agile scalable models. The list

contains 21 principles and can be seen in Table 3 together with an explanation of each principle.

Table 3. *Principles of Scaled Agile (Laanti, 2014).*

	Principle	**Explanation**
1.	The content is the key	Use feedback from user and the intrinsic knowledge to create best possible results.
2.	Co-creation	Collaborative groups solve problems faster than individuals.
3.	Feedback the fuel learning	Use rapid feedback on all results.
4.	Business Agility	Releases generate revenue.
5.	Use of Automation as Leverage	Use automation to leverage the manual effort needed.
6.	Scale Using Fractals	Fractals are nature's way to scale. Use higher abstraction levels.
7.	Avoid Combinatorial Explosions	Cope with complexity by splitting it up to smaller pieces.
8.	Sequence for maximal throughput	Find the maximal throughput for the portfolio by identifying what can be done in parallel, and what must be done in sequence.
9.	Appreciate deep knowledge	It requires more than five years to create deep knowledge. Use experts to tackle the most difficult problems.
10.	Work levelling	Create an even workload and eliminate unnecessary work and waiting time.
11.	Simplicity	Seek simplicity in solutions.
12.	Situationality	Avoid making processes overly complex.
13.	Control process, not items	Create simplicity for decision-making instead of controlling each decision individually.

14.	Growth mindset	View failures as a source of success and always improve what originally created success.
15.	Listen to employees, they know all the problems	Understand the problem needed to be solved. Value is created in the front-line.
16.	Detect and use patterns	Many problems have probably already been solved by someone and somewhere, leverage that.
17.	Cost innovation	Do not tie capital, allow flexibility in investment at the portfolio level.
18.	Utilize tacit knowledge	Use tacit knowledge to ensure that the direction is the right one.
19.	Learning happens between teams	Create collective knowledge that share the same vision an ambition.
20.	Fast is better than perfection	Tolerate small imperfections, fast is better than perfection.
21.	Prevent problems when small	Do not ignore small problems, they can grow and become real challenging.

Scaling agile in large organizations with well-established structures and routines pose several challenges. Previous research highlights problems in coordination and communication between teams, adoption with the organizational structure and understanding agile concepts along the value chain. In particular, resistance to change and weak management play a big role in the success of adopting new scaling practices. In general, training personnel, communicating and engaging people in the process are found to be success factors in case studies related to agile scalability (Kalenda, Hyna, & Rossi, 2018).

3.3.2 SAFe at the Portfolio Level

As mentioned earlier, the Scaled Agile Framework (SAFe) is one of many frameworks for scaling agile within an organization. Out of the frameworks for scaling agility, SAFe is considered as one of the more mature ones (Kalenda, Hyna, & Rossi, 2018). Even though empirical evidence of the results of SAFe is lacking, it has been reported to bring considerable improvements in terms of productivity and quality (Laanti, 2014). As stated earlier, the Scaled Agile Framework consists of four levels; team,

program, value stream and portfolio (Kalenda, Hyna, & Rossi, 2018). This chapter aims to describe the portfolio level in more detail.

The portfolio level contains practices, roles and principles that concerns strategic direction, investments, agile and lean practices. It contains the people and processes required to develop solutions that the organization needs to meet its strategic objectives. This level aims to align the enterprise strategy with the execution of the portfolio (Scaled Agile Inc., 2019b).

One SAFe portfolio to govern the entire solution set is adequate for small and medium sized enterprises. However, in larger organizations multiple portfolios are required, typically one for each line of business. The SAFe framework aims to build a lean portfolio. The main reason for this is that traditional approaches to portfolio management inhibit innovation in the organization and they are not sufficient enough to cope with higher degree of uncertainty (ibid).

To achieve a Lean Portfolio Management (LPM) there are three essential collaborations needed to be realized; strategy and investment funding, agile portfolio operations and lean governance (ibid). Each collaboration and its core activities are shown and described in Table 4, 5 and 6. Explanations of terms found in the tables below are portrayed in Appendix A. The explanations of SAFe vocabulary in Appendix A are taken from Scaled Agile Inc. (2019a).

Table 4. *Core activities within Strategy and Investment funding (Scaled Agile Inc., 2019b).*

Strategy and Investment Funding	
Activity	**Description**
Connect the Portfolio Strategy to the Enterprise Strategy	The portfolio strategy is connected to the enterprise strategy by Strategic Themes (see description in Appendix A) and the budget.
Maintain a Portfolio Vision	The Portfolio Canvas defines the strategy for the portfolio. It provides critical inputs to the Portfolio Backlog and Lean Budgets (see Appendix A).
Fund Value Streams	The funding for value streams is based on Lean Budgets. These budgets are supported by so called Guardrails that consists of spending policies, guidelines and practices for a specific portfolio. These reduce friction, delays and overhead.
Establish Portfolio Flow	Balancing the work originating from the portfolio with the capacity of the Agile Release Trains (ART) (see Appendix A).

Table 5. *Core activities within Agile Portfolio Operations (Scaled Agile Inc., 2019b).*

Agile Portfolio Operations	
Activity	**Description**
Coordinate Value Streams	Although several value streams can operate independently, coordination is still needed. A more detailed description of the coordination can be found in Appendix X.
Support Program Execution	Transforming the traditional PMO (Program Management Office) to an agile PMO (APMO). The APMO is usually responsible for communicating the change vison, leading the move to milestones and fostering more agile contracts between suppliers and customers.
Drive Operational Excellence	The APMO (or by proxy, LPM) has a leadership role in helping the firm achieve its goals. This leadership is supported by a Lean-Agile Center of Excellence (LACE) that provides suggestions on how to implement SAFe practices. LACE is continuously helping the company through the organizational changes in becoming a Lean-agile enterprise.

Table 6. *Core activities within Lean Governance (Scaled Agile Inc., 2019b).*

Lean Governance	
Activity	**Description**
Forecast and Budget Dynamically	As mentioned earlier, budgets are built to be lean, which means that they are more lightweight, fluid and more responsive to change. The LPM are responsible for the budgets of the value streams. These budgets are adjusted dynamically over time.
Measure Lean Portfolio Performance	Each portfolio needs to be measured to ensure the implementation of the strategy, the spending of resources and that the results are continually improving.
Coordinate Continuous Compliance	Each solution is dependent on its environment. To make sure coordination, compliance requirements are required which may include financial constraints and regulatory guidelines.

Another explanation of the agile portfolio practices is provided by Laanti et al. (2015). She summarizes the agile portfolio management practices based on the definition

provided by the Scaled Agile Framework. The list of practises is shown in Table 7 along with the rationale of each practice.

Table 7. *Practices of Agile Portfolio Management based on the Scaled Agile Framework (Laanti, Sirkiä, & Kangas, 2015).*

	Practice	**Rationale**
1.	Epics, prioritization of epics	Avoid a long queue of development items that will get outdated. Specify the new Epics just in time when needed. Focus on value derived from each Epic.
2.	Portfolio Backlog (consisting of Epics)	Clear visibility and communication of implementation needs. The fractal backlog structure helps development teams to identify in general what is the larger entity (i.e. Epic) that the Stories under development will contribute to. A change of priorities in Portfolio Backlog enables the company to quickly change its strategic direction.
3.	Epic Owner(s)	Each Epic has an Epic Owner that is responsible for making all the decisions regarding the contents of that Epic. An Epic owner remains the same from idea until the Epic is ready, and participates all negotiations and meetings considering the Epic, thus resulting to lots of tacit information.
4.	Enterprise Architect(s)	Architecture is a business decision. What architecture solutions are used impacts the Return On Investment, i.e. the payback of each investment decision made. Thus, Enterprise Architects analyse and make decisions regarding the possible future architecture solutions, e.g. what cloud solution, database or framework a company should use.
5.	Program Portfolio Management	Program Portfolio Management is a group of senior managers, strategy planners and directors that make portfolio decisions and prioritize the Portfolio Backlog jointly. This usually leads to better decisions as all opinions are heard and viewpoints considered
6.	Strategic Themes	Strategic Themes express the intent to which direction the enterprise would like to develop its portfolio, i.e. what kind of new strategies it will implement in the future. Epics are derived from Strategic Themes. The practise of tying Epics, Features and Stories ensures that all work is checked against strategy and provides feedback also to strategy process.
7.	Portfolio metrics	Portfolio metrics measure the enterprise's performance at the highest level. They can include measures like employee engagement and market share/development.

3.4 Common denominators across APPM literature

As there is no common ground in the research field of agile project portfolio management, common denominators across APPM literature has been identified. Specifically, three recurring patterns have been found: communication, collaboration and commitment. These are presented below.

3.4.1 Communication

Although many organizations manage project portfolios in accordance with project portfolio theory, they can face problems including delayed projects, resource struggles, stress and lack of overview (Blichfeldt & Eskerod, 2008)

According to Blichfeldt and Eskerod (2008) one of the main reasons for this is that project portfolios appear to contain other types of projects than new product development (NPD) projects. Additionally, the existence of these projects is often unknown to top management, thus not subject to PPM. Projects subject to PPM are projects in portfolios whose existence higher management is aware of and that are involved in PPM activities such as resource allocation, prioritization and go/kill decisions of projects. Companies tend to engage in many other small projects that is not subject to PPM and that tie up valuable and scarce resources. These projects are also not formulated and documented, thus awareness of them is often solely located at department levels and not communicated to higher management. Top management is rarely involved in these initiatives since they are initiated independently of top management's PPM and only affect a few people in the organization. Empirical study suggests that, in practice, these "unknown" projects consume a substantial amount of employee time and resources. The mere fact that small projects unknown to top management are initiated and completed has profound managerial implications as well.

Blichfeldt and Eskerod (2008) suggest two ways to overcome the problems that the projects not subject to PPM cause: 1) have PPM embrace all projects and 2) separate "unknown" projects from PPM by creating a resource pool solely for them. However, both impose challenges. The former may not work since top management has limited capacity. Likewise, bureaucracy inhibits employee flexibility and freedom to do independent project work. The latter would imply more work since top management has to deliberately decide on the boundary between projects subject to PPM and those that are not. Similarly, decisions have to be made upon resource distribution among these two project classifications. However, there is no rule-of-thumb to indicate the needed enactment from top management, it usually depends on the company's predispositions towards top-down PPM and employee empowerment (ibid).

The communication between different roles is assumed to be crucial for the project portfolio management process, specifically between the project portfolio manager, line management and senior management. The project portfolio manager is a person responsible for a PPM activity, for example risk management. Poor cooperation

between these roles leads to conflicts which cause inefficiency, ineffectiveness and reduced PPM performance. Conflicts on scarce and critical resources often lead to conflicts with line management (Jonas, 2010).

Visual communication is significantly important in an agile organization. Large amounts of information can be compiled and visualized through images. These images transform abstract information into knowledge transfer between people. This enables effective coordination and communication between teams and individuals (Sebestyén, 2017).

3.4.2 Collaboration

Increased collaboration across different domains of practice is often associated with agile methods (Dikert, Paasivaara, & Lassenius, 2016). To gain a shared vision and understanding among actors there needs to be a willingness for collaboration (Stettina & Hörz, 2015). Collaboration based on recurring patterns of action is discussed by several researchers (Stettina & Hörz, 2015; Vähäniitty, 2012; Krebs, 2008; Leffingwell, 2007). According to Leffingwell's (2007) framework SAFe recurring collaboration occur across the different levels, team, program and portfolio level. Collaboration through recurring activities are often found at the project level, however, frequent collaboration is even more crucial at the portfolio level when pursuing an agile project portfolio management. If teams deliver results more frequently then they automatically need to receive feedback more often. The number of portfolio reviews can vary however. Companies operating in high velocity markets can have delivery intervals of two weeks for teams, which means that portfolio reviews in annual cycles is insufficient (Stettina & Hörz, 2015).

There exist different opinions among researchers regarding the influence that resource scarcity has on collaboration. There is concern that resource scarcity inhibits collaboration due to selfish-behaviour (Hodgkins & Hohmann, 2007), while others claim the opposite, that scarce resources actually force collaboration instead of preventing it (Sweetman & Conboy, 2018).

According to Sebestyén (2017), building knowledge within an organization is an important activity to consider when pursuing an agile approach to multi-project management. Knowledge building is a result of collaboration between different people. It has a central role in development operations and entails constant organizational adaptiveness to changes in the market. Adaption requires the ability to take in feedback, internal creativity to process and analyse the information, and the ability to make decisions. Having different feedback channels is a success factor as it provides a better picture of the situation (ibid). Figure 4 below illustrates the impact that the level of knowledge has on development time (Sebestyén, 2017).

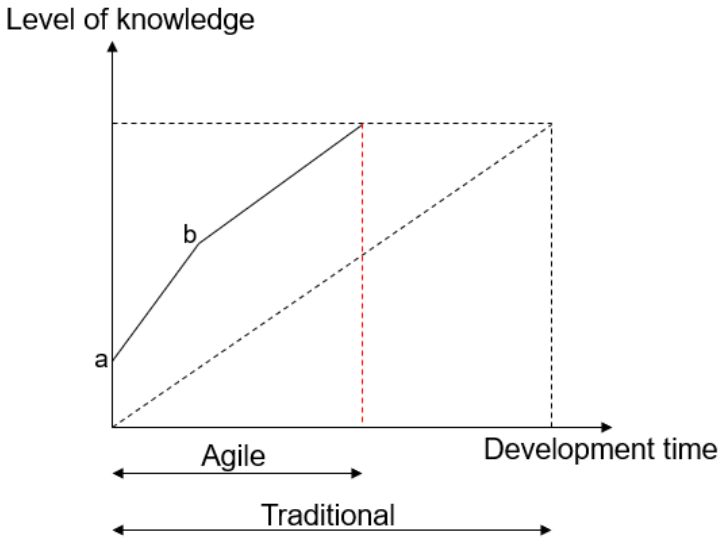

Figure 4. *The leverage of knowledge. Work starts at a higher level (a), and the pace of problem solving is faster at the outset (a-b) (Sebestyén, 2017).*

Furthermore, a fundamental problem with current organizational structures is that they are built on environments where power is inherited, and knowledge reinforces the position of the individual. These structures make it more difficult to learn, develop and share information and knowledge. The only way to influence decisions is to create a common vision through the sharing of information and knowledge (Sebestyén, 2017).

3.4.3 Commitment

The importance of having top management decide on project portfolios have been suggested by many researchers. According to Stettina and Hörz (2015), top management can be well aware of the benefits of agile methods, but active participation is often missing. On the contrary, too highly committed top management can lead to longer development times due to overload of involvement of many top managers at the same time (Jonas, 2010).

As stated earlier, agile methods aim to increase responsiveness and flexibility (Serrador & Pinto, 2015), thus decreasing time-to-market. Increasing the commitment of employees is one approach to shorten the development cycle time. Although employees in many organizations feel stressed due to tight schedules and tough demands, surprisingly little of the work is actually adding value. The reasons for poor efficiency are many. Two reasons are weak commitment and lack of concentration of employees, which often is a result of conducting too many projects simultaneously. If an organization wants to shorten lead times for projects, then it should ensure that each employee is dedicated to one project at a time (Sebestyén, 2017). Figure 5 illustrates the effect that a committed staff has on lead time.

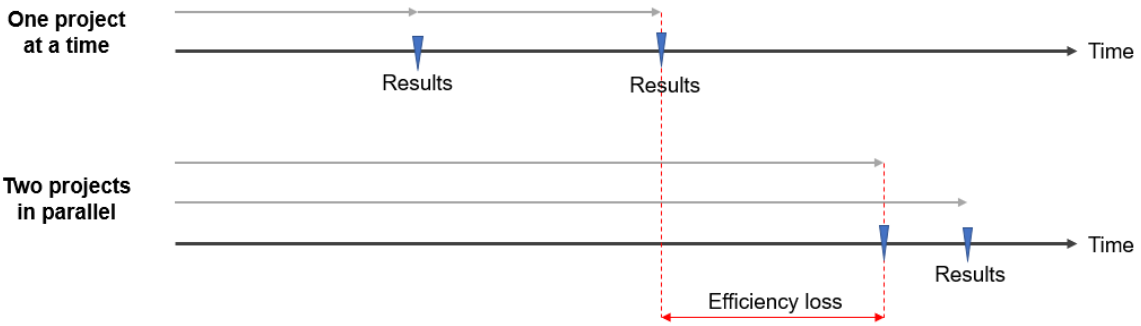

Figure 5. *Effect of committed employees (Sebestyén, 2017).*

If the employees only focus on one project at a time, higher management are unable to start an unlimited number of projects. This limitation gives the portfolio team the opportunity to prioritize projects, deciding which one to start and in which order. Without overall control, overload becomes inevitable (Sebestyén, 2017).

As mentioned earlier, the existence of small unknown projects not subject to PPM drain resources primarily assigned to "real" projects. This is, however, not the only reason why many companies struggle with problems concerning resource allocation. Another important factor is that people are rarely assigned to projects full-time. Instead, employees' time is often dedicated to other duties and daily work in their departments which means that a very small portion of time is devoted to project work. Furthermore, the motivation of the employees may be even higher for small projects not subject to PPM since the end results are more visible (Blichfeldt & Eskerod, 2008).

Many organizations are struggling with back-loaded projects, which are projects in which problems are discovered late in the development process. Traditional project management promotes detailed planning in early stages of the process, when the least is known. The possibility to plan the right solution in detail at an early stage is almost non-existent, yet many organizations still do it. As a result, problems are discovered too late, causing delays and large cost overruns when additional resources are needed. Additionally, personnel get reallocated and the largest portion of resources is found at the end, thus reducing the commitment (Sebestyén, 2017).

Front-loaded projects sought to solve problems as early as possible and is based on customer needs (ibid), which corresponds with agile ways of working. The concept of agile emphasizes the importance of focusing on the customer requirements. Specifically, it is the first principle of the Agile Manifesto, claiming the customer to be the highest priority in the development process (Measey, 2015). The key success factors to front-loaded projects are cross-functional teams, committed staff, transparency and communication. The portfolio team has a large responsibility in increasing commitment among employees by eliminating interruptions, thus shortening lead times and reduce costs (Sebestyén, 2017).

4. Findings

The following chapter presents the results of the empirical material obtained through the different data gathering methods, including interviews, observations and documents. An analytical framework comprising two major categories is used to enable guidance for the reader. The chapter also presents quotes from the interviewees, but with respect to the confidentiality agreements with the company the names are rewritten to maintain anonymity.

4.1 Analytical Framework

The research field of APPM is diverse and relatively scarce. Therefore, an analytical framework was developed in order to guide, organize and facilitate the empirical data gathered. It enables the reader to follow the findings of the study in a more structured way. The analytical framework gradually evolved throughout this thesis and the foundation of it comprises two major categories (see Figure 6 further below). One of them providing a more specific perspective on the matter, while the other a more general. The two categories are as followed:

1. The common denominators across APPM literature: communication, collaboration and commitment.

A more general approach to evaluate the empirical data was desired, therefore the three common denominators across APPM literature (i.e. communication, collaboration and commitment) were used as a lens for presenting the empirical data.

2. The company's current situation in adopting agile.

Specific attention was paid to SAFe (Scaled Agile Framework) due to two reasons. Firstly, it is considered as one of the mature models in scaling agile to the portfolio level (Kalenda, Hyna, & Rossi, 2018). Secondly, there has been a recent attempt in adopting it at the case company, thus highly of interest for the author of this thesis to investigate. SAFe is only one of many other models for scaling agile within APPM literature.

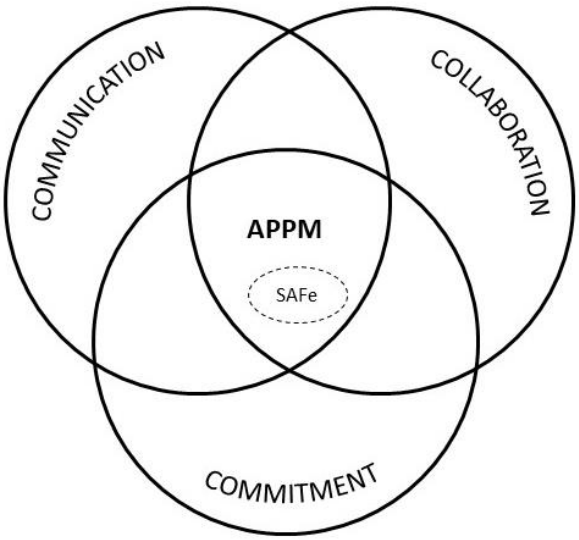

Figure 6. *The analytical framework of the findings.*

To provide the reader a complete understanding of the two categories, a thorough description of the case company is depicted as a basis, including general information about the company, its product development process and current project portfolio management. The first major category is introduced after a presentation of the company. The second major category is presented at the end of the chapter, after the presentation of the company's product development process and PPM.

4.2 Company Description

The organization in study is a global manufacturing company within the automotive industry. The company designs, develops and manufactures heavy vehicles. Majority of its business is built on hardware technology, but the expansion of its software department has increased rapidly in recent years.

With respect to its history, it can be considered traditional in terms of organizational structures. The company has a matrix organization where people work in projects managed by the project office, while their employment is within the line organization. All functions within the company are included in the line organization which is responsible for following up its project deliveries on the basis of verifiable milestones. The project office is responsible for executing and delivering projects in terms of projects targets, schedule and costs. Deviations with the project plan must be escalated to both the line organization and the project office to ensure the project objectives.

The company has a hierarchical structure as shown in Figure 7. The highest instance, top management, consists of the company's board of directors. Each director is responsible for a department at the company (e.g. R&D) which comprises of four sub-levels: sector, sub-sector, section and group.

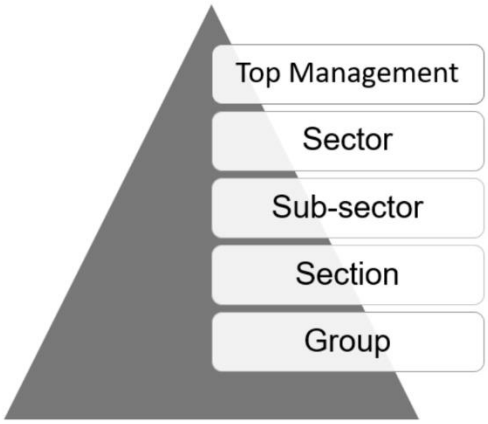

Figure 7. *Hierarchy structure of the departments of the company.*

The company's methods and processes are deeply rooted in the waterfall model. Throughout its many years of existence, the company has been able to develop products in a sequential process without many iterations. The design and development of the products has had a relatively linear process structure. The technology and customer requirements have been largely stable and clear over time, allowing the firm to set long-term milestones and still meet customer demand. This type of working behaviour is sufficient in a complicated environment where problems can be difficult to solve, but the solutions are yet predictable. As the market is heading towards an increasingly complex environment where uncertainty is more prevalent, traditional ways of working are not enough in order to stay competitive on the market. The solutions to the complicated problems are no longer adequate since they do not work well with complex problems. Complex problems involve too many unknowns and interrelationships that are constantly changing, thus highly unpredictable. To provide the reader a better understanding of the degree of complexity, a drawing from one of the interviewees is illustrated in Figure 8.

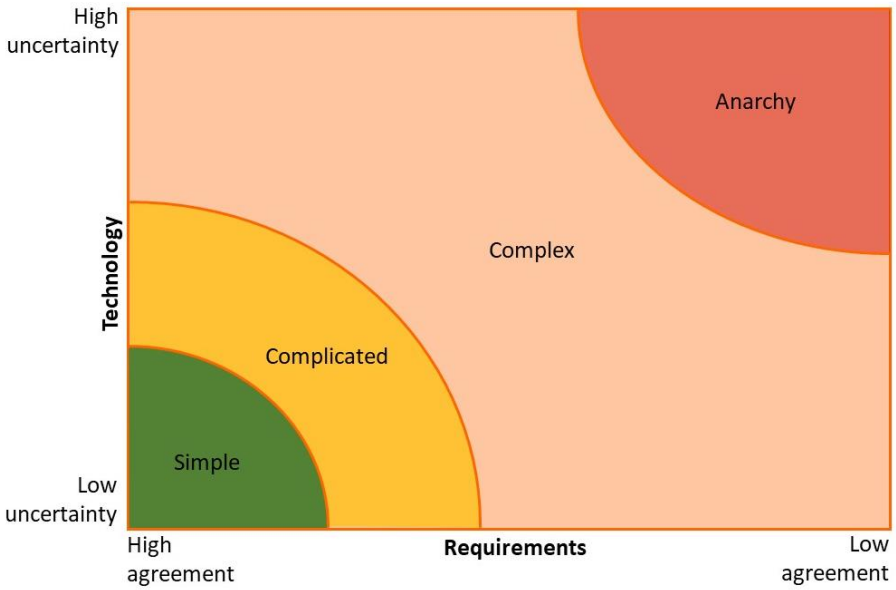

Figure 8. *A general illustration of the degree of process complexity.*

The transition from the yellow area (complicated) to the pink area (complex) has become a major challenge for the company. To be able to manage the new degree of complexity, agility is required. Currently, the majority of the firm's tools and methods are not fully in compliance with today's business environment. However, there is a growing awareness of the need to change the work culture in order to reduce time-to-market and increase flexibility.

Along with the uncertainty, new trends are emerging within the automotive industry. The automotive industry comprises a wide range of organizations manufacturing motorized vehicles. Current trends that have gained great recognition are autonomy, connectivity and the electrification of vehicles. The case company is well aware of the technology shift that the industry is heading towards, and recognizes the importance of bearing it in mind when formulating the business strategy. The development of new and innovative solutions for transporting goods through the means of these new technologies has therefore gotten much attention. These new trends provide great business opportunities, but comes with great challenges as well. The challenges rely within two dimensions. One of them being the technical dimension which is manageable since it is a matter of the company's internal capabilities. The second is the maturity of the society, which is much more difficult to influence. The technology may exist, but it is the society's acceptance of it that determines whether it should be commercialized or not.

Due to new emerging trends and the ever-changing business environment, the company's employees must work differently. For a couple of years, much attention has been paid to implementing agile methods and principles at the team level. However, the realization of getting higher level activities, such as PPM, along in the transformation is evident.

4.3 The Adoption of Agile

The idea of working agile within the R&D department emerged at the team level. Inspirations to work agile were originally taken from the company's IT department, a department that does not belong to R&D and is placed in a completely other building. Since the concept of agile has its origin within the software department, it became naturally for the people working within IT to adopt it first. They have been working with agile methods several years before this thesis was conducted. With time, the firm noticed a gap between the R&D and IT department. Hence, the idea of working agile was initiated at the R&D department approximately two years ago. However, the concept of agile was not recognized by all the sectors at first, instead efforts were made within one of them. This sector's main business focus was within software development.

As the implementation was initiated at the team level, it began by getting one team to work agile. However, once that team handed over their work to another team, there was a substantial decrease in speed. At early stages in the process, the team realized that its surroundings acted as bottlenecks. Due to the diverse ways of working, they

were not able to cooperate properly. To cope with this problem, the company has therefore managed to get more teams to work agile. Additionally, the company created a *release process* with the intention to synchronize teams. The release occurs once every month where the teams' software deliveries are tested together in an integration lab. Ultimately, the firm managed to create a remarkable decrease of the average lead time of an assignment, from twenty-two working days to only seven. The efforts of making teams synchronize better through the release process was still an ongoing work during the time of this thesis.

At the time of this thesis, the utilization of agile methods was varying across teams and projects. There are teams who have conducted a complete implementation of Scrum into their daily work, while others utilize Kanban boards solely. Kanban boards are used to display work in three different phases: to do, in progress and complete. Tasks can be reprioritized, reassigned or updated if needed.

While some teams utilize agile methods, there are those who choose not to due to several reasons. People working close with hardware technology have had difficulties to do so due to long lead times. In comparison to software, hardware often takes longer time to develop before it is ready for testing. Therefore, sprints of two weeks that is typically of Scrum, is not applicable. Others who work closely with suppliers have also had difficulties to imitate agile methods. In their case, the suppliers act as bottlenecks. Recently however, a project to make the company's suppliers work agile as well was initiated.

A framework that has gotten attention recently is SAFe (Scaled Agile Framework). An attempt to implement it was initiated a couple of months before this thesis was conducted.

4.3.1 The Adoption of SAFe

The Scaled Agile Framework has not formally been announced by top management to be implemented at the company. An attempt to use this approach has been done within one of the strategic buckets, which specifically works with the development of new technology. The framework has recently been adopted to a certain extent and adjusted to fit the company's processes. It was initiated as a pilot. The adoption includes the creation of a development flow that runs in parallel with the product development process. The interviewees refer the flow to as a *building kit* which is equivalent to a value stream in SAFe. What differs the new development flow from the ordinary product development process is the absence of fixed milestones, allowing decision-making at later stages within the process. Furthermore, the resource allocation differs as well. As majority of the budget is assigned to individual projects, a budget has been assigned to the flow instead.

The development flow consists of capabilities which are brought and discussed at a meeting, specifically called an *A-meeting*. During this meeting, capabilities are prioritized in a common backlog. These are then decomposed into smaller tasks for

teams to conduct. One interviewee said that a clear decomposition of an initiative at higher level of the organization to tasks at the team level enables clarity in both goals and prioritization.

Below the A-meeting there exist different segments that can be considered as products. Each segment has a Chief Product Owner (CPO). Currently, there only exists one Agile Release Train (see explanation in Appendix A) in which there is one Release Train Engineer (RTE) responsible. The mission is to involve more teams and create several agile release trains. In that case, there would be a need for a Solution Manager who is responsible for the solution train, that is all agile release trains. During the time of this thesis, there have been discussions and deliberations regarding this phase in the process at the case company. Specifically, how to interpret roles such as Solution Manager and Epic Owner, and which employee is the most suitable for it.

According to the interviewees, the formulation of roles and responsibilities is considered as one of the main challenges in adopting SAFe. To manage that type of transformation it is of high importance to understand how to decompose capabilities. It should be broken down into stories, and one story shall be conducted within a period of two weeks. Besides from roles, the integration and adaption of SAFe in relation to current decision-making forums and project status update-meetings.

Since the adoption of SAFe is a pilot, the implementation of roles from SAFe has become even more challenging. The adoption has been challenging due to the rest of the organization still working in a project organizational environment. Specifically, it has been difficult as interaction towards other departments outside the pilot is still required. One interviewee expressed her opinion regarding the incremental implementation of SAFe, pointing out her dissatisfaction when she got a new role as RTE (release train engineer), but still remained in her previous position since there was nobody doing that work. The transition became a burden. There exists a frustration regarding the lack of preparation before the pilot was initiated, ultimately leaving employees confused and overloaded with work.

"The RTE role has a completely different focus. I would focus on coaching the agile teams. As a sub-project manager, I would work much more cross-functional, more outwards than inwards. I have much of that left in my work, it is me people come to when they have those type of questions. … I am still in some kind of project while I am working in a value flow."

- Person N (2019)

Furthermore, since the adoption of SAFe is only a pilot, there are no dedicated resources and people were not educated sufficiently. Higher management responsible for the SAFe initiative had not even taken an education in SAFe at one time. The pilot has reached the second product increment, yet no evaluation of the first product increment has been done.

The pilot initiative is based on inspirations from SAFe. Several of the respondents expressed a frustration, meaning that they would rather implement SAFe by the book,

instead of only taking bits and parts of it. Since the pilot only has some characteristics of SAFe, people tend to interpret it differently.

"Instead they say that we should be inspired by it and then nobody knows how to relate to it, what should be used and not. I would have preferred if we did it all."

- Person N (2019)

Currently, the line managers are very engaged with the product at the case company. However, their role needs to be changed if the company wants to become completely agile. The fundamental dimensions of the line manager role should remain according to some of the respondents, such as understanding the technology, but the individual does not have to be the expert on it.

4.4. Product Development Process

The company's product development process is similar to a stage-gate model and comprises three sub-processes, each assigned one colour; yellow, green and red. An illustration of the product development process is depicted in Figure 9. The yellow arrow represents pre-development, and deals with the investigation of business possibilities and technical solutions. Projects within this phase is managed by the moderating department and it includes research, advanced engineering and cross-functional work with concept development. The green arrow embodies the development and industrialization of products, involving major product development projects. Projects within this phase is managed by the project office. It also contains a separate development process, called DOL (Design OnLine), aimed for minor assignments and projects. This process has a separate decision meeting and dedicated resources. The red arrow represents work including maintenance and updates of current product range.

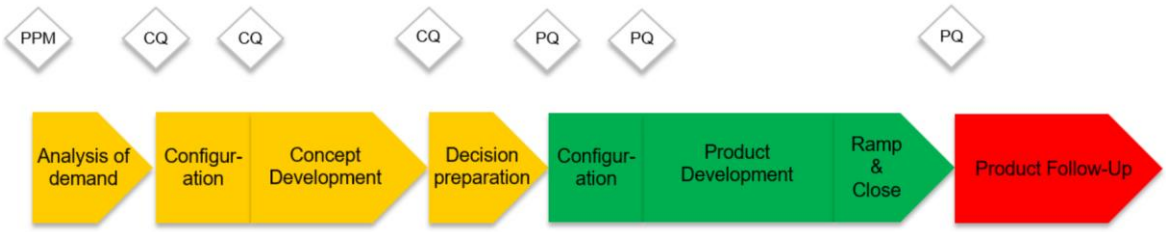

Figure 9. *The product development process of the company.*

4.4.1 Decision-making forums

Decision-making takes place at different strategic meetings throughout the development process, see Figure 9 above.

The CQ (concept portfolio) and PQ (product portfolio) meetings are the highest decision-making instances in the product development process where decisions regarding concept development projects and product development projects are made.

These meetings consist of a steering committee who commissions the project office and appointed project manager to run the product development projects (green phase). If the targets have to be altered while a project is in progress, the steering committee must make a decision on the new targets to be applied. Furthermore, according to company policy, projects are not allowed to be terminated beyond the second CQ meeting.

Before a project enters any of the CQ and PQ meetings, it must go through the product planning meeting (PPM). During this meeting, the project is assigned to a team and a project manager from the line organization. The project manager remains in charge of the project until the first PQ decision point. Once it enters the green phase, a new project manager from the project office is assigned to the project (Back & Isakovic, 2018).

4.4.2 Strategic Buckets

Projects are initiated and assigned to strategic buckets before entering to the yellow phase in the product development process. Currently, the project portfolio consists of approximately 200-300 projects, including concept development (yellow phase) and product development (green phase) projects. The strategic buckets are development areas in which monetary resources are allocated to, thus allowing the company to steer projects in the direction of the company strategy.

The idea of using strategic buckets at the company emerged several years ago, but it has not been fully established until approximately two years ago. The main reason for this initiative was to create a better balance and alignment between projects and the business strategy. Specifically, the firm wanted a better balance in the portfolio between projects that were short-term and had strong financial benefits with projects that were more long-term and had less apparent monetary contribution.

Historically, the company has had buckets before. However, at that point in time they were large and inconsistent, thus difficult to gain a good overview of the projects in the portfolio. Currently, the company has several buckets that together embody the strategic goals of the business. Each bucket has a cross-functional work-group involving members from both the marketing and R&D department. Their main objective is to prioritize projects in accordance with the assigned budget. Subsequently, the outcome has to be approved by the steering committee of the bucket before being brought up for decision-making at the CQ and PQ meetings. The steering committee does not have mandate to release budget on its own, this decision is only made at the CQ and PQ meetings, which are held once a month.

On occasions, a project must be replaced into another strategic bucket due to several reasons. The bucket may have consumed all its monetary resources or other projects have been considered more important to proceed with. Regardless of reason, a portfolio meeting (PM) is held by the bucket owners to decide upon the replacement of projects. The bucket's work group can request to expand its budget if the project

cannot be repositioned. This issue is then brought up at the strategic portfolio meeting (SPM) (Back & Isakovic, 2018). Decisions concerning money allocation between the buckets are made here. This meeting involves the heads of sectors at R&D, head of marketing, as well as people responsible for product planning. They debate issues concerning current financial status and future distribution of money. They are also responsible for the creation and removal of buckets. The content and guidelines of the buckets have been redesigned and clarified during the last year.

To provide the reader a better overview of how a project first is initiated and finally reaches the product development process, an illustration is shown in Figure 10.

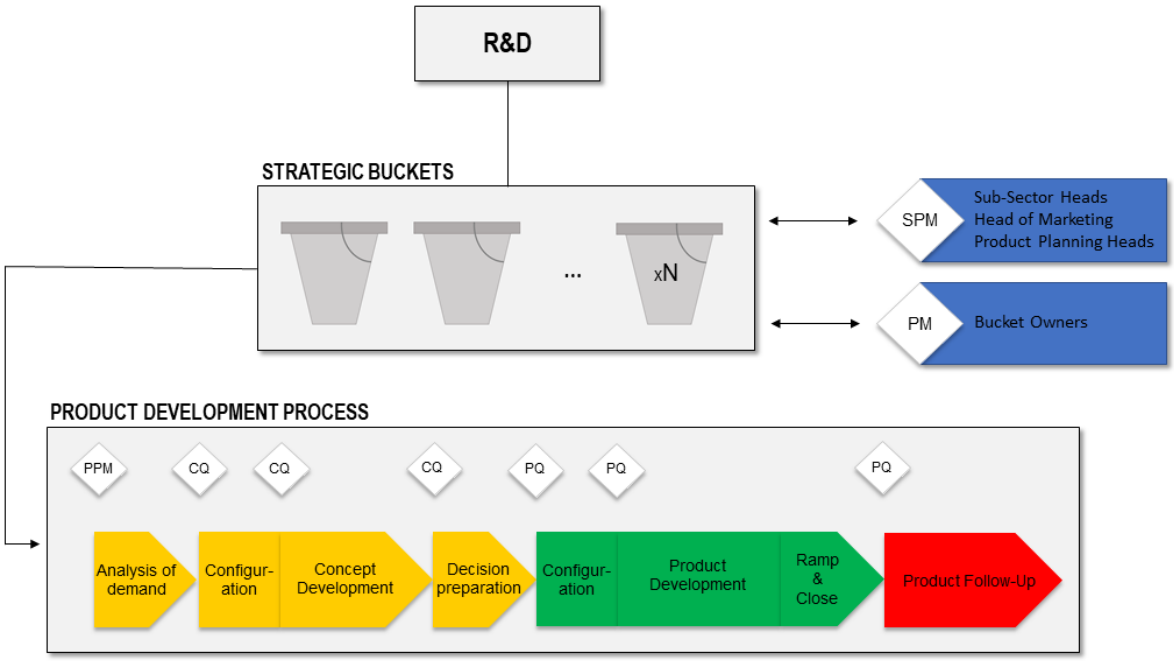

Figure 10. *An overview of the usage of the strategic buckets. As the number of buckets varies with time, it is marked with a "N".*

The prioritization of projects occurs at two levels at the company. Firstly, a prioritization at the corporate level is conducted through the distribution of budgets to the strategic buckets. This allows the company to steer budgets to development areas according to their priority. Secondly, another prioritization is done by the bucket owners within their buckets. Together with the bucket work group, the bucket owners estimate the costs of each project and then prioritizes them in relation to their assigned budget. The estimation of costs varies across the strategic buckets. It usually depends on the individual bucket owner, where the majority makes rough guesses while others who have tight budgets, they conduct detailed calculations. The prioritization needs to be confirmed by the bucket's steering committee.

4.5 Communication

As mentioned earlier, initiatives to work agile have primarily emerged at the team level of the R&D department. The utilization of agile methods varies among teams and projects. In general, agile thinking is much more prominent and recognized within the software department, in comparison to the hardware. A common ground for integrating agile values and principles is yet to be found at the company.

Regardless of agile method used, the main issue lies in the interpretation of agility. The majority of the interviewees explained that the meaning of agile values, roles and principles are interpreted differently, thus impairing the communication between employees. One portion of the respondents meant that the term agility has become a buzzword among high-level managers by emphasizing their tendency to misuse the term without fully comprehending it. Specifically, employees have been ordered to work agile without getting any specific guidance. This has led to them interpreting agile values and principles on their own, ultimately creating discrepancy between them and higher management. One respondent explained his experiences with managers that did not fully recognize the need of frequent feedback-meetings. The traditional manager at the firm usually attends meetings solely for decision-making. In the case of the respondent, the manager was confused when the meeting suddenly was intended for discussing progress of work. A common ground of how to interpret and translate agility into the organization is missing.

In addition to the misuse of the term agility, managers tend to not fully comprehend their position in the agile transformation. The vertical interaction, between managers and their subordinates, have been harmed due to this. As the traditional managers struggle to find their role in an agile environment, they tend to ultimately remain with the same tasks and responsibilities as before. The obscurity that the traditional manager possess in an agile organization causes confusion among employees. Since there is a current mix of traditional and agile roles within the company, many interviewees explained that it is sometimes difficult to determine their responsibilities. Agile roles at the team level, such as Product Owner and Scrum Master, are relatively well-established at the firm. However, once you reach the tactical levels of the organization, where the project portfolio is managed, obscureness increases. To whom and where employees should send or receive information to becomes more unclear.

Due to the high variety in both usage and interpretation of agile methods, many of the interviewees highlighted the importance and need of higher management communicating the agile transformation properly. Particularly, communicating the reasons behind the change and its implications in practice. In order to make a change, management need to clarify that the transformation is about utilizing the skills of the employees in a different way, and not about firing personnel. Further, they emphasize the importance to involve the employees in the transformation, making sure that everyone comes along. One interviewee mentioned that the firm had recently been through a year of great success, launching a new vehicle-platform. Consequently, it

has become increasingly challenging in convincing employees to change their way of working since their current ways of working led to great success.

Although the concept of agile is a diffuse topic at the case company and not many know how to interpret and translate it into the organization, the majority of the respondents understand the importance of it considering the uncertain and dynamic business environment. The awareness of new emerging trends within the automotive industry is great and the majority of the staff recognize the need to change current ways of working. People have become increasingly aware of the need to become faster and more flexible in responding to changes to customer requirements and market trends. However, whether the firm should utilize SAFe or any other specific method, has yet not been outspoken.

Communication has been lacking in terms of resource management as well. One respondent specifically explained his experiences with receiving plenty of manpower, however, they did not correspond to the competencies needed. Projects have also been promised manhours that did not exist at the time it was distributed, which ultimately left them understaffed due to poor resource and cost estimations. Other interviewees have similar opinions, saying that problems often arise due to distributing money and employees separately. Each strategic bucket has its own budget, which is translated into manhours and then allocated to projects. However, there has not always been enough employees to manage those manhours, creating discrepancy between financial resources and available manpower.

> *"The manager added 800 hours. Later, it turned out that we only used 200 hours. What happened was that the 600 hours that were left, they were put in another project. Not much attention was paid to the root cause, that we had people working 10% on the project, which is very slow."*
>
> - Person O (2019)

Additionally, the interviewees explained a sense of unacceptance to fail within the work culture. When a project is lacking resources, it should be noted with a purple mark in the company's project management software-tool. Currently, one of the sub-sectors is involved with almost 100 product development projects (i.e. only green projects, yellow and red projects are not included) in which only a couple of them are flagged for resource shortage.

> *"Not many want to say that they have a resource deficiency, it is not quite accepted. If you are in, then you are expected to deliver. You do not want to show that you have used your resources wrong, instead you put a red mark on it, that is we have a problem."*
>
> - Person P (2019)

Furthermore, a portion of the respondents highlighted the fact that the company is relatively person-dependent, pointing out that there exists a favouritism. If for instance

a project manager is liked by many people, it becomes easier for that individual to influence decision-makers at the SPM (strategic planning meeting), thus receive resources desired. Even though decisions and the releasement of budgets occur solely within diverse decision-forums, such as SPM and PPM, bucket owners and project managers still have a great influence on those in practice.

To investigate the employees' understanding of the company strategy, the interviewees were asked about the awareness of the company's strategic goals. The answers differed. Each year there is a new release of a document describing the company's long-term strategic objectives. Everyone has access to it, yet there are many people who do not fully recognize them. The strategic goals of the company are visualized and communicated differently among projects and departments. The approach to communicating the strategic goals throughout the organization is largely dependent on two factors. Firstly, the type of management, and secondly, the placement within the organization. Some interviewees claimed that there exist two different schoolings at the company, either you find it important to understand the bigger picture or you only focus on the function assigned to you. For example, a function owner tends to pay much attention to the function that the individual owns, rather than the larger perspective. Likewise, system owners which are individuals with great technical responsibility tend to have biased opinions.

Some interviewees claimed that the communication channels vertically in the company are much more distinct than those of the horizontal. For example, so called *pulse meetings* are held regularly, with a cycle of one week. An illustration of these meetings is shown in Figure 11. The central meeting is held at the sector level and involves discussions about the current state of the projects running. This is where deviations are escalated by the project managers and the line management. The aim is to clarify problems and create conditions which will allow them to be resolved. Here, project managers and sub-sector heads can ask for more resources or support if needed. The central meeting is held within a large room where all the current projects within R&D's product development process are displayed on the walls. The status of the projects can also be acquired digitally. The outcome of the central meeting is then brought up for discussion at a meeting consisting of sub-sector heads and section heads. Lastly, the groups are informed about the outcome through a meeting with the section heads. The sub-sector heads can occasionally be present at these meetings as well. This process is a never-ending cycle.

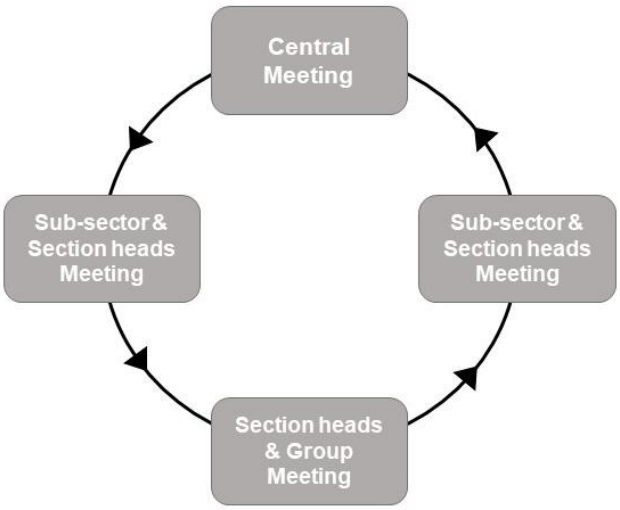

Figure 11. *Pulse meeting process.*

According to the respondents, people tend to push information into this meeting-cycle due to obscure alternatives of communication channels. People can on occasions choose to communicate information through pulse meetings, even though the right source of information can be acquired elsewhere. Ultimately, leaving people without answers to certain questions or issues that they may have.

Finding information within the company in general is difficult according to the interviewees. There exist many communication channels, where several are not properly designed, making the working culture less transparent.

"…our intranet is often called Go Fish, which says a whole lot."

- Person Q (2019)

4.6 Collaboration

As mentioned earlier, the company's attempt to implement agile methods began at the team level, which through time evolved in the creation of the agile release process. In the pursuit of agility, the company has made further attempts in increasing the collaboration between teams. Currently, the firm is deliberating establishing integration points where teams meet to present their work, even though they still are in the prototype phase. These integration points aspire to increase interaction and coordinate deliveries in order to avoid project delays. This has not been an easy task however. The firm has faced several challenges mainly related to the synchronization of work. Since the usage of agile methods vary across different departments at the company, it has been even more difficult to synchronise the work and deliveries due to the diverse ways of working. Many teams who have not yet implemented agile methods are considered bottlenecks in the product development process. Furthermore,

when change has needed to be done, it has been done within multiple teams but at different point in time which has caused a lot of time waste.

As attempts have been made to synchronize teams, the lack of synchronization of projects still remain. The fundamental purpose of collaboration is to achieve a common goal. Each project has its individual objectives, but all projects together should embody the overall goals and strategy of the company. Many of the respondents emphasize the lack of coordination between projects, especially between those activities that several projects share. For example, a lot of software needs to be tested on field. There is a limited number of vehicles available for testing and nobody responsible for synchronizing the reservations. At the present, there exist approximately 300 vehicles, and most of them are occupied at all hours. A project can sometimes have to wait half a year to conduct the field test, thus causing delays in product development. The projects can act as obstacles to one another, rather than a collaborative force.

Collaboration is not necessarily an internal issue. As stated earlier, there are teams and projects who work closely with the company's suppliers, thus making them more dependent on external parties. The dependency inhibits their own power to influence and reinforce working behaviours. The external factors are therefore not to their advantage in the implementation of agile methods. The company has addressed this issue however, by collaboratively adopting agile methods together with its suppliers. Through incremental changes in the way the company interacts with its suppliers, it aspires to reduce the lead time across the entire supply chain.

The barriers to collaboration do not solely lie in the hands of external parties, nor the type of coordination tools and methods used. The work culture itself can become a major obstacle. According to the interviewees, people have a tendency to keep their work progress to themselves until the final milestone, thus making it difficult to avoid future problems and getting people to remain on the same path. One respondent specifically explained that this kind of behaviour is based on the treatment of employees in previous experiences. He claimed that groups have been receiving small amount of resources in the beginning of a project, but been promised to revise if needed in the future. However, the revision was not allowed ultimately. This type of situation has created dissatisfaction and negative emotions with employees, which ultimately influence the entire work culture.

As there are many challenges with collaboration, several of the interviewees discussed ways to improve it as well. To increase collaboration, authority must be sacrificed. The respondents emphasized the strong authority that many managers have in decision-making, which inhibits teams to become self-driven. The firm needs to facilitate autonomy in teams by giving them more authority. According to the respondents, it would increase mutual trust among employees.

"The firm is traditionally governed through technical meetings where managers have a lot to say in the decision-making. … To become faster, decisions need to be made further down at the team level. It is a matter of mindset. You are not used to make your own decisions. You are used to having people do it for you. Therefore, it is difficult to get away from that."

- Person N (2019)

Another approach to increase collaboration is through knowledge building. The storage of data is conducted through different approaches at the case company. The company creates design guidelines as they learn more about the product, including specification of requirements and procedures to achieve those. These guidelines are regularly updated and saved in the archive. There also exists unofficial documentation among teams and projects, such as hand-over documents. Furthermore, after each project a lessons-learned is held to discuss experiences that could be valuable for future projects. The interviewees highlighted that there exist several methods and guidelines for how to store information and knowledge at the firm. However, the utilization of these methods is not sufficiently supervised and regulated. The reutilization of knowledge varies across projects and is largely dependent on both the individual and management.

Several of the respondents emphasized that the company has lost valuable knowledge during the last couple of years, primarily due to two reasons. Firstly, rapid expansion of personnel has made it increasingly difficult to educate and train newly recruited, thus challenging to retain knowledge within the company. Secondly, significant changes were made in year 2016, involving large investments and the re-design of different product interfaces, ultimately leading to the launch of a completely new vehicle platform. According to the respondents, the company possessed agile capabilities before this launch, but has along the way lost old ways of working.

"I do not think it is a matter of introducing new agile methods, it is about us loosing old knowledge, that is agile habits of working. When we created …, that was the Big Bang. We need to remember how we worked before these enormous projects."

- Person R (2019)

4.7 Commitment

As stated earlier, prioritization of projects occurs at two levels within the organization. One at the corporate level, and another one within the strategic buckets. However, the prioritization that is set at that level is not as clear at the lower levels of the organization, especially at the team level. The lack of communication between the different levels of the company seems to decrease commitment of the employees. The majority of the respondents alleged it to be one of the main causes of delays and inflexibility in the product development process, since A better and clearer prioritization of projects is needed in order to increase agility.

The unclarity of prioritization throughout the organization is the root cause of several other problems, especially problems that emerge at lower levels of the organization. One of the problems that all interviewees pointed out was the overload of projects. As prioritization is almost nonexistence, employees have difficulties to determine which project to work with. This often leaves them in a position where they treat all projects as equally important. Ultimately, employees are spread out and assigned to multiple projects, leaving them less committed. One interviewee explained that one employee could on occasions deal with eighteen projects at the same time. Twelve out of the thirteen interviewees at the case company expressed their dissatisfaction with the firm's prioritization of projects. They claim that the company's project portfolio is too ambitious and that the termination of projects is a decision that is often difficult to be made. Furthermore, as project leaders on occasions act opportunistically by attempting to get employees not subject to their project to act on their own behalf, employees do not know what to focus on. This ultimately leaving them less committed. It is of importance to point out that the citation below is from an individual who has worked at the case company for a total of twelve years.

The prioritization at (the company) is bad because there is no prioritization, everything is equally important. I have never known a time where a project has been terminated after it has been started.

- Person S (2019)

The classification of project types is one guideline used as a basis for prioritization. Each project is classified to a project type depending on its objectives. For example, when a customer orders a product that does not exist in the company's current product range, it is called a S-order (special order). If a customer has a problem with an already purchased product, then the order is called a FQ-order (field quality order). According to the interviewees, it is relatively easy to prioritize between the different order types. The great challenge emerges when prioritization is conducted within one order type. For example, all green projects (green phase in PD) are considered equally important, thus incredibly difficult to prioritize. Frequently, teams and projects have different understanding of what is the most important, resulting in project delays. The frustration that this issue generates is evident among all of the respondents.

"How do we prioritize S-orders in relation to green projects? Or if we put two green projects against each other, then we do not know which one to do first. Different groups can do things differently, ultimately leaving us without a complete product."

- Person T (2019)

Due to deficiencies in prioritization, the allocation of resources is impaired as well. The company's resources are spread out among many different projects, resulting in an incredibly low availability of employees, as little as ten percent on occasions. The lack of dedicated resources causes project delays. Additionally, the firm has been

struggling with maintaining a good supervision of resources within projects, causing people to constantly red-flag projects in the project management software-system. Resource estimation at the company is, according to several of the respondents, often underestimated. Group managers tend to give rough estimations for a long time period.

Furthermore, projects and small assignments are occasionally initiated outside of the portfolio. For example, projects that have originally been denied in the product development process, have later emerged in the DOL (Design OnLine) process. A few of the interviewees explained that people tend to choose other paths to push their own interests through. These "hidden" projects are ultimately consuming resources from the same resource pool as the real projects. Project managers are not always informed when a team member pursues interests elsewhere, causing negative emotions within the work culture.

There was once a project that popped up in the yellow process that did not have a business case, which we ultimately terminated. There was no business case to earn money from. This project then popped up in DOL. Either people take that path or they are moonlighting.

- Person U (2019)

A portion of the respondents emphasize an unclear company strategy as one of the reasons for poor prioritization and resource management, meaning that the strategy of the company was clearer in the past. The development and launch of the new and very successful vehicle-platform has according to the interviewees "stirred the pot", pointing out that the key stones of the company strategy have changed. Together with the dynamic business environment and the investments that the company has made within the area of new technology, project complexity increases. It has become increasingly difficult to revise projects towards a strategy that is diffuse in the first place.

5. Discussion

This chapter aims to analyse and discuss the findings of this thesis. The chapter begins by presenting challenges with the company's current PPM, followed by a discussion about the APPM at the company where focus lies within the two major categories presented in Chapter 4.

5.1 Challenges with current PPM

The organization is highly aware of the market trends it is facing as a manufacturer in the automotive industry. The case company acknowledges the importance to reduce time-to-market and increase flexibility in order to meet customer expectations in the future. It may be well argued that the company has great aspirations to change traditional working habits in order to pursue agility. As much attention has been paid to incorporate agile methods at the team level, there is an ambition to scale agile to the portfolio level as well. I have sought to investigate possible procedures that the company can apply in order to gain an APPM. However, the results indicate that the company seems to struggle with problems associated to traditional PPM. The company's current PPM has several deficiencies and does not function properly in the view of the PPM research field.

It is evident that one of the issues with the company's current PPM corresponds with the one discussed by Abrantes and Figueirédo (2015) where resource conflicts are often related to information known in projects and that does not reach the portfolio level. The company has a separate process (DOL) specifically for smaller projects and assignments that are not classified as product development projects. However, the firm seems to fail to utilize it properly. It has been misused to pursue individuals' interests before those of the project. These "hidden" projects are consuming the same resources as the product development projects, which are unknown to higher management (Blichfeldt & Eskerod, 2008). Project managers have not always been consulted when employees have been spending their time on work with other purposes than the one of the original project. This type of situation where information is not shared decreases transparency within the work culture. As project managers do not acquire complete and reliable information, it becomes increasingly difficult for them to determine the accurate status of a project, thus the project portfolio becomes much more challenging to manage. With the misutilization of DOL, hence, without accurate information regarding projects resources, resource transparency decreases (Stettina & Hörz, 2015). It can be argued that this could be a possible cause for the poor resource estimations and balancing at the case company. Additionally, it could be a cause for the great frustration among employees (Stettina & Hörz, 2015), especially among project managers, at the case company.

The results indicate that the company seems to suffer from the *resource allocation syndrome*. Poor project scheduling, over commitment (i.e. too many projects in relation

to available resources) and opportunistic project management behaviour are a couple of causes for this syndrome (Engwall & Jerbrant, 2003). It is difficult to determine the extent to which the company struggles with these issues. However, it may well be argued that over commitment is a major challenge at the company. A project should not be started until the required resources are available (Kerzner, 2014). The results of this thesis show that projects have occasionally been assigned manhours that did not exist at the time when it was distributed. This is an indication that the firm initiates too many projects in relation to its available resources. There is no limit to the number of projects initiated, thus causing project overload (Zika-Viktorsson, Sundström, & Engwall, 2006) and delays in the product development process (Sebestyén, 2017). In terms of poor project scheduling, several of the interviewees highlighted the lack of coordination between projects, especially the synchronization of the field test reservations. Even though it is difficult to determine the degree of poor project scheduling, the results gave a small indication that it may be an issue at the company, thus worth paying attention to.

Along with the poor prioritization of projects, the resource allocation syndrome enlarges. As there are no clear guidelines or policies for prioritization, employees do not know which projects to focus on, which ultimately leaves them over committed (i.e. too many projects in relation to available resources). The over commitment seems to be the cause of stress and frustration among employees (Blichfeldt & Eskerod, 2008; Zika-Viktorsson, Sundström & Engwall, 2006). The decision-making in terms of project priority seems vague and unclear. Thus, prioritization of projects against one another becomes a major challenge (Cooper, Edgett, & Kleinschmidt, 2000). The results indicate that the company seems to initiate projects by pushing them down the organization, rather than letting teams pull work from above. It can be argued that the communication is lacking here, since people seem to prioritize differently. Higher management seems to fail to communicate the prioritization throughout the organization that is set at the portfolio and strategic bucket level. Increased supervision is clearly needed.

Balancing desired resources with resource availability is one of the major challenges within PPM (Cooper, Edgett, & Kleinschmidt, 2000). The results show that projects have either been shorthanded resources or been given resources that do not correspond to the competencies needed. The resource allocation within the strategic buckets could be one possible cause for this. Here, budget and people are separated before being allocated to projects. The assigned budget is translated into manhours which is then distributed among the projects. People have then been assigned to the projects, but have not necessarily been able to fill in those manhours. It can be argued that there exist a discrepancy between financial and human resources, partly because human resources are much more difficult to manage and reposition compared to financial resources (Hendriks, Voeten, & Kroep, 1999). This could therefore be a cause of poor resource balancing. It can be concluded that the company need to reduce the discrepancy between the two types of resources, especially since the allocation of

human resources is becoming increasingly crucial in dynamic environment (ibid). Perhaps, by not allocating those resources separately, thus merging them.

5.2 Agile Project Portfolio Management

The empirical data in Chapter 4 was presented according to the two categories:

1. The common denominators across APPM literature: communication, collaboration and commitment.
2. The company's current situation in adopting agile (specifically SAFe).

The author of this thesis has sought to summarize the discussion of the empirical data within these categories to provide the reader an overview of the company manages the agile scalability in order to implement APPM. Themes has been derived from the discussion in section 5.2.1 and 5.2.2 further down, which consequently have been compiled and presented in Table 8 below. The company's performance within each theme has been marked with a colour: green (high performance), yellow (moderate performance) or red (low performance).

Table 8. *An overview of the discussion on APPM at the company.*

Theme	Explanation	Performance
Feedback the fuel learning	Use rapid feedback on all results.	
Synchronization	Collaborative groups solve problems than individuals.	
Sequence of project execution	Identify what must be done in parallel and what must be done in sequence to maximize throughput of the portfolio.	
Even workload	Create an even workload.	
Scale using fractals	Scale agile incrementally.	
Understanding of Agile	The personnel's understanding of what agile specifically means to the company.	
Importance of Agile	The personnel's perception of the importance of agile.	
Knowledge Building	Storing and leveraging of obtained knowledge.	

Work traceability	Vertical traceability of work items, from team level to portfolio level.	
Work culture	Tensions within the working environment. The employees' willingness to sharing.	
Educated staff	Knowledge within agile among employees.	
Employee empowerment	Listen to employees at lower levels. Value is created in the front-line.	

5.2.1 Communication, Collaboration and Commitment at the Case Company

From the results, it is evident that the company struggles with several issues related to communication, collaboration and commitment.

It is evident that one of the issues with the company's current PPM, in terms of *communication*, corresponds with the one discussed by Abrantes and Figueirédo (2015) where resource conflicts are often related to information known in projects and that does not reach the portfolio level. The company has a separate process (DOL) specifically for smaller projects and assignments that are not classified as product development projects. However, the firm seems to fail to utilize it properly. It has been misused to pursue individuals' interests before those of the project. These "hidden" projects are consuming the same resources as the product development projects, which are unknown to higher management (Blichfeldt & Eskerod, 2008).

As mentioned earlier, one major problem that the company has with their current project portfolio management is that information about projects' status is not always accurate and does not always reach the portfolio level (Abrantes & Figueiredo, 2015). This was concluded to be the cause of the issue discussed by Blichfeldt and Eskerod (2008), where the case company struggles with resource deficiency and project delays due to the emergence of other projects and small assignments not subject to their project portfolio.

Blichfeldt and Eskerod (2008) suggest two solutions for this problem: 1) have PPM embrace all projects and 2) separate "unknown" projects from PPM by creating a resource pool solely for them. The company's process DOL seems to correspond with the latter, but does not function properly. One possible cause for this could be that higher management does not have enough capacity to monitor and decide on the boundary between projects subject to PPM and those that are not. However, there is no rule-of-thumb to indicate the needed enactment from top management, it usually

depends on the company's predispositions towards top-down PPM and employee empowerment (ibid). As the concept of agile strongly promotes team empowerment and a bottom-up approach to implement agile methods (Kalenda, Hyna, & Rossi, 2018), inviting new ways to increase control and power of higher management would inhibit the agile scalability rather than facilitate it. The company could instead focus on making the communication more transparent, by making it more visual through images for example (Sebestyén, 2017).

The results of this thesis indicate that higher management within the case company has had difficulties in communicating the agile transformation properly. Communicating and engaging people in the transformation process are found to be success factors in agile scalability (Kalenda, Hyna, & Rossi, 2018). The employees seem to have a relatively good understanding of the importance to work agile. However, how it should be interpreted, translated and integrated with the company's processes and tools is yet a diffuse matter. Ideas has historically always been born at the team level and then grown upwards within the company. The same has happened with agile methods, but as the employees do not know how to address and interpret the concept of agile, they create their own interpretations which many of them are not in compliance with each other. The employees at the case company are, more or less, implementing agile methods by trial and error. On the other hand, decentralizing power in this way by allowing teams investigate and select agile methods that suits them the best is an advantage. One of the scaled agile principles presented by Laanti (2014) emphasize the importance to listen to the employees working in the front-line, where value is created. The company performance well in terms of this principle. However, since there is a desire to apply agile methods on a larger scale, multiple processes and stakeholders must cooperate, thus control and guidance are needed.

According to Stettina and Hörz (2015), top management can be well aware of the benefits of agile methods, but active participation is often missing. The results of the case study clearly emphasize this issue at the company. Several of the respondents discussed issues related to managers not fully comprehending their role within an agile organization, which ultimately left them with the same tasks and responsibilities during the transformation. It can be argued that this can be considered a large bottleneck in the agile transformation, especially since managers possess a position of high authority in decision making. In order to facilitate the agile scalability, managers need to take responsibility (Scaled Agile Inc., 2019a). To manage the agile scalability, a common ground for agile principles and values is needed. Currently, there is none, thus a major obstacle for implementing agility at a larger scale at the portfolio level.

In general, the vertical communication within the company is working well. The company's system of pulse meetings is held regularly which is one approach to send information vertically through the organization. The findings show that this communication channel have on occasions been used to communicate or receive information even though it should be done elsewhere. As there were only a few of the respondents who highlighted this issue, it can be argued that it is not a major obstacle

for scaling agile at the company. The company should consider reinforcing existing communication channels, or invite new ones.

Collaboration through recurring activities is crucial at the portfolio level when pursuing an APPM (Stettina & Hörz, 2015). The company has made attempts in increasing the collaboration between teams, through the implementation of agile release trains and integration-point meetings. However, the results indicate a lack of synchronization at a larger scale, specifically between projects. The interdependencies between projects, such as activities that they share (e.g. field testing), are not always fully observed, which ultimately make them liabilities to one another. As APPM is based on transparency (Stettina & Hörz, 2015; Krebs, 2008; Leffingwell, 2007), these interdependencies will become more prominent and visualized if the company recognizes and increases collaboration between projects.

Furthermore, it is of high importance for management to fully acknowledge the need for recurring activities. The results of this thesis show that employees have experienced problems where managers perceive meetings solely for decision-making and not for receiving and discussing feedback. Frequent and rapid feedback is one of the core processes within scaling agile (Stettina & Hörz, 2015; Krebs, 2008; Leffingwell, 2007), thus of high importance for managers to realize. This issue seems to relate to the issue discussed earlier, where managers struggle with finding their role within the agile transformation. Hence, it is of outmost importance to educate managers and personnel well in advance before adopting agile methods (Leffingwell, 2007).

There does not exist a common ground for the consequences enabled by resource scarcity in literature. There is a concern that resource scarcity inhibits collaboration due to selfish-behavior (Hodgkins & Hohmann, 2007), while others claim the opposite, that scarce resources actually force collaboration instead of preventing it. (Sweetman & Conboy, 2018). The prior coincides with the case of the company. The results show that people tend to keep their resources to themselves during times of resource scarcity. Along with the feeling of unacceptance when flagging for resource deficiency in the company's project management software tool, it may well be argued that resource scarcity inhibits collaboration. As collaboration is impaired by the lack of resources, resource scarcity is itself caused by poor balancing between desired resources and resource availability (Cooper, Edgett, & Kleinschmidt, 2000). Hence, it can be argued that the problems that the company struggles with do not exist due to the absence of an APPM, rather they have to do with the company's current PPM not functioning according to legacy PPM.

As stated by Sebestyén (2017), collaboration through knowledge building within an organization is a key activity when pursuing an agile approach to multi-project management. Fortunately, with respect to the results, it can be argued that knowledge building is not considered a major problem at the case company. They use several methods to gather, create and store information. The utilization of these is highly dependent on the individual, thus used differently and to different extent. The results

could not give any indication that knowledge building is a major obstacle to the company's pursue for an APPM.

The firm seems to struggle with several issues related to the *commitment* as well. Two fundamental success factors within commitment are related to the allocation of staff. Firstly, employees should be assigned to projects on a full-time basis. Secondly, they should not be spread out across a large number of projects (Sebestyén, 2017). The company seems to fail within both. It is evident that the company struggles with dedicating staff to projects. Many employees are assigned to too many projects at the same time, ultimately leaving them stressed and frustrated due to the overload of work (Zika-Viktorsson, Sundström, & Engwall, 2006). Conducting too many projects simultaneously without adequate amount of resources causes efficiency loss as well (Sebestyén, 2017). To increase agility, the company need to reduce the number of projects assigned to each employee. The optimal outcome would be if an employee was dedicated to one project at a time. However, the company's ability to achieve that does not seem to happen anytime within the near future.

High project visibility has a great influence on the effectiveness of a portfolio in terms of resource sharing and commitment of employees (Patanakul, 2015). The pulse room were the central pulse meeting is held has all the projects within the department of R&D displayed on boards on the walls. Visual communication as such is significantly important in an agile organization. Large amount of information can be extracted from those boards (Sebestyén, 2017). Status, deviations and problems about projects are presented here. The high project visibility can facilitate portfolio decisions (ibid). However, it is important to highlight the fact that the status information is not necessarily accurate. As presented in the results, employees have a tendency to avoid showing their problems due to the lack of resources. Projects are rarely flagged with resource deficiency within the company's project management software tool. Hence, wrong and misleading project-status information can be used as a basis for portfolio decisions.

Poor efficiency in projects is often a result of conducting too many projects simultaneously, thus low amount of dedicated resources (Sebestyén, 2017). The firm appear to use a push approach when initiating projects. There is no limitation of the number of projects allowed to run simultaneously and they are constantly initiated. Project overload is clearly an issue. People are rarely assigned to projects on a full-time basis. The large number of projects along with the thin distribution of resources, commitment is considered very low at the company.

As project leaders try to get employees not subject to their project to act on their own behalf along with the absence of a clear prioritization, employees do not know what to focus on, ultimately leaving them less committed. Since there is no clear prioritization, employees are left uncertain with what spend their time with. The portfolio team has a large responsibility in increasing the commitment among employees by eliminating these types of interruptions (Sebestyén, 2017). Roles responsible for prioritization of work need to become much clearer so that teams can

be left without disruptions. Employees working at the front-line should be able to know the highest priority of work, thus not interrupted or influenced by opportunistic behaviour of project managers. It is evident that the deficiencies in prioritization is a liability for commitment.

5.2.2 Adoption of SAFe

The company is in its early stages in the implementation of SAFe. Since the adoption of the framework was initiated as a pilot, many projects and stakeholders were left out. It is of high importance to recognize these circumstances since they influence the evaluation of the implementation of SAFe at the company.

Furthermore, the implications that the adoption of SAFe has on the company's PPM are difficult to determine due to several reasons. Firstly, the pilot was initiated only a couple of months before the time of this thesis, thus it was too early to acquire any results of its impact. Secondly, the pilot only included one strategic bucket, thus the complete PPM of the company is not taken into consideration.

Within the pilot, the company has managed to create one value stream that has been assigned a budget. The funding of value streams instead of projects corresponds to one of SAFe's core collaborations at the portfolio level, that is *Strategy and Investment Funding* (Scaled Agile Inc., 2019b). However, outside of the pilot the company is still working in a project organizational environment, where budget is assigned to projects. Likewise, the importance to decompose initiatives to small and clear tasks (Scaled Agile Inc., 2019a) occur within the pilot, and not outside of it. Furthermore, in the perspective of SAFe, budgets are supported by spending policies and guidelines (so called *Guardrails*) (Scaled Agile Inc., 2019b). According to the results, the company does not seem to have any clear guidelines for assigning budgets to projects. The estimation of budgets varies widely, and majority of the bucket owners seem to conduct rough guesses. The case company could benefit from these types of spending policies and guidelines since their absence has shown to cause project delays.

As presented in the findings of this thesis, the company has begun a collaboration with its suppliers with the purpose to work agile together. Even though this initiative is not subject to the specific SAFe-pilot, it corresponds to another one of the framework's core collaborations at the portfolio level, that is *Agile Portfolio Operations*. One activity included in this collaboration involves the fostering of agile contracts between suppliers (Scaled Agile Inc., 2019b). It is evident that the company has managed to acknowledge the importance to consider external parties in the adoption of agile.

SAFe is based on the decomposition of a portfolio backlog (consisting of *Epics*) which creates work items (so called *Stories*) at the team level (Scaled Agile Inc., 2019a). The company uses backlogs within teams where team members can pull work items from. However, the company does not use central portfolio backlogs where teams can pull tasks from. This approach clashes with the strategic bucket system, since each bucket is considered a portfolio itself. The strategic bucket structure could possibly be

combined with the portfolio backlog approach by establishing a central portfolio backlog within each bucket. Teams would then pull tasks from the bucket level backlog. This would increase traceability of tasks, but the resource transparency would remain unchanged since teams would still be subject to solely one strategic bucket.

The purpose of the portfolio backlogs is to increase visibility so that teams can identify the larger entity that the work items under development will contribute to. A change of priorities in the portfolio backlog enables the company to quickly change its strategic direction (Laanti, Sirkiä, & Kangas, 2015). However, it is evident that the deficiencies in the company's current PPM would impair the backlogs' core function. Currently, projects are initiated by being pushed down the organization rather than being pulled by the teams. As the company does not seem to be able to decide upon a prioritization, the backlogs would be of no use.

The case company has managed to establish roles within SAFe. The roles at the team level, such as Scrum Master and Product Owner (Cervone, 2011) are much more established than those of the higher levels. Epic owners and Solution managers (Laanti, Sirkiä, & Kangas, 2015) are currently discussed and yet to be determined. It is evident that the company has problems during the transition between different roles. Employees have received a new agile role while still performing within their previous role. The literature advocates for educating and training employees well in advance before adopting SAFe (Scaled Agile Inc., 2019a). The results indicate that the firm seems to fail within this area. Those employees who have gained any kind of education in SAFe have acquired it on their own, based on genuine interest. However, several individuals involved in the pilot appear to have been thrown into it without proper education. Higher management responsible for the initiative has on occasions not been educated at all. As weak management is one major factor that inhibits the success of adopting new scaling practices (Kalenda, Hyna, & Rossi, 2018), it is evident that higher management needs to take more responsibility in the agile transformation. Specifically, providing personnel education within agile, not least educating themselves.

6. Conclusion

This chapter aims to summarize the discussion of the thesis in order to answer the research question. The first two sub-questions are answered, followed by the main research question. Suggestions for future research and sustainability implications are presented at the very end of this chapter.

6.1 What major deficiencies exist within the company's current PPM?

- **Poor prioritization.** Prioritization is almost nonexistence. Employees have difficulties to determine which project to work with. This often leaves them in a position where they treat all projects as equally important. Ultimately, employees are spread out and assigned to multiple projects, leaving them less committed.

- **Initiating more projects than available resources.** There is no limit to the number of projects initiated, thus causing project overload and delays in the product development process.

- **Balancing desired resources with resource availability.** Currently, people and budget are allocated separately. The assigned budget is translated into manhours which is then distributed among the projects. There exists a discrepancy between people and budget. Resource scarcity inhibit resource sharing, thus impairing collaboration within the company.

6.2 What critical factors need to be taken into consideration to facilitate the agile scalability?

- **Work traceability.** The establishment of the strategic bucket structure has created alignment and visibility between projects and the business strategy to a certain degree. However, the lack of transparency between different levels within the company still exist. The strategic bucket structure could possibly be combined with the portfolio backlog approach by establishing a central portfolio backlog within each bucket. Teams would then pull tasks from the bucket level backlog. This would increase traceability of tasks.

- **Even workload.** The company needs to decrease the number of projects assigned to one employee. The company needs to concentrate its resources, specifically assign employees to projects on a full-time basis.

- **Sequence of project execution.** Too many projects are run simultaneously without adequate resources, partly because the company constantly initiates new projects. In order to reduce efficiency loss, the company should aspire to execute projects in sequence as much as possible.

- **Understanding of Agile.** The staff understands the importance of changing their working behaviour towards agility. However, there does not exist a common ground for interpreting and translating it into the organization. Higher management needs to communicate the purpose of agile so that the personnel understands what it specifically means for the company.

- **Work culture.** The company needs to release tensions within the work culture. There is a need to create an open and transparent environment where people want to share resources and progress of work. Collaboration as such facilitate the agile scalability.

- **Educated staff.** The company needs to educate their staff within the concept of agile. Uneducated staff inhibits the agile scalability and transformation. It is specifically important to educate people in the transition between roles to increase trust and safety among the employees.

6.3 How can a mature industrial company become more agile in their PPM?

It is evident that the problems that the company is struggling with is highly discussed within PPM literature. It can be argued that the problems that the company struggles with do not exist due to the absence of an APPM, rather they have to do with the company's current PPM not functioning properly in the view of the PPM research field.

The suggested course of action for the company is to firstly consider dealing with the problems posed in the first sub-question since they seem to impair with some of the factors in the second sub-question. Several of the problems that the company has in terms agile scalability would be solved, or at least be improved, if the company manages the challenges with their current PPM.

6.4 Sustainability Implications

In terms of sustainability, the results of this thesis have social implications which are presented in the following section.

6.4.1 Social

Based on the results of this thesis, it is evident that an organization needs to adopt a social approach when managing the agile scalability to implement APPM. To be able to adopt agile methods and practices on a larger scale, aspects such as work culture, transparency and even workload need to be taken into consideration. To transform an organization towards agile it is of utmost importance to consider the wellbeing of employees. Specific attention should be paid to management communicating the transformation in a way that make the employees feel engaged, less stressful and safe.

6.5 Future Research

This study contributes to the understanding of how a mature industrial company can manage the agile scalability to become more agile in their project portfolio management. As this thesis is based on a single-case study within the automotive industry, for future research it of interest to conduct a multiple-case study to determine whether the challenges emphasized in this study are common within the industry as a whole. Furthermore, as this study is based on qualitative data, it would be of high interest to conduct a quantitative study on APPM to widen the empirical contribution.

It would also be favourable to conduct longitudinal studies on APPM. As the case company made an attempt in adopting SAFe only a couple of months before this thesis was conducted, it was not possible to acquire any results on the impact it had on the product development process. Therefore, for future research it would be of interest to investigate of a complete implementation of SAFe (Scaled Agile Framework). By studying an organization in three stages, before, during and after, a better understanding of the benefits and challenges with the framework could be obtained.

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Appendix A

SAFe vocabulary

Agile Release Train (ART): The ART can be seen as a team of agile teams which develops and delivers solutions in a value stream.

Kanban: A pull system where teams pull work when than capacity is available rather than having work pushed on them.

Lean Budgets: Each portfolio operates within an assigned budget, which is then allocated assigned to value streams.

Portfolio Backlog: The Portfolio Backlog is the highest level of backlog and it contains 'epics' which intend to create a comprehensive set of solutions. These so called 'epics' can be seen as initiatives for strategy. 'Epics' are decomposed to 'capabilities' which are found in the Solution Backlog.

Product Owner (PO): The Product Owner is responsible for the team backlog.

Program Backlog: The Program Backlog consists of 'features' which address the user needs for a single ART.

Program Increment (PI) Planning: It is a face-to-face meeting with the mission to align all teams on the ART.

Release Train Engineer (RTE): The RTE is a leader and a coach for the Agile Release Train (ART). The RTE's main responsibilities are to facilitate the processes of ART and support teams in delivering value.

SAFe portfolio: A SAFe portfolio consists of a set of value streams which are to be funded and developed.

Solution Backlog (or proxy, Value Stream Backlog): The Solution Backlog consists of 'capabilities' which involves multiple ARTs.

Strategic Themes: The strategic themes are an important tool for communicating the strategy to the entire portfolio. Strategic themes provide the differentiation to achieve the future state of a portfolio.

Team Backlog: The Team Backlog consists of stories (tasks) that originated from the Program Backlog. These tasks are executed by the team.

Value Streams: Value Streams refers to the series of steps that a firm uses to create solutions.

Appendix B

Interview Guide

Communication:

How do teams communicate with each other?
Do teams get rapid feedback on results?
What is the communication like between projects?
What is the communication like between different levels of the company?
What communication channels and tools exist?
Are the company's overall strategic objectives clearly communicated to the employees?
What obstacles exist with the company's internal communication?
How is the concept of Agile communicated within the company?

Collaboration:

How does the company build knowledge?
How are teams synchronized?
How is the collaboration among teams and projects in terms of resources?
How is the collaboration between different departments within R&D?
How is the work culture perceived at the company? Why?

Commitment:

How does the company allocate resources? Are dedicated resources allocated?
How does the company prioritize projects?
Are roles and responsibilities clearly defined at the company?
How many projects are allowed to run simultaneously?
How is the workload?