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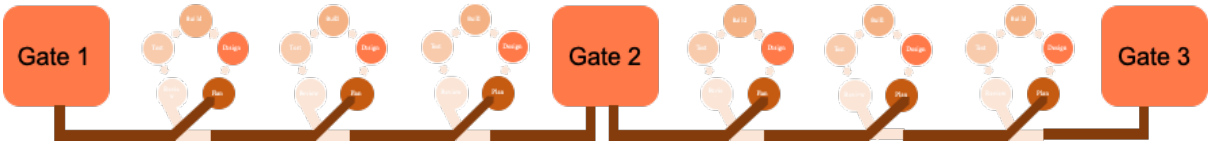

Handling Changed Product Development Requirements Within the Manufacturing Industry

Is agile the way to go?

Master's Thesis in the Quality and Operations Management Programme

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Gothenburg, Sweden 2019
Report No. E2019:087

MASTER'S THESIS E2019:087

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Cover: Figure 9. Stage gate and sprints (Created by the authors, 2019)

Chalmers digitaltryck
Gothenburg, Sweden 2019

Abstract

Background - In the 1990s, the digital era transformed industries where software usage accelerated, which resulted in a software development crisis. As the crisis occurred, software developers realized there was a need for change. In the early 2000s, the agile manifesto was introduced after being developed by software developers due to problems that the traditional development frameworks could not solve. Today, many organizations developing products within the manufacturing industry stand in before the same problems as software developers did.

Purpose - The purpose of this master thesis is to describe and analyze the agile framework created for software development and its relevance in product development within the manufacturing industry.

Problem - Today, many organizations within the manufacturing industry struggle with rapidly changing market requirements, which set demands of working more efficiently in order to reach the market faster and redeem market share. One of the latest methods for working with these requirements in product development is through the agile framework. Agile is a framework designed for software development but has started to receive recognition in the world of product development within the manufacturing industry. The master thesis includes how the agile framework, with its methods and tools, can create value for product development within the manufacturing industry. How the agile framework can be connected to success factors in product development within the manufacturing industry and if agile product development can gain value from having stable processes.

Theoretical Framework - The master thesis is based on a literature study and interviews with three project management experts and six organizations within the manufacturing industry. The findings gathered from the literature study and interviews were used for the analysis, conclusions, and recommendations.

Findings and recommendations - All methods and tools included in the agile framework presented in the theory can, based on the empirical findings, suit and create value for product development within the manufacturing industry. Some methods and tools might be more value adding than others, depending on the organization. The framework requires adjustment to the organization and there needs to be a deep understanding of the agile manifesto. The recommendations are presented in a six-step model on how to implement the agile framework.

Keywords
Agile, Agile Product Development, Traditional Product Development, Organizational Change, Lean Product Development, Agile in manufacturing industry, Scaled Agile Framework, SAFe.

Acknowledgements

We would like to express gratitude and appreciation to the following organizations and individuals who have enabled accomplishing this master thesis.

A big thank you to Goovinn AB for letting us conduct this thesis on your behalf and to all of the employees for making us feel welcome and cheering for us. An extraordinary thanks to our company supervisors Svante Thurén and Jesper Bengtsson. Both of you have been incredibly helpful and supportive throughout this thesis.

At the Chalmers University of Technology, we would like to thank our supervisor Gunnar Wramsby for providing excellent support and believing in us and our ideas throughout the thesis. We would also like to thank all the people and organization who have participated in the interviews. We are grateful for their time, input and willingness to share their knowledge.

Emma Tendell Rutgersson & Ebba Karlsten, June 2019

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1. Introduction

In this section, the background of the master thesis topic is presented. Thereafter, the purpose of the thesis and a problem description to each of the three research questions will follow. Lastly, the section ends with the delimitations of the thesis.

1.1 Background

Scientific management became established in the manufacturing industry more than a century ago, a time when the majority of organizations were considered being run like machines. Scientific management is still evident in many organizations today with a hierarchical and linear organization, which optimizes labor productivity by control and specialization (Maylor, 2010). During this time, the traditional ways of managing product development, such as the stage-gate method arose. Traditional development frameworks focus on developing quality products through a stable and systematic way of working. Today products have shorter life cycles, which are a result of fast-changing technology and new requirements. Short product life cycles and new requirements demand fast development processes and greater customer focus (Sommer, 2015). It increases the demand for products to reach the markets faster in order to stay competitive (Sommer, 2015).

The view on organizations has shifted from machines towards being viewed as living organisms. This has lead organizations toward exploring other ways of managing product development projects (Špundak, 2014). New methods of developing products have arisen, such as agile development, while the foundations of traditional development remain (Petersen & Baca, 2009; Karlström & Runeson, 2005; Begel & Nagappan, 2007). Traditional development frameworks could affect the development of products in fast-changing markets negatively due to long development periods without reviews. The development is ongoing without the possibility to take in new requirements due to a set plan from the start of the project. The traditional development lacks the possibility to shift focus and does not encourage the employees to make their own decisions due to a hierarchical organization structure. A rigid project plan which commonly is set from the start of the stage-gate process could result in the products being outdated when viewed as finalized and ready to be launched (Stoica et al., 2013).

In the 1990s, the digital era transformed industries where computers and internet usage accelerated, which resulted in a software development crisis within the IT industry. As the crisis occurred, software developers realized there was a need for change. In the early 2000s, the agile manifesto was introduced after being developed by software developers due to that they had problems which traditional development frameworks could not solve. Traditional product development frameworks create plans for the final product and its features years in advance of launch. The software industry was rapidly changing, and when the product reached the market, it was therefore no longer valuable for their customers (Cooper, 2016). The agile framework which enabled organizations to be flexible and responsive has begun to attract the

manufacturing industry. The agile framework has the methods and tools which enables organizations to cope with customer requirements, fast changes and provides the ability to manage them which results in organizations being able to grow and meet changing market trends and requirements (Boehm & Turner, 2004)

Today, many organizations developing products within the manufacturing industry stand before of the same problems as software developers did (Williams & Cockburn, 2003; Highsmith & Cockburn, 2001; Begel and Nagappan, 2007). The automotive industry is an example of an industry in need of change in order to survive where traditional development frameworks can hinder the development. The industry stands before considerable changes in their market as there is a need for moving towards electric engines instead of combustible engines, a move towards self-driving cars and sustainable thinking. Since a car development project can take years and the market shifts fast, there can be a need to continually check so that they are doing the right thing. Which then requires the possibility to take in new requirements and shift focus fast.

When in need of evolving the development process in order to stay competitive, it can be challenging to know which development framework that is best suited for an organization. Some researchers argue that agile methods and tools are not novel and that organizations have been using agile methods for many years without being labeled as agile (Merisalo-Rantanen et al., 2005). The fundamental values and principles of agile are not revolutionary nor the specific methods and tools but having a set of methods and tools within the organization used by everyone can structure the organization (Agilemanifesto, 2001). It is unsure if organizations need to implement all the agile methods within the framework in a product development process in order to succeed. It might be successful for some organizations only to use some of the agile methods, primarily if some of the agile methods and tools already exist but in different forms (Merisalo-Rantanen et al., 2005). Since the agile methods mainly are developed for software development, it is also of interest to investigate which of them that are suitable in a product development process of manufacturing products (Liker & Hoseus, 2008).

The choice of product development framework might be interpreted as a choice between being fast and flexible or stable with set routines and standardized processes (Dönmez et al., 2016). Since the agile frameworks primary focus is flexibility, this has led to companies believing that agile hinder the stability and are therefore one of the main struggles when becoming more agile (Aghina, et al., 2016). The traditional way of developing provides long-term planning, which creates stability (Špundak, 2014). According to Dönmez et al., (2016), the need for a stable and fixed backbone with core elements is what ensures flexibility and speed. Therefore, it is of interest to analyze if flexibility and stability is a trade-off or if stability can enhance flexibility.

1.2 Purpose

The purpose of this master thesis is to describe and analyze the agile framework created for software development and its relevance in product development within the manufacturing industry.

1.3 Problem Description and Research Questions

Today, many organizations struggle with rapidly changing market requirements which set demands of working more efficiently in order to reach the market faster and take market shares (Williams & Cockburn, 2003; Highsmith & Cockburn, 2001; Begel & Nagappan, 2007). One of the latest methods for working with these requirements in product development is through the agile framework. Agile is a framework designed for software development but has started to receive recognition in the world of product development within the manufacturing industry (Cooper, 2016). Due to that agile is developed for software development, it is of interest to analyze how it can benefit product development of manufacturing products and if agile is applicable in the new environment.

In this master thesis, research of organizations with product development within the manufacturing industry will be made. The first research question is of importance in order to gain knowledge about agile and how agile can be applied in a manufacturing industry setting.

RQ1. How can the agile framework with its methods and tools create value for product development within the manufacturing industry?

In order to understand if and how the agile framework can be applied within the manufacturing industry it is of value to analyze current success factors in product development processes. Some organizations within the manufacturing industry might already use agile methods and tools in their existing product development process without being aware of it. Finding success factors will be of importance in order to analyze how those success factors have enhanced the product development process. The second research question is therefore of interest in order to describe and analyze if the agile framework has any correlations to success factors within product development.

RQ2. How can the agile framework be connected to success factors in product development within the manufacturing industry?

Today, there are still many organizations who have chosen to stick with traditional development methods such as stage-gate (Maylor, 2010). Since flexibility is the central pillar in the agile manifesto, it can seem paradoxical with stability. Thus, organizations might fear changing approach (Dönmez et al., 2016), especially since stability and robustness is one of the main advantages to the traditional approach (Špundak, 2014). Organizations in fast

changing markets do however need to cope with being flexible which is challenging when using traditional development methods (Špundak, 2014).

One can assume that stable processes in organizations make it easier for projects to be flexible, projects can then change goals and plans without having to change how the organization work (Aghina et al., 2016). Flexibility in projects could be exemplified by how this thesis was composed. The purpose of this thesis was set from the start, but the direction was changed during execution. A time plan was set early where the scope and research questions were formulated. There was a flexible approach, and circumstances affected the outcome of the thesis by changes in time plan, scope, and research questions. A fixed way of organizing the thesis made it possible to be flexible in changing the content.

Being agile and having stable processes can seem paradoxical, but according to Aghina et al. (2016), the most successful organizations are both stable and flexible. Therefore, it is of interest to investigate how and when an organization can be mutually beneficial from the two aspects of flexibility and stability. It is also of interest to investigate what processes should be recommended to be stable despite an agile foundation of the project. Lack of knowledge about how and when to have stable processes in an agile project leads to the third research question.

RQ3. How can agile product development projects gain value from having stable processes and routines?

1.4 Delimitations

This master thesis is delimited to focus on the agile framework and if the framework can provide value to product development processes in a manufacturing industry setting. The agile framework was invented for software development. Therefore, the theoretical findings will mainly be based on agile software development. The empirical findings only contain organizations developing products within the manufacturing industry. It is already confirmed that agile applies well in software development, while there are uncertainties if the agile framework fit in other environments. There is also limited research regarding agile when developing products within the manufacturing industry. Since the study is limited to interviewing six organizations and three experts, the results will be based on those findings. The results of the master thesis might have different results if other organizations were interviewed. The master thesis does not focus on lean product development and it is not included in the problem description. Since there are similarities between lean and agile, lean product development is included in the theory.

The foundation of the agile mindset is to be flexible and stability is considered the opposite of flexibility. Hence, it is of interest to study flexibility and stability in comparison with each other. Delimitations have therefore been made to compare flexibility and stability in how the two aspects affect the development process. The agile framework can be interpreted differently from person to person. Hence, this master thesis the definition of agile is delimited to the theory presented in the theoretical framework section.

2. Theoretical frameworks

This section presents the main findings from the literature review. The purpose is to provide a basis of the knowledge which is needed to analyze the empirical findings. The section begins with theoretical findings within product development in order to provide an overall understanding of the subject. Furthermore, two frameworks of product development are presented. Firstly, the traditional product development provides an understanding of why the other framework, agile product development, arose. The findings regarding agile development are mainly connected to software development. The theoretical findings regarding agile are divided into twelve subheadings which will be utilized throughout the thesis. After that, the Scaled Agile Framework (SAFe) is described since it is one of the common ways to adapt agile methods and tools together with findings of how to undertake an agile implementation. Within agile and SAFe, there are aspects related to Lean product development hence, a section on Lean product development can be found. Lastly, this section ends with findings on change management since organizations in need of new product development frameworks will have to experience change management.

2.1 Product Development

Product development can be described as the process of designing, creating, improving, and marketing products (Galli & Kaviani, 2017). It is about taking an idea into reality in the shape of a product which meets the market needs while still being economical and manufacturable (Wheelwright & Clark, 1992). Product development can be either development of existing products or the development of new products. The development of products is commonly completed in projects, and through different kinds of tools, techniques, different applications of knowledge and skills in order to meet product requirements (Galli & Kaviani, 2017).

Product development, especially product development of new products, is one of the most important, yet the riskiest challenges an organization has (Cooper & Kleinschmidt, 1987). When developing products there is a need for information regarding what the customer wants, what features the product should have, the price which the customer is willing to pay, what features can be removed in order to reduce costs but still keep the customer satisfied (Mital, 2014). The goal of manufacturing products is to sell and to gain profit which requires a successful product development. A successful product development process does according to Mital (2014) include four attributes. These are, Cost, Quality, Product Development Time and Development of Know-How. Cost is both the producing cost and the development cost which in the end determines the selling price of the product. It also determines the product's attractiveness of the market. The product cost includes both fixed costs such as equipment and tools, and variable costs such as labor cost and material cost. Quality refers to the quality of the product which reflects the market share and customer satisfaction. Then there is the product development time, which is the time it takes to assess market needs for when the product starts to sell. How quickly a product reaches the market determines the economic return, but the time

should never interfere with the quality. The last attribute is the Development of Know-how which is the ability to repeat the development process for future products (Mital, 2014).

The development of products can be performed in different ways. In this master thesis, the focus is on the traditional product development framework and the agile product development framework. The theory of each focus area will be found below.

2.2 Traditional Product Development

A development process consists of activities which are performed during a period of time and are commonly performed in the traditional development way. Traditional product development frameworks are often hierarchical based, document-focused, and emphasize a set and long-term development plan. In traditional product development, there are commonly team leaders and project managers. The team leader is often responsible for leading the project team while the project manager is responsible for budgets, time management and team meeting (Cooper & Sommer 2016).

The scope of the development project sets the requirements and features of the product while involving all work required to develop the product. In traditional product development, the scope is identified and thoroughly documented at the start of a project. That is also when the team has minimum knowledge about the developed product. Changing the scope after finalization is viewed as unfavorable hence the cost of change increases over time. If the product development starts after the requirements set from start and changes occur later in the process, it will be time-consuming and costly to enable the changes. It is common to use scope bloat, where there are extra features included in the products which have not been required (Layton, 2012). In traditional project management, the term scope creep is used to describe the phenomena of changing requirements after the initial starting phase (Maylor, 2010).

2.2.1 Traditional Product Development Process

Product development using traditional frameworks is commonly executed in sequences trough breaking down the process. The sequences are planned from idea to launch (Cooper, 2011). The primary goal in the traditional approach is to increase predictability, stability and high assurance (Boehm & Turner, 2004).

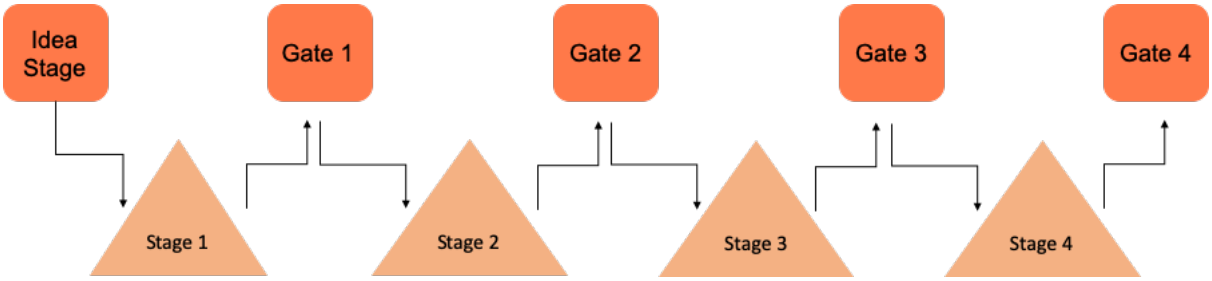

Figure 1. A Stage-gate model (Created by the authors, 2019).

The stage-gate model as seen in Figure 1 is one method within the traditional product development framework. The stage-gate model was introduced by Cooper in 1990 to create a more efficient method of developing products. It aimed to reduce lead times by managing, directing and controlling the development process (Cooper, 1990). The model can be described as an operational process from idea to end product (Karlström & Runeson, 2005). The stage-gate model consists of a set number of different stages, and the classic Cooper stage-gate model

consists of five different stages. These are, set scoope, build a business case, development, testing & validation, and launch. Between every stage, there is a gate and a gate meeting with top managers and stakeholders of the project. The top managers and stakeholders decide if the project will move on to the next stage and continue to be funded. Another decision can be that the project should be shut down or that it needs more time at the current stage before continuing (Karlström & Runeson, 2005). Karlström and Runeson (2005) state that the stage-gate model demands large amounts of documentation which could be considered as time consuming.

2.3 Agile Product Development

When developing through a plan-driven method as mentioned above, a complete set of requirements are commonly developed in the starting phase of the development. During the 1990s, requirements on technology and software businesses changed rapidly, which resulted in finalized products being outdated and customers not being able to specify their needs (William & Cockburn, 2003). A traditional product development approach was according to Deemer et al., (2010), commonly used during this time where requirements and detailed plans were well developed and set early on in a project in order to minimize the cost associated with late changes. The traditional approach is, however, limiting due to its low responsiveness to changed business circumstances (Highsmith & Cockburn, 2003). It was also limited to the initial plan; new ideas and innovations were often seen as threats to the project rather than an improvement opportunity (Deemer et al., 2010). During that time, many software businesses focused on project initiation rather than customer satisfaction. When the market began to change, they were therefore not able to deliver what the customer needed since the product requirement had changed during the product development process (Highsmith & Cockburn, 2001). Hence, they found the need for being able to respond quickly to changing requirements and unexpected events which lead them to develop the Agile Manifesto in the early 2000s (Williams & Cockburn, 2003). As seen in Figure 2, 45 percent of the software developed was not used by the end customer which resulted in waste of time and money (Standish Group, 2011).

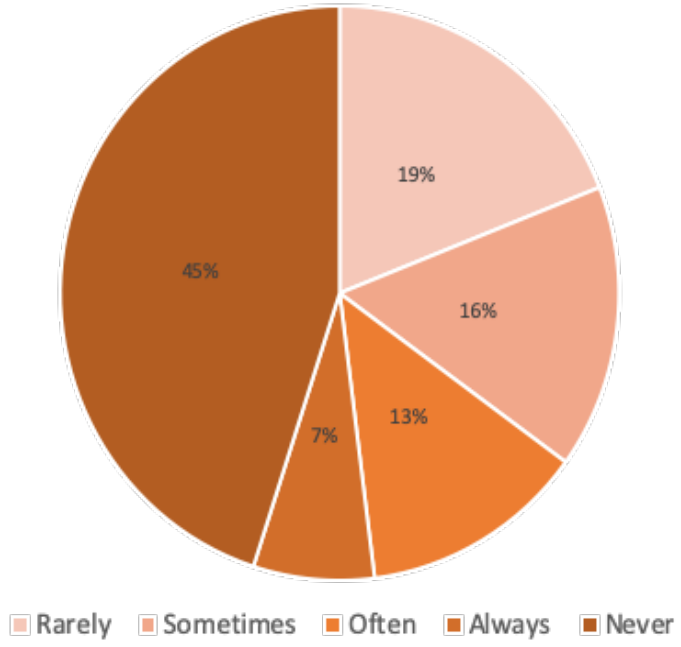

Figure 2. Usage of software features (Standish Group, 2011).

2.3.1 The Agile Values

The agile manifesto was created at the beginning of 2001 by developers with a background within the software industry as a consequence of the 1990s development struggles. They all had the same urge to change their development processes towards being customer- and high quality focused (Williams & Cockburn, 2003).

The agile manifesto has defined four values which requires contemplation. Even though there is value in both sides of one value, the left side should be valued more (Highsmith & Cockburn, 2001). The four agile values according to the Agile manifesto (2001) are:

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

The first value prioritizes problem-solving trough communication, and values interactions instead of using controlling and time-consuming communication methods. The value can occur seen as a reaction to the insensitive and impersonal way of handling a project using traditional project management methods (Cobb, 2015). The individuals' wellbeing, how project groups are composed, and how well the people in the group can collaborate is more important than processes and tools (Gustavsson, 2016). It can provide profound satisfaction for the employees since set processes and tools do not hinder them. However, it needs to be the right capacity in the team, and people need to work as a team instead of individuals for the project to succeed (Measey, 2015). Having a lower amount of processes and tools can result in that the team no longer can blame processes. The team cannot rely on following a process and expect an outcome. It is the team who is responsible for the development and so that the right tools and processes are being used (Gustavsson, 2016). If the team is too process and tools driven in the development process, they would not be as responsive to change, which would result in a lower possibility to meet the customer's needs. For example, if the need for communicating change occurs, the change should be considered when it arises, not when planned in a process (Layton, 2012).

The second value is about producing working products, the work and the development of the product must be evaluated. Documenting should not be the primary focus and documentation should only be made when adding value to the organization (Nyman, 2010). In traditional project management methods, documentation is commonly substantial where it could affect the development negatively (Cobb, 2015). Spending a significant amount of time on documenting, for example, technical specifications, test plans, and requirements are time-consuming where some of the data might not get used. Although all projects require documentation in some form, they are only useful if they can serve the product directly and includes what is needed to achieve the goal. The goal should be to create value for the customer (Measey, 2015). The agile approach advocates short development cycles, named sprints, with results being delivered at the end of each cycle. Having a long development cycle with the

result provided without customer interactions requires a lot more documentation. By using the short sprints, the amount of documentation can be reduced (Gustavsson, 2016).

The third value is about involving the customer, not only involving the customer during project start, when scope changes or at the end, but the customer should also bring input throughout the whole development process. At the start of a project, there is commonly a lack of knowledge about the product. Therefore, decisions are being made with incomplete knowledge. The agile method is about being flexible in order to change as learnings come during the product development process. It is, therefore, an advantage to collaborate with the customer from start to finish in order to develop a product which will satisfy the customer (Layton, 2012; Cobb, 2015).

The fourth value is about responding to changes in order to develop relevant products which are related to the previous value. In product development, knowledge increases the further a project proceeds, and in traditional project management, the ability to change lowers exponentially, which is a weakness (Cobb, 2015). In agile, the ability to do changes are set in the system, and when changes arrive, they are incorporated with the existing work. Changes are seen as an opportunity to improve (Layton, 2012).

2.3.2 Agile Manifesto

The agile manifesto also consists of twelve principles which were developed for software development by IT companies along with the agile values (Cooper, 2016). Nyman (2010) has described nine of the 12 principles applied to a manufacturing setting. Therefore, the principles for software development and how they are translated into manufacturing development are presented below (Agilemanifesto, 2001).

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

Where Nyman (2010), has translated the principle to "The most important thing is to make the customer satisfied by early and regular deliveries of value-creating projects results." As described by Highsmith and Cockburn (2001), the main priority in agile is the customer, and its satisfaction which also is one of the main differences from the traditional approach were project initiation was the main focus. Instead of waiting long periods before delivering results it should be presented at regular times in the process (Cooper, 2016)

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

According to Nyman (2010), it can be translated to "Adaptation to changing requirements and conditions is natural, even at a late stage, utilize change to the customer/organization's advantage." The agile approach welcomes change, and it is natural to handle changing requirements anywhere in the development process (Highsmith & Cockburn, 2001). The

development process should be able to handle changes while avoiding delays (Gustavsson, 2016).

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

Nyman (2010) translates it to “Deliver useful project results often, preferably every few weeks.” The delivery of progression and results can be used as a way of gaining immediate feedback. It can, according to Cockburn and Highsmith (2001), be used as a development guide where the feedback is used to set the development direction. Through working in sprints and involving customers and delivering results at each sprint will increase interactions and ensure regular deliveries (Cobb, 2015).

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

Nyman (2010), translates it to "Business experts and developers work closely together." The communication can be viewed as one of the main benefits with agile hence the communication between all stakeholders is enhanced. It increases development speed and saved cost due to developing a product that the customer values (Highsmith & Cockburn, 2001).

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

Nyman (2010) translates it to "Self-propelled and responsible individuals are the primary success factor." In an agile organization, the teams are the decision makers where there is low power of the management. They are also self-organized, which requires motivated individuals, hence they are not given tasks (Marmgren & Ragnarsson, 2001). A team who are motivated have a better chance of delivering their best (Feltovich, 2018).

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

This principle has been translated to a manufacturing context through "Communicating face to face is the best way to convey information, both within the team and to the outside world" (Nyman, 2010). Being co-located makes communication successful according to Cao and Ramesh (2007) the most efficient way of communicating.

7. “Working software is the primary measure of progress.”

It is translated to "Useful results are the main measure of progress" by Nyman (2010). The results are valued at each sprint which makes the development to be made according to requirements (Cobb, 2015).

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

Nyman does not have a translation for this principle. It is however about keeping a repeatable and maintainable speed in the development so that the delivery can be repeated at each release (Gustavsson, 2016).

9. Continuous attention to technical excellence and good design enhances agility.”

Ensuring that there is the appropriate team structure and skills within the team makes the team maintain their working pace and enables them to improve the product and handle change (Gustavsson, 2016).

10. “Simplicity, the art of maximizing the amount of work not done, is essential.”

Nyman (2010) has translated it to "Simplicity - the art of doing the right things, neither more nor less, is fundamental." It is about not developing the product more than necessary, and it should be developed to be able to do the requested job and not more.

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

Being self-organizing requires motivation and skilled team members, hence they will need to make decisions, communicate, take ownership and share ideas within the team (Hoda and Murugesan, 2016)

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

Is translated by Nyman (2010) to "The group regularly evaluates and adjusts its working methods to improve its efficiency." It does not only improve efficiency, and reflections result in improvements of individuals, process, skills, and techniques.

2.3.3 Agile Product Development Framework

Agile means flexible, being agile in product development means having the ability to be flexible in changes and improvements (Gustavsson, 2016). Agile is considered to be a modern product development framework based on cooperation with customers, iterative development, teamwork and ability to handle changes among the development process (Rico, Sayani & Sone, 2009). The agile methods developed by IT businesses have been identified to improve communication, cooperation, faster delivery and faster response to changes in technology and customer demands (Begel & Nagappan, 2007). Despite agile having its roots in software development, Cobb (2005) describes that agile values can be applied in the product development within manufacturing industries as well. Some fundamental aspects of agile product development are, as previously mentioned, communication, flexibility regarding the

project's ability to handle external requirements but also trust in the employees. Some examples where the agile framework deviates from the traditional framework are, the proportion of documentation and the ability to deviate from the set product development plan (Rico, Sayani and Sone, 2009). The agile framework is developed to enhance customer satisfaction, faster development with finding solutions to the fast-changing requirements and lower defects (Boehm & Turner, 2004)

It is difficult to find one shared and universal definition of agile. However, Cockburn and Highsmith (2001) have defined it as:

> *"Agility is dynamic, context-specific, aggressively change-embracing, and growth-oriented. It is not about improving efficiency, cutting costs, or battening down the business hatches to ride out fearsome competitive "storm". It is about succeeding and about winning, about succeeding in emerging competitive areas, and about winning profits, market share, and customers in the very center of the competitive storms, many companies now fear."*
>
> (Cockburn & Highsmith, 2001, p. 122).

When working with the agile framework in product development, it is common to use Scrum methodologies (Cooper, 2016). The method was presented in 1995 by Jeff Sutherland and Ken Schwaber (Maximini, 2015). In order to succeed with the Scrum methodologies, the implementation requires transparency, review, and adaption. Transparency equals having essential parts of the process visible to those in charge of the results. It requires a common language within the team, and it has to be a common understanding of the work in a development project and when it is defined as finished. The review minimizes abnormalities in the development process, and the adaption is to change the abnormalities so that they do not occur again. It is a structured way of involving the customer in the development project (Gustavsson, 2016).

Flexible and dynamic development process

In traditional development projects, the scope is commonly set before the development starts. According to Cobb (2015), a set scope is a weakness when an organization is in a market with uncertain and changing requirements. Instead, the agile framework enables handling changes in goals and project baseline. If the fact that requirements can change during project execution is taken into account, then the working process can be adapted for it from the start (Cobb, 2015).

The agile framework in product development is based on embracing change rather than rejecting it (Williams & Cockburn, 2003). In order to embrace change, the product development process has to be flexible, incremental and iterative which the agile methods enhance (Beck et al. 2001). Dealing with changed requirements and unexpected events have

resulted in agile planning being in short iterative cycles. The planning in agile is based on the understanding that everything is uncertain which will enable a flexible and adaptive development process (Nerur et al., 2005). The plan is adaptive, and goals short-term which enable quick response to changed requirements (Cooper, 2016).

When developing products, there has to be a scope in order to understand the basic requirements of the product. The basic requirements also help in estimating the work needed in order to create the requirements (Kerzner, 2017). When setting the scope, requirements are gathered at the beginning of the project despite using an agile or traditional approach. The requirements are however not fixed and are refined throughout the project when the development team gains further knowledge about the product and customer needs (Sohi et al., 2015). At any time in the development process, the team or stakeholders can come with new ideas on changed requirements. Changes in the scope are viewed as a possibility to improve the product and changes late in the process. When one has much knowledge about the product, that knowledge can be the most valuable (Layton, 2012). If there is flexibility in being able to shift focus during development, the odds of having developed something that is valuable for the customer are higher. (Nyman, 2010)

The agile approach also has fixed resources and schedules, but since the requirements are prioritized, the lowest ranked ones are pushed out. The iterative development process is built to welcome change. Each new requirement is added in priority to the product backlog. The scope is set by focusing on the features which support the vision and goals of the project, where the most valuable features are developed first while lower ranked ones might never be developed (Layton, 2012). While welcoming change, there has to be an understanding of the current scope in order to know what new requirements that should be the highest prioritized. There needs to be an understanding of if the new requirement supports the vision and the efforts for the new requirement (Layton, 2012).

Short planning periods with frequent deliveries

The development process is divided into sprints where interactions are made at each sprint (Cooper, 2016), as seen in Figure 3. Each sprint is recommended to be between two to six weeks (Cockburn & Highsmith, 2001). Project planning is performed at each sprint, and the plan is created to last until the next sprint, this hinders the planning from being long-term (Cooper, 2016). At each sprint, the team has to make tradeoffs on what to bring into the new sprint (Cockburn & Highsmith, 2001). The interactions at each sprint increase the responsiveness and changes in requirements can be applied to the development process after each sprint (Cooper, 2016).

In Agile, detailed planning is only made for the short-term events since according to Gustavsson (2016), long term plans are only guessing. A plan is a tool which enables the development group to reach the desired goal, and it is not a commitment. According to Divir and Lechler (2003), it is more important to be able to handle changes than a plan. If changes

occur in a project, a well-documented and detailed planning will be made in vain (Gustavsson, 2016).

When applying the agile framework by using the scrum method, planning of the development process is made in sprints and when one sprint ends the next starts. The product development occurs within the sprints (Cohen, Lindvall, & Costa, 2004). When being in a sprint, the next one is unknown until the previous one has been finalized. Each event during the product development cycle is within a rough plan, but it is not further detailed, at each sprint the rough plan is reviewed and if an event is not relevant for the next phase it is put low on the priority list for that sprint (Abrahamsson, Salo, Ronkainen & Warsta, 2017). Before each sprint, the scrum team delivers a forecast of what they will be able to deliver during the sprint. After that, the sprint plan is set by the scrum team along with the goal and desired result for the next sprint. It is decided upon what the team should deliver until next sprint and the work required to fulfill the delivery (Schwaber & Sutherland, 2017).

Each sprint has a set goal, a definition of what to be performed and a flexible plan which can be used as a guide. During the sprint, the product should be developed to be presented and reviewed at the end of each sprint to the product owner and other stakeholders such as the customer (Awad, 2005). The review ensures a structured way of involving the customer in the development. Since delivery of results is presented at each sprint, the customer is being "forced" to have an opinion, and the development will follow the customer's requests (Gustavsson, 2016). If each sprint is too long, the product definition can change, it can be too complex and risk increases. The sprint can, however, be disrupted before the planned end date if the development goal has been changed. It can be changed if the market changed, the company chooses a different business path or if technology changes (Schwaber & Sutherland, 2017).

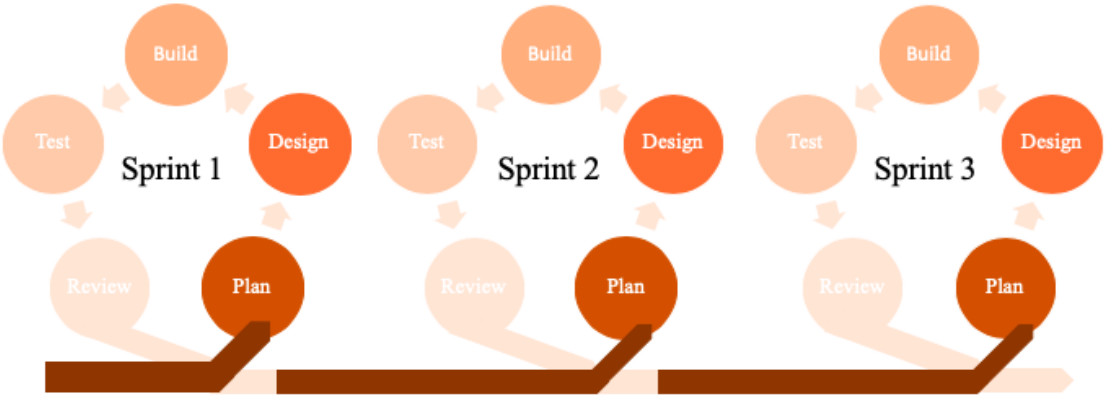

Figure 3. An Iterative Project Cycle (Created by the authors, 2019).

Despite the sprints, an agile development process can be divided into five planning levels;

Vision, Roadmap, Scheduling, Sprint plan and Daily planning activities. The vision, roadmap and the schedule include planning for the early stages of the project while the sprint plan and daily planning activities are planned for during the development process. The planning of vision is made to ensure which direction the development project should go. In order to provide an efficient project, a discussion regarding the project's vision and goals need to be discussed at a deep level. It is the most extended plan out of all five plans. Instead of creating many documents containing information about the vision and goal, it should be as simple that it can be written on a piece of paper (Gustavsson, 2016). The roadmap is an overall view of when project results should be completed without set dates and detail but should view the project from start to finish. It is a way of communicating the content of the project (Gustavsson, 2016). The scheduling should include time limits and key dates in the development process, but it does however only need to include dates that are beneficial to communicate. Since missed dates can be viewed as failures a more detailed plan should be delivered at the sprint level. The scheduling plan can, for example, be delivered in a Gantt chart (Gustavsson, 2016).

Time limitation

Due to that the level of competition has increased and product life cycles shortened within some markets, the time to market needs gets shorter (Holweg, 2008; Sabadka, 2013). Even though the agile product development does not include a set scope from the start, the time frame for the development can be set. However, during the development process, the team will reassess and asses the time needed to complete work and how much they can develop during the set time. The work focuses on completing the high priority tasks within each sprint where each time-box of a sprint is set. The time for when the development is completed is not set from the start due to that throughout the development, the team learns more, and the working speed varies. Agile development is faster than traditional development (Layton, 2012).

When an agile product development process is being planned, scheduling is one out of five planning levels. Time limits and key dates should be included in the scheduling for the development process. However, dates should only be included if it is considered as beneficial to be communicated (Gustavsson, 2016).

Not develop more than necessary

During a sprint, both product backlog and sprint backlog are used in order to decide what to develop. The product backlog is a prioritized list of tasks needed to be performed in order to develop products, but who have not yet been finalized. The product owner is responsible for the backlog, and it is reviewed before each sprint (Awad, 2005). Here changes of the product are placed, and the backlog develops during the product development process. Changes are made throughout the development process to ensure the product to be competitive and useful on the market. The product backlog lists attributes, functions, improvements, and requirements (Schwaber & Sutherland, 2017). The sprint backlog makes the identified work performed by the team visible. It is a prioritized list of requirements and tasks that should be performed in a given sprint. It makes the current state visible, and it shows the scrum team plans. The scrum team has the authority to change the sprint log (Layton, 2012; Awad, 2005).

According to Gustavsson (2016), there have been issues regarding finalizing agile projects due to that the opinion for when a project is finalized differs. Hence there is no clearly defined end, each post in the product backlog need to be described as when and what is required to name it finalized. Everyone in the team must understand when the work is complete (Schwaber & Sutherland, 2017). Finalizing a project requires handing over a project result and some work such as returning resources, material, people and collect experiences. In a traditional development process, it is commonly hectic at the beginning of the project and the end as visualized in Figure 4. This since a low amount of communication has been made throughout the development process by all involved parts. The agile method reduces the imbalance of workload since decisions and reconciliations are made throughout the development process in the sprints where results are both tested and reviewed. This makes the workload balanced and the amount of work at the end of a project, at the handover phase, is not any different from the previous working phases. In an agile development process, it is the product owner who is responsible for deciding upon when a project is finalized (Gustavsson, 2016).

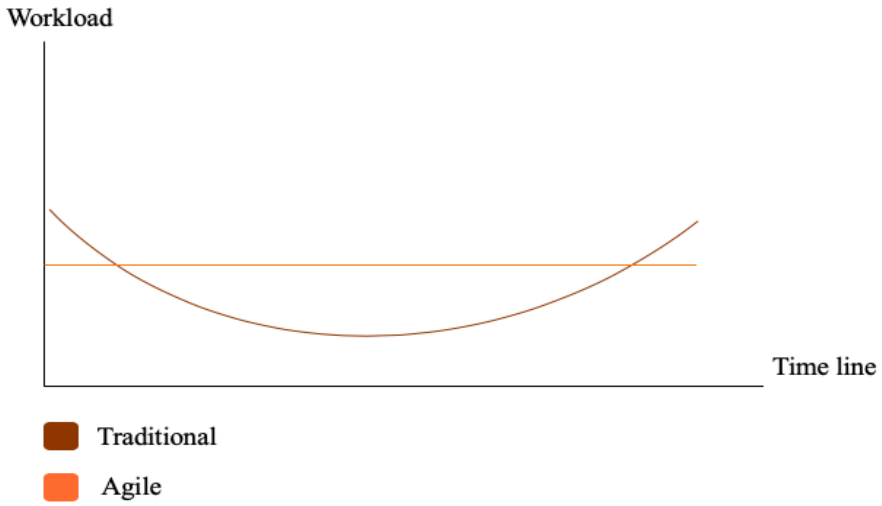

Figure 4. Workload (Created by the authors, 2019).

Customer focus

The agile framework values customer focus and to have a close collaboration with the customers. Projects based on the traditional framework includes customers through a set contract. A contract-based project leads to the project manager having to stick to projects time limits and keep the costs down while delivering what the customer requests. Hence, it could be hard for a project manager to work with the team while simultaneously work to satisfy the customer's demands. This due to that the organization's and the customer's demand for the project might not match (Cobb, 2015). Another issue related to customer contracts is that the contracts are pre-decided and limited to what the project should include. It also includes requirements on how much the project can change during the process. The contracts rigidity is required in order for the organization to be able to fulfill the set requirements. In order to avoid the rigidity and limitations that customer contracts create, it is an advantage to include the

customers as the agile framework suggests (Cobb, 2015). According to Cobb (2015), including the customers during the development process enables the process to handle changes along with the project. At the start of a development process, the organization should set abstract goals together with the customer in a general agreement instead of a set contract. During the product development process, specific goals should be set together. This is of great importance according to Cobb (2015) since markets today often are uncertain and the customer demands change rapidly.

Teamwork

The agile framework is based on team performance with self-organizing and cross-functional teams (Hoda & Muruges, 2016). Requirements and solutions are created within each project team (Beck et al. 2001). Cross-functional teams benefit projects since it enhances communication and quick feedback which enables faster development (Cooper, 2016). The team is not coordinated by plans, rules, and reports. Instead, they are coordinated by work cycles and customer feedback (Denning, 2018). The management in agile does not control or check whether the employees are working correctly, instead they guide and enable creativity by removing obstacles and hinders (Denning, 2018; Hoda & Muruges, 2016).

The scrum team should never involve more people than one can look in the eye. Thus, large groups hinder communication (Gustavsson, 2016). The team has a collective responsibility with a focus on delivering results at each sprint (Gustafsson, 2016). A cross-functional team is built of employees with different competencies which a specific product development process requires.

The team is independent and does not depend on knowledge from people outside the team. The size of the team should be small enough to enable flexibility, but big enough to know how to develop the product. Schwaber and Sutherland (2017) suggests three to nine team members to minimize complexity and to enhance flexibility, creativity, and productivity. If required a larger group, the group should be divided into smaller ones where each group has its area of responsibility (Gustavsson, 2016). To ensure an efficient team it is not only the number of individuals within it that affects the outcome, but it is also the competency in the team. To have the right competence in the team equals not having to rely on someone outside the team to solve problems consequently, in order to minimize lead times (Gustavsson, 2016).

Cross competence

According to Chin (2004), it is crucial to define clear roles and responsibilities within every project team. It is even more critical when working according to the agile framework since it defined roles and responsibilities create limits that guide the team. These limits do however need to be flexible in order to allow information and communication to cross them. Chin (2004) describes that roles in an agile organization can change rapidly, be eliminated, grow or change. Being diverse in a team creates valuable input, it requires the team members to cross the limits and go beyond their defined role and expertise. Within an agile team, one cannot rely on one person to know everything when a problem occurs. Therefore, it is a shared responsibility to

solve the problem. This results in everyone having to go beyond their competence area in order to help solve a problem within other team members' competence area (Chin, 2004). Sutherland & Sutherland (2014) state that Scrum teams should be without titles or competency areas. There can be particular competence areas, and each team member can have their focus area, but the responsibility for the product development process is shared among the team members. The team should have as broad knowledge as possible, and no one should have a specific role, except the role as a tester (Gustavsson, 2016). The tester reviews and criticizes the results being delivered and tries to find shortcomings or issues which will provide a better result. The role is vital as it ensures quality, instead of involving the tester at the end of the development project, the tester should be involved during the whole process (Gustavsson, 2016).

Self-organizing team

The scrum teams are commonly self-organizing and are organized in cross-functional teams with clear goals and collective responsibility (Maximini, 2015). According to Hoda & Muruges (2016), self-organizing teams "Enjoy high levels of autonomy, commit to, select, and accomplish their own tasks, to organize themselves". The self-organizing team does not have a leader who controls them, and it is instead the team who decide on their tasks (Schwaber & Sutherland, 2017). The team is self-driven and are the decision makers since they are those with most knowledge about the details and problems in the development (Gustavsson, 2016).

Roles

In agile product development, there is no team leader or project manager. Instead, there is a scrum team with roles such as product owner, scrum master, and employees within a development team as seen in Figure 5. The scrum team is self-organizing and cross-functional which means that they do not require any external parts to be included in order to reach desired results (Maximini, 2015).

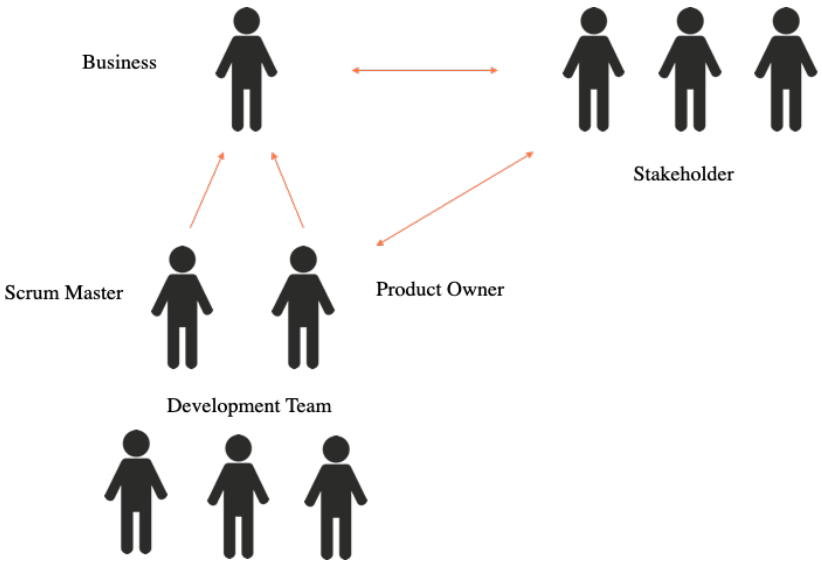

Figure 5. Scrum Team (Created by the authors, 2019)

Development team
The development team is responsible for developing and delivering a result which can be presented at the end of each sprint. The team should be big enough to enable delivering the desired result but small enough to enable flexibility (Maximini 2015).

Scrum master
The scrum team is responsible for coaching the development team and remove obstacles that hinder them from working according to scrum (Maximini 2015). Everything that hinders the scrum team is a waste of money, time and resources (Gustavsson, 2016). The responsibility for daily activities is on the scrum master where the role involves making sure that the development team follows the appropriate agile methods and tools. The role also includes removing obstacles which can hinder the development team from using the methods (Cooper & Sommer, 2016). The scrum master is more of a coach than a boss compared to the traditional approach. The scrum master has a mandate over the process in order to make sure that the agile methods are used, as an example, decisions regarding how long a sprint is (Gustavsson, 2016).

Product Owner
The product owner is the one ordering the product being developed and can either be external or internal within the organization. The product owner is responsible for the requirements related to the project. The traditional development framework commonly has a decision maker role which includes making decisions regarding the project's boundaries and comprehensive demands. Within the Scrum methodology and agile framework, the decision-making responsibility is related to the product owner. The role includes the responsibility of demands based on requirements from the customer. The decision maker within traditional development frameworks and the product owner's role differ, mainly regarding the authority of decision areas. Both the traditional decision maker and the product owner can make decisions about the budget, resources, delivery and accepting change proposals. The product owner can however also make decisions about changes in technical solutions, prioritization and to make the final decisions and demands for the product (Gustavsson, 2016).

The product owner is also responsible for the product backlog, to describe and prioritize the tasks within it (Sutherland & Sutherland, 2014). Requirements can be unclear, and it is the product owner’s role to provide detailed information, this includes keeping the project on track and prioritizing requirements (Gustavsson, 2016). The product owner is however not responsible for the daily activities of the team, as a project leader in a traditional project development would be (Cooper & Sommer, 2016).

It is critical that the product owner is present during the development process, but how much can be decisive for the project. If the product owner is not present at all, there will be issues regarding the development direction. If the product owner, however, is too engaged, fast decisions and changes can result in resources not being able to cope, and the result will not be

as desired. It has to be a balance, and the product owner should preferably not be a part of the development team. If the product owner is found within the development team, decisions can easily be made without too much bias (Gustavsson, 2016).

Open and spontaneous communication

Agile encourages face-to-face communication. Hence, it is the most efficient way to communicate information (Agilemanifesto, 2001). When working in sprints and with scrum, there are daily scrum meetings approximately 15 min a day lead by the Scrum Master. At the meeting the scrum team coordinates the daily work, the previous day is reviewed, hinders are discussed and what should be completed on that day is decided. The daily scrum meeting has the purpose of ensuring that the team moved towards the sprint goal at the right pace (Awad, 2005). Rico, Sayani and Sone (2009) describes that the frequent communication within each sprint results in less documentation and more focus on product development.

Understanding of the development process among suppliers

When developing products, there is commonly a need for external suppliers, hence organizations might lack internal resources. Gustavsson (2016) argues for organizations to choose suppliers based on their possibility to adapt an agile framework. There are two crucial aspects which have to be considered when choosing a supplier. Firstly, they need to have the ability to deliver and present deliverables frequently. Secondly, they need to enable short and continuous reconciliations (Gustavsson, 2016).

Documentation

The agile framework values working products rather than documentation (Agilemanifesto, 2001). The focus should be on delivering desired results within the development, and documentation should be performed when it adds value to the process (Nyman, 2010). Compared to developing products by using a traditional framework with large amount of documentation, the agile framework includes tacit knowledge within the team members heads (Highsmith, 2003). Highsmith (2003) argues that documentation is vital in order to share and collect gained knowledge for future projects.

Stability

Stability and flexibility are often considered the opposites of one another, and it is considered paradoxical to strive for both stability and flexibility. It has been identified that organizations often choose between either flexibility or stability to achieve their goals, thus seeing the flexibility and stability as a trade-off (Aghina et.al, 2016). Stability in this intention means that variation is eliminated. According to the New Oxford American Dictionary, stability is defined as "state of being stable" and can also be described in a context with regularity and continuity. Flexibility in this context is referring to the ability to make and adapt to changes (Dönmez et al., 2016). According to Dönmez et al. (2016) flexibility and stability can be stated in terms of an outcome and a process. Thus, a flexible outcome and process and stable outcome and/or process. Unlike Farjoun (2010), who claims that one is either flexible or stable, Dönmez et al. (2016) argues that this does not have to be a trade-off. An organization can be both flexible

and stable in both a process and an outcome. Dönmez et al. (2016) strengthens their conclusions by their argument. Firstly, a development process can be flexible while the end product is stable. Consequently, what to develop is set, but how to develop it, for example with what technique is flexible. It can also be vice versa, flexible outcome with a stable process. The authors also argued that stability in this context by using routines could enhance the organization's flexibility. Stability and flexibility can according to Dönmez et al. (2016), be mutually beneficial.

Agile software development has its focus on flexibility, and therefore stability often is interpreted as an aspect that is excluded in the method. Since, as mentioned earlier, flexibility and stability are seen as each other's opposites. Despite the fact that Dönmez et al.'s (2016) research was executed at five different software developing companies, they found that agile software development has methods that created stability. Those methods were mainly found in routines regarding the work structure, such as team sizes, work phases, and meeting lengths. The elements of the agile framework that creates stability also creates flexibility within the framework. Thus, through routines, greater flexibility is created since flexibility not only refers to the result but also the processes. By having stable routines, the way to perform the work can be improved continuously. The Agile framework encourages employees to continually strive to work in the best way with the best routines and formal structures adapted to the projects they work within. Therefore, according to Dönmez et al.'s (2016) study, it appears that stable and agile routines can create and enhance flexibility.

2.3.4 Scaled Agile Framework

When organizations want to adapt lean product development and agile methods and tools in their organization the Scaled Agile Framework, also known as SAFe, is a possible option. It is a framework developed for larger organizations and was first mentioned back in 2007 (Leffingwell, 2007). The framework was however not published until 2001, and it has continuously been updated ever since the release (Scaled Agile Framework, n.d.). The SAFe framework can have many advantages where several case studies have shown a result of increased productivity, increased motivation among the employees, decreased product deficiency and decreased time to market (Scaled Agile Framework, n.d.).

The framework is based on four variants, as seen in Figure 6. The different SAFe variants are Essential SAFe, Portfolio SAFe, Large Solution SAFe and Full SAFe (Scaled Agile Framework, n.d.). The different variants include different levels of an organization, and the different levels are Team Level, Program Level, Large Solution Level and Portfolio Level. The variants and levels are presented in Figure 6.

When an organization is about to implement SAFe, a choice has to be made regarding which of the SAFe variants that should be implemented. The choice should be based on organizations' size where Full SAFe suits larger organization and Essential SAFe suits smaller organizations (Scaled Agile Framework, n.d.). Despite the SAFe variants providing a clear framework on

how to work, the framework does need to be customized to the organization's needs and circumstances (Scaled Agile Framework, n.d.).

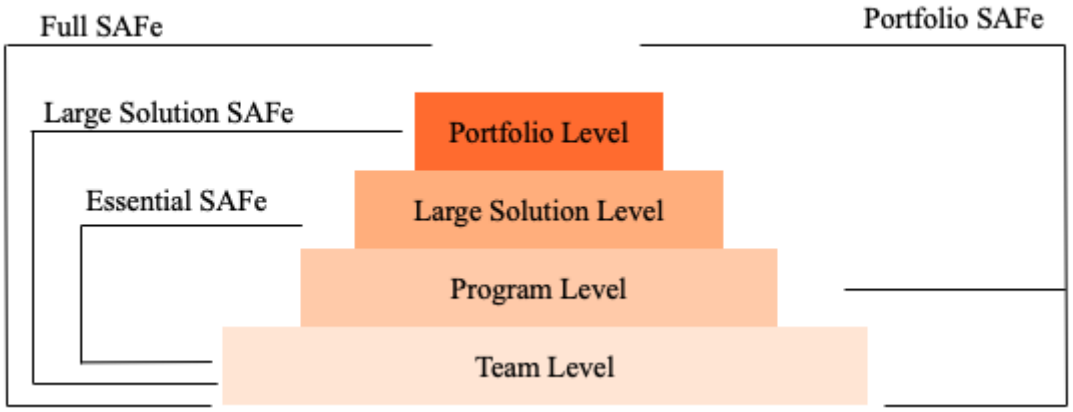

Figure 6. The SAFe Implementation Variants (Scaled Agile Framework, n.d.).

2.3.5. Undertaking an Agile Implementation

When embracing the agile framework in an organization, it is crucial to understand that the agile framework is not just a set of methods which can be implemented on top of the existing organization and its management. The agile framework requires new management and a new way of thinking with a new organizational culture (Denning, 2018). The real purpose and focus of the organization are also essential to keep in mind.

The transformation from the traditional approach to an agile approach cannot be driven by people within the top, neither from the bottom of an organization. There must be employees involved at all levels in the organization which therefore requires a combination of a top-down and a bottom-up approach (Denning, 2016).

As seen in Figure 7, Measey (2015) has described five components that are important in order to create an agile organization. An agile mindset is crucial in order to adapt the agile values, principles practices, tool, and processes. It is about being agile, not working agile. Measey (2015) argues that when implementing agile or lean, an organization can not only adapt the way of working, the processes and tools, in order to reach the advantages with agile. It requires the mindset, and an agile mindset requires that agile has been a part of the organization, it should be a part of how the organization integrates with the world (Measey,2015).

Figure 7. Components in the Agile Way of Working (Measey, 2015).

According to Moe et al., (2008), agile methodology development for software development has been criticized due to the lack of scientific support by both academics and practitioners. Despite the agile framework being developed for software development, all kinds of organizations are learning that the new development can be successful. Organizations who are truly agile are taking are succeeding with their business whether or not they are labeled as agile (Denning, 2018). Organizations can be agile, without using the term. They are however organized in an agile way with low top-down management, short cycles and small teams where feedback from customers are valued. An organization with an agile core connects everyone and everything, everywhere at all times (Denning, 2018).

Denning (2018) discusses the working culture which is associated with agile and the creation of an "agile sweatshop.". The agile methods are supposed to enhance innovation, and the working team is required to use their initiative and have a commitment which requires leadership to change from a highly hierarchical culture to a flatter culture. If implementing the agile methods in a highly hierarchical culture Denning (2018) states that it leads to employee burn out due to high pressure

Denning (2018) also states that the agile framework cannot be implemented in an already existing management practice. Hence, the agile framework includes an entirely new and different management. Merisalo-Rantanen et al. (2005), however, state that the agile principles have been around since the 1960s and are not a new way of working. In order to embody agile management practices, the organization needs to understand that it is a new mindset and a different organizational culture (Denning, 2018). Implementing an agile transformation can according to Denning (2018) not be led from the top management nor from the bottom-up. It requires a combination of top management encouraging and inspiring agile leadership within the whole organization.

2.4 Lean

Lean is a philosophy that has its roots from Toyota in Japan (Petersson & Ahlsén, 2009). Toyota Production System (TPS) was introduced by Taiichi Ohno and was targeted to remove and eliminate waste which can be characterized as non-value adding activities for the customer. TPS consists of who pillars, Just-in-Time (JIT) and Jidoka. JIT aims to focus on producing the right thing at the right time with the right quantity, which results in reduced stocks. Jidoka helps the organization to improve the quality of the products. TPS resulted in a global concept that today is known as Lean production (Jasti & Kodali, 2015). Lean production and TPS have some differences, but the principles and objectives are similar (Chiarini et al., 2018).

2.4.1 Swedish Lean Product Development

Product development differs from manufacturing where lean was firstly introduced, although the differences, the lean philosophy can be applied in product development. How lean is applied in product development deviates from lean production, for example how to handle rework differs. In lean production, rework is considered waste and the organization strives to eliminate it, but in lean product development it can be considered as new knowledge which can enhance the products´ value. Therefore, is crucial to know how to implement and work with lean in a product development process (Holmdahl, 2016).

In Lars Holmdahls (2016) book Lean product development på Svenska, he describes essential aspects and values in lean product development for Swedish organizations. The values are (Holmdahl, 2016):

- Respect for the individual: Make use of the whole organization's knowledge, if all listen and respect each other despite job title the organization will achieve it.
- User focus: Develop with rather than for the user.
- Focus on creating value: Strive for simplicity, hence organizations should work with continuous improvement to enhance their way of working. Within lean, there is an ambition to continually improve by analyzing the current state, finding the root cause of each deviation and then eliminate them. Value within an organization can be found through a value stream mapping. Within lean it is common to perform a current state analysis within a value stream mapping in order to understand what is happening in a process. The process ensures that everyone is given a clear understanding of the process and what is going on within it (Mark, 2013).
- Holistic perspective: The employees must work for the entire organization and not just fulfill their group's task. All employees need to strive for the same goal.
- Discipline and determination: A company using Lean product development should trust the employees' knowledge and that they can accomplish their work. Also, trust the customers and the supplier in order for them to trust the company.

2.4.2 Standardized Processes

Having standardized processes is an important aspect when adapting the lean philosophy. Standardized processes increase the possibility of working with continuous improvement, kaizen - which is one of the most fundamental values of Lean (Holmdahl, 2016). Standardized work means a commonly agreed and currently best way of working. Anyone who performs the task, then executes it in the agreed way which improves the ability to work with continuous improvement (Holmdahl, 2016).

2.5 Change Management

Changing from a traditional development framework to an agile framework requires an organizational change. According to Cameron & Green (2015), all organizations in need of change must gain knowledge and confront problems that appear in order to reach success. There needs to be clear outcomes of the change to gain interest from those going through the change. Otherwise, there will be a lack of adaptation. Change Management is a structured method on how to handle change within an organization (Cameron and Green, 2015). Reaching new goals within an organization requires collaboration among the employees, it cannot be made through one individual (Rubenowitz, 2004). There are high risks of conflicts when going through a change; hence there is a risk of misinterpretations regarding new goals and responsibilities. Employees might feel threatened and unsafe due to insecurities related to status and work position. It is therefore of high importance to implement a change thoughtfully with the employees being involved in order keep them within the organization (Rubenowitz, 2004). People within an organization are commonly not against change, but instead being changed. If feeling forced to change there is more likely for the employees to show resistance (Stanleigh, 2013), the need for change must come from a possibility which has to be taken into account (Kotter, 2012). Stanleigh (2013) expresses the importance of communicating the need for change, put focus on the positive results and to always maintain the new norms and structures. There should not be any possibility for the employees to fall back on old working patterns.

When changing, there must be a change leader who engages in the change and can support the employees. The leader must lead change, not just follow it (Stanleigh, 2013). A leader does, however, need to be separated from a manager, and Kotter (1995) claims that unsuccessful change management often comes down to there being too many managers and fewer leaders. A manager is a formal role, while a leader has skills in making coworkers perform well. A leader can also be a manager, but a manager does not automatically imply being a leader.

Kotter (1995) has created a process including eight stages on how to achieve and lead change. Firstly, there needs to be an established impression that the organization needs change within the organization. The whole organization should have an understanding of the market and the organizations market position (Kotter, 1995). The second stage is to create a group of change leaders which should include people from all levels of the organization. The third stage is about creating a vision and strategy. The vision should be a deception of the future, and the strategy should be a description of how to reach the vision. The vision and strategy should be communicated through various means of communication which is stated in the fourth stage. This in order to reach everyone within the organization. The fifth stage should enable initiatives and create decisiveness since Kotter (1995) states that communication and determination are not enough to change an organization. Hinders must be eliminated, and individuals should be given authorities to carry through the change. The sixth stage highlights that change takes time. In order for the organization not to lose motivation it is important to celebrate milestones. This relates to the seventh stage, which includes not accepting slack in the new way of working. The last stage is the final goal which includes consolidating the new way of working into the culture in order for the change to be endured (Kotter, 1995).

2.6 The Analytical Framework

Throughout the theoretical findings a framework based on the most important methods and tools from the agile framework is converted into an analysis tool. The analysis tool as seen in Table 1, will be used throughout this master thesis.

Table 1. The Analytical Framework

Agile Framework
Flexible and dynamic development process
Short planning periods with frequent deliveries
Time limitation
Not develop more than necessary
Customer focus
Teamwork
Cross competence
Self-organizing team
Roles
Open and spontaneous communication
Understanding of the development process among suppliers
Documentation

3. Methodology

In this section, the methodology used to conduct the study is presented, as seen in Figure 8. Firstly, the research strategy is described, and after that, the data collection methods, such as literature review and interviews, are presented. Ethical considerations followed during the thesis will also be included in this section. Lastly, the trustworthiness of the thesis is presented.

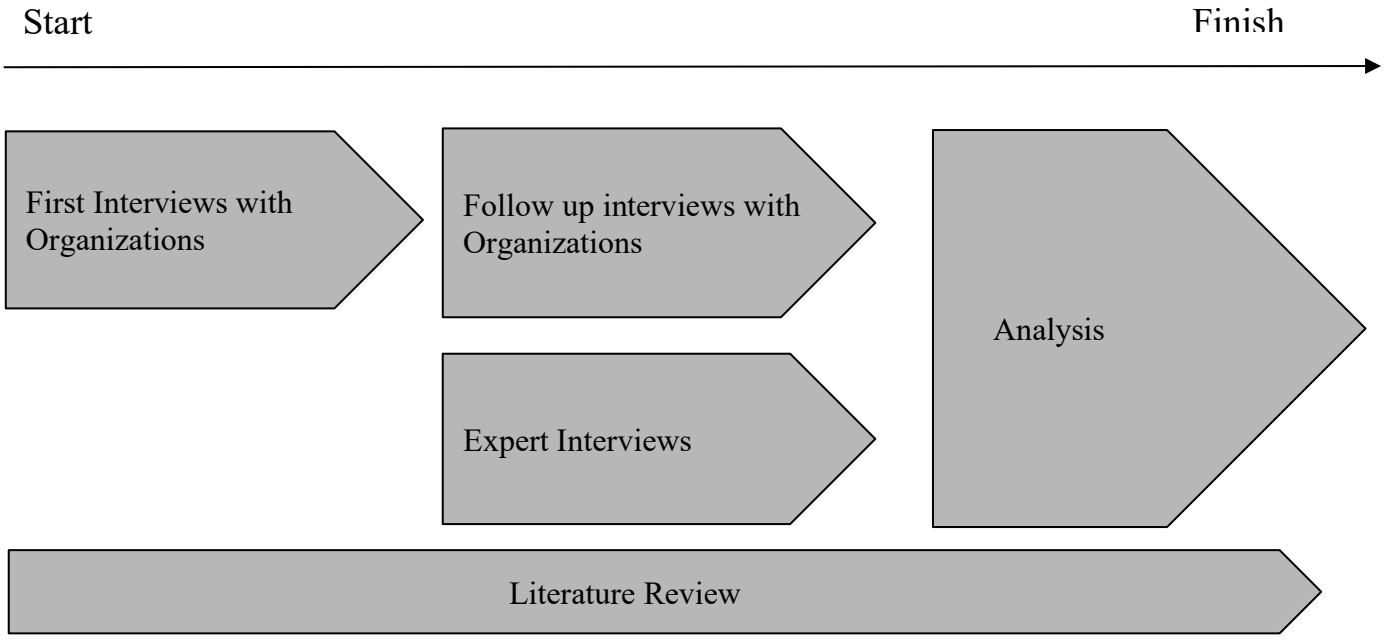

Figure 8. Structure of the Methodology (Created by the authors, 2019)

3.1 Research Strategy

Research can base on qualitative or quantitative data, in qualitative data, words are emphasized rather than numeric data as in quantitative data (Bryman & Bell, 2011). This master thesis is based on a qualitative research strategy, and this means that data are gathered through interviews with the chosen participants and their view of reality.

Depending on the relationship between research data and theory, a master thesis is either deductive, abductive, or inductive (Bryman & Bell, 2011). An inductive approach to research is when empirical data is used to build theory while a deductive approach to research is when theory is identified, and the empirical data is used to support the theory (Bryman & Bell, 2011). This master thesis is based on both approaches. Therefore, an abductive research approach was used. An abductive research approach means that the theoretical framework can be changed and developed before, during, and after the research has been processed. The abductive research strategy is beneficial in finding new variables and relationships. Hence it captures the characters in the empirical and in theory simultaneously (Dubois & Gadde, 2002). The

abductive research approach was also chosen due to it is the most beneficial when conducting a study in an organizational setting. As actions unfold, the complexity in an organization can be captured. Employees within an organization can be helpful to interview in order to gain knowledge in the field (Bryman & Bell, 2011).

3.2 Data Collection Methods

Two main data collection methods have been used in this research, literature review and interviews. Firstly, a literature review was performed to understand and give a solid foundation on the theoretical frameworks used in the study. After that, the interviews were accomplished to obtain an empirical view and a broader understanding of the subject. These two methods were used in order to answer the research questions.

3.2.1 Literature Review

The master thesis started with a literature review in order to build a theoretical framework. The theoretical framework was built during the whole thesis, which implied a process where the theoretical framework constantly grew in parallel with new empirical learnings. The literature review's focus was to obtain an overall understanding of product development, the traditional frameworks, and its weaknesses. Consequently, to generate an understanding of why many organizations today strive towards agility. Furthermore, literature about the agile framework provided a comprehensive picture of the chosen topic and provided insight regarding why the agile framework once was developed. The comprehensive knowledge gained about agile resulted in a chosen set of methods and tools to create an in-depth understanding. The chosen methods and tools were used to design an analysis tool which was used as a base during the whole thesis. The majority of the literature review was performed before collecting the empirical data. This was of great importance to enable asking the right kind of questions in the interviews. The literature review was accomplished through the use of Chalmers library database summon and Google Scholar.

Keywords: Agile, Agile Product Development, Traditional Product Development, Organizational Change, Lean Product Development, Agile in the manufacturing industry, Scaled Agile Framework, SAFe.

3.2.2 Interviews

Interviews can be performed using different methods, and interviews can either be structured, semi-structured, or unstructured. A structured interview is when there is a set of pre-decided questions being asked. A semi-structured interview is when there are a few pre-decided questions on the topic, while spontaneous questions can occur during the interview. Thus, a semi-structured interview is based on the pre-decided questions, but somewhat also steered by the respondent's answers along with the interview. Consequently, the spontaneous questions being asked depends on the respondent's answers. An unstructured interview does not have any pre-decided question but, rather a topic to discuss with the respondent (Bryman & Bell, 2011).

In this master thesis, semi-structured interviews were performed with pre-decided questions. The same interview guide with pre-decided questions was used for the interviews performed with the organizations. When interviewing the three experts, the same interview method was also used but with another interview guide. The interview guide for the organizations consisted of seven different pre-decided questions. Firstly, a question about the respondent and the organization, after that questions about the product development process, the structure of the organization, communication methods, stability, agile framework and success factors as seen in Appendix 1. The interview guide for the experts was based on seven questions about the topics: introduction of themselves, learnings, success factors, challenges, agile product development, product versus software development and implementation of a new framework as seen in Appendix 2. The pre-decided questions on the topic were asked in the same way to all participants while the spontaneous questions differed. The spontaneous questions were based on the respondent's answer. These questions enabled reaching a better understanding of the answer and the topic. Denscombe (2018) explains that semi-structured interviews provide increased flexibility since it covers a broader spectrum. It provides a deeper understanding of individuals. Hence it includes issues, emotions, and motivations. Questions can be asked which are difficult to predict in beforehand. Therefore, semi-structured interviews were chosen for this thesis. Yin (2009) discusses the importance of not steering the respondent and as an interviewer to speak moderately. When performing the interviews, these two aspects were carefully considered. All interviews were recorded except one due to confidential regulations. Both authors of this thesis performed all the interviews.

The three chosen experts have many years of experience in product development, project management and change management. By working within project and change management for many years, they could share gained knowledge and insights. The experts did not represent an organization and were chosen as a complement to the organizations due to them being able to share knowledge without bias. One interview was performed with each expert and held face-to face. Each interview went on for one to two hours.

The organization interviews were performed with six organizations and held face-to-face. At each organization, two to three employees involved in the organization's product development process were interviewed. At each interview, only one employee participated, except for one interview where two employees were present, this due to that one of the respondents had only worked at the organization for six months. The first round of interviews went on for one hour with each interviewee. A follow-up interview was conducted with some organizations to fill gaps or to get a better understanding. The follow-up interviews were performed through phone or email due to facilitated accessibility for both parts.

The six organizations were chosen based on that they all develop products within the manufacturing industry and were located in the Gothenburg area. They differ in sizes, operates in different industries and are therefore not competitors to each other. Interviews were held to gather empirical data and to obtain a broad understanding of the development processes within

the chosen organizations. To receive a deeper understanding, the number of respondents at each organization was between two to three employees. The different organizations are all successful and global or national leading in their respective field of business. The selected organizations were therefore chosen and considered as relevant in order to answer the research questions. Another reason why these six organizations were chosen was to gain an understanding of how agile product development can be applied and used in different organizations within the manufacturing industry.

3.3 Analysis

The analysis was conducted through a thematic analysis method. According to Bryman (2011), it is a common way of analyzing qualitative data. Bryman (2011) explains that through a thematic analysis of the data, themes, and patterns can be found. The method was chosen based on that is was the best way to find common themes among all of the empirical findings and ensured that the material could be presented without missing essential parts. As Bryman (2011) states, the method can be somewhat vague, hence there is no clearly defined course of action. It was however chosen since it suited the data best, compared to the other analysis methods studied.

The analysis started with transcripts of the empirical findings. Each transcription was studied in order to distinguish findings compared to the research questions and the agile framework. There were 12 themes found, where the themes found are the given headlines in the section empirical findings. The findings related to each headline were gathered through relating citations from each organization to each theme. The structure within the empirical findings provided a solid base for the analysis. Within the analysis, the findings from each organization were compared to the theoretical findings of each theme.

3.4 Ethical Considerations

Throughout this master thesis, the four ethical consideration principles defined by Bryman and Bell (2011) have been followed in order to ensure that no harm has been made to any participant in the thesis. The four principles described by Bryman and Bell (2011) indicate that there should be no harm to participants neither physically or psychologically, that there must be informed consent, no invasion of privacy and no deception.

The four ethical considerations were followed by in beforehand informing all respondents about their rights. The participants were informed about anonymity, the ability to withdraw their participation at any time, rights not to answer asked questions and information about the purpose of the thesis.

In order to avoid harming the respondents, the respondents were informed about their and the organization's anonymity in the report and the presentations. The respondent's anonymity was clearly stated when the request to participate in the study was sent. Moreover, at the beginning of all interviews, information about the respondents' and organizations' anonymity was again

mentioned. The respondents were informed about the purpose of the thesis in their invitation and during the interview. The purpose was communicated in order to avoid a lack of informed consent (Bryman & Bell, 2011). At the beginning of all interviews, a summary of the purpose of the thesis was declared. To avoid an invasion of privacy, the participants were informed that they had the right decline answering questions during the interviews. Deception is described as "when researcher represent their research as something other than what it is" (p. 144) according to Bryman and Bell (2011). By explaining the thesis and its' purpose, deception was avoided.

Since the purpose of this thesis is to analyze the organization's way of working with product development it was of great importance to take into consideration that there is sensitive information being shared. Some organizations are under the implementation of the organization's new framework which can be sensitive to share. This adds to the importance of highlighting the information about anonymity and the purpose of the thesis. The respondents represent their organization, therefore informing about their rights ensures that no harm comes to them.

3.5 Trustworthiness

When conducting a qualitative research Bryman and Bell (2011) describes four different dimensions of trustworthiness namely Credibility, Transferability, Dependability, and Confirmability.

3.5.1 Credibility

The dimension has similarities with internal validity, which is a quantitative quality measure regarding if the findings can be trusted. Credibility can be described as "acceptability to others" (Bryman and Bell, 2015. p.401). The credibility can be increased by using more than one method or source of data and letting the respondents validate the date. Within this research, both literature reviews and interviews have been used to collect data. Validating the data gathered from interviews was possible for those who showed interest but was only made by two organizations. The credibility has also been increased by there being two authors of the thesis. Thus, there is a shared understanding and agreement on the data which increases internal reliability (Bryman & Bell, 2011). The credibility was also increased since the thesis has been written in collaboration with experts within the studied field. The chosen organizations decided the respondents of the interviews. Which might be a risk as other respondents within the organizations could have other perspectives about the topic. To mitigate the risk of only receiving one persons' perspective and to create external reliability, two to three interviews with two to three different respondents at each organization were performed. Furthermore, follow up questions were asked to validate the answers. Follow up questions were asked, and the respondents were asked to give examples that could give the answers validation.

3.5.2 Transferability

The second dimension can be related to external validity and relates to the uniqueness of the research. Transferability refers to whether the research can be transferred to another context. It can, however, be difficult when conducting a qualitative study (Bryman & Bell, 2011). The transferability has been ensured through comprehensive documentation of the thesis process. There has been awareness among the authors of this thesis regarding the outcome being dependent on the answers gained from the interviews. The research can be performed on other organizations, with a possibility of other results. The findings can, however, be used by other organizations within the manufacturing industry.

3.5.3 Dependability

The third dimension can be related to reliability. It can be hard to achieve dependability while conducting qualitative research since interviews differ and data results depend on the interviewee's answer (Bryman & Bell, 2011). Bryman and Bell (2011) describe that the research process should be thoroughly documented to increase dependability. This has been increased by describing the research process in the methodology section. Recording and transcribing the semi-structured interviews have also increased dependability. In addition, Appendix 1 and Appendix 2 are available to present the questions that were asked during the interviews and to increase transparency.

3.5.4 Confirmability

The fourth dimension relates to the objectivity of the research. Confirmability is the degree of feelings and personal values affecting the research. Bryman and Bell (2011) state that complete objectivity is impossible, the authors do however need to act in good faith. Confirmability has been assured during the research through the authors reflecting on possible biases. There has been an awareness regarding keeping objectivity throughout the research. Confirmability has been increased by being transparent throughout the research when choices were made. Throughout the research, until the analysis, these have kept an objective approach. During the analysis, findings, and conclusions there is a clear distinction between own reflections and input from literature and interviews.

One identified risk was to use the word agile during the interviews. If the interviews were designed with questions consisting of the word agile other answers might have been collected. In the interview template, questions are based on the agile framework, but the word agile is not mentioned until the end. In some interviews, agile was mentioned early in the interview due to that the respondent referred to it.

4. Empirical findings

In this section, all the empirical findings of this master thesis will be presented. Firstly, findings from the interviewed organizations will be presented and finalized with the analysis framework. Further, findings from the expert interviews will be presented.

4.1 Organization 1

The organization is one of the leading Swedish companies within the food industry. The organization is located in Gothenburg, and there are about 250 employees.

4.1.1 Product Development Process

Flexible and dynamic development process

The organization has a product development process with set activities which is used for all product development projects. The respondents do not describe the development process and method to be according to a specific framework, but according to the respondent, it is similar to a stage-gate process. The respondents describe that the product development process is divided into activities where some activities can be considered as a gate. When it is time for a "gate", there is a meeting with all the people involved in the project, and those meetings are booked well in advance.

The respondents described that the activities do not need to be finalized in a specific order, but some activities need to be completed before the "gate" meetings. The respondents think that their development process with pre-decided activities helps them to know where they are in the process. It also helps them create clarity on what to do and areas of responsibility. According to the respondents, the development process is considered as excellent support for those who work in a project. The order of when to perform the activities and how to perform them is not set. It can vary from person to person and project to project.

Short planning periods with frequent deliveries

The time between each "gate" can differ, but the project development process always has a set time limit. The time limit is required since the organization only has two occasions each year when they can launch new products. Therefore, the majority of projects have a time limitation of six months. Initially, the development process starts with a presentation where the project manager pitches the project internally to the organizations' management. When the management agrees upon the development project, it can start. According to the respondent, they sometimes know very precisely what they want to develop when they start a new project. In some other cases they, for example, only have a product idea. When the product being developed is specified, the employees working in the R&D department contact the supplier regarding what ingredients they need. After the suppliers have delivered the ingredients, an internal test panel test the product. The internal panel consist of about five employees from the

marketing and R&D department and the participants in the internal test panel can vary from project to project.

The internal test panel is rarely satisfied with the first test results, and therefore, new requirements with specifications are communicated to the suppliers. This process continues until those in the internal test panel are fully satisfied with the result. When ingredients are delivered to the R&D department, they can be tested very rapidly, often on the same day. The respondents describe rapid testing to be a result of everyone in the organization being located in the same building, including the production. Product testing is consequently performed with employees within the organization, and when they are satisfied with a product, they also have an external test with about 150 consumers. The consumers get samples and answer a questionnaire. This involves the consumers, since the organization receives their opinions. Sometimes, adjustments are made according to consumer opinions. The consumers that are included in the external test panel are thoughtfully chosen. A demand for everyone within the external test panel is that they should consume the product, which the organization produces at least once a week, this in order for the consumer test's answer to be suitable.

Time limitation

The organization has set time limitations for when new product development projects should be completed due to that the customers only buy products two times a year. If the project proceeds longer than expected, there might be a decision to postpone the project for the next launch. However, this can according to the respondents cause the organization to lose market shares as competition is intense. The organization is continually trying to adhere to the project plan and usually succeeds.

Not develop more than necessary

The organization limits the product development to a specific number of projects. The number of projects ongoing at once is based on experience. Moreover, the respondents explain that their customers have limited capacity for how much they can order due to that there is limited space at their stores. Hence, the organization must carefully assess when they choose to remove existing products and replace them with new ones. The organization also produce limited edition products, and sometimes those are to attract attention.

Customer focus

The organization rarely involves the customers during the product development process. The customers are usually only involved in the end when the product already has been developed. They are involved at the point when the organization is about to sell the product to the customer. The customer is not the consumer. The customer is mainly supermarkets or wholesalers that sell the product to the consumer. The consumer is involved in the process as described earlier with consumer tests.

4.1.2 Organizing Teams and Roles

Teamwork
The organization mainly works in functions of competence. The different functions are all involved at some point during the development, mainly when their competence can contribute. Only during the "gate" meetings all functions are gathered and involved at the same time. Even though the organization is arranged in functions, the teamwork is according to the respondents excellent. This due to that everyone in the organization is located in the same building.

Cross competence
The organization does not work with cross competence in the development projects. Instead, activities are divided into different functions. The respondents say that the organization is too small to be able to work with cross competence teams.

Self-organizing team
Those working in product development projects have the authority to make decisions. If someone is uncertain about a decision, the respondents say that everyone knows whom to ask. Therefore, crucial decisions do not demand long lead times since there are possibilities to reach out to those who have the authority to make decisions. When making decisions about tests the internal test panel make decisions together

Roles
The different roles involved in the projects are project manager, product developer, purchasing department, marketing department, sales department, finance department, and production. During the project meetings, all departments cooperate and share inputs. The project manager is according to the respondents, mainly the decision maker. According to the respondents, the project manager always needs to be able to argue for the product and project.

4.1.3 Communication

Open and spontaneous communication
The respondents described that communication within the organization works very well. Communication works well since everyone sits located in the same building, information is quickly spread, and decisions are rapidly taken. Internal communication is almost exclusively face-to-face, but when decisions are made, they are written down, and an email with information is sent to those involved. Documenting and emailing decisions, according to the respondents, helps everyone to remember the decisions, it helps to clarify and make sure there are no misunderstandings.

Everyone in the organization is as mentioned located in the same building. According to the respondent, this is the main reason why the internal communication is open and spontaneous. The respondents explain that everyone knows whom to ask, who is responsible for what and

where everyone is located in the building. Communication is therefore quick and easy, lead times for communication are more or less non existing according to the respondents. In the past, the organization had the sales and marketing departments located in Stockholm. The respondents say that it is a huge difference in communication now compared to then. Now the communication helps them to move more rapidly in their development process compared to the past. As described earlier, when new tests from the supplier arrive, those participating in the testing of the ingredients can do it the same day. When departments were not located together, this was not possible.

Externally, the organization mainly communicates with suppliers and customers through email and phone but occasionally face-to-face. Those working at the R&D department write emails with specifications of what they want to order from the supplier. They mainly use the same suppliers for all ingredients, which benefits the organization since they have built a good relationship with their suppliers. The respondents explain that working with majorly the same suppliers makes communication easier since they can refer to old projects and ingredients when ordering new ones.

Understanding of the development among suppliers

The organization majorly works with the same three suppliers which according to the respondents results in the suppliers having a great understanding of the organizations' development process. Each project usually requires about ten tests before the organization is satisfied with the product. According to the respondents, this requires fast suppliers who can adapt to the organizations new requirements and can deliver new ingredients quickly.

Documentation

As mentioned, decisions and essential information is documented and sent to those who are involved which enables to remember the decision and make sure that there are no misunderstandings.

4.1.4 Stability

The respondents argue for the organizations' product development process to enhance stability. The decided process with set steps benefits the employees within the project to know that they are following the plan and that activities are being finalized before the set date. The activities do not have to be performed in a specific order but must be finalized before a set date.

4.1.5 General Findings

The organization does not work according to the agile framework and many employees within the organization have never heard about the agile framework.

4.2 Organization 2

The organization is a global leader within information and communication technology with around 96 000 employees. The interviewed departments develop power systems, and interviews were held with two different development teams

4.2.1 Product Development Process

Flexible and dynamic development process

The product development process starts with an assignment to develop a product from an internal customer. The internal customer has received input from the external customers and partly bases the assignment on customer information. After that, a product specification is created by the development team, which then is sent to the supplier. The suppliers manufacture the developed products. Requirements on the product are set from the start of a development project. It creates clarity in the development process according to one of the respondents. If changes occur during product development, it was mentioned as disturbing by one of the respondents. The same respondent also describes that change rarely occurs when requirements have been set. This depends on the requirements being based on two pre-development studies. The studies are supposed to ensure the ability to develop the product.

A visual planning board supports the development process. The board is according to the respondents were the team views all the stories, tasks and priority. Meetings are held where the purpose behind the stories and tasks are explained. During the meeting prioritization of tasks are made. The visual planning board creates a close scrum team with openness and transparency regarding stories and tasks. This is one of the most valuable gains from applying agile tools according to the respondents.

Short planning periods with frequent deliveries

The development process is based on a three-year project cycle where the cycle is divided into sprints. The time of a sprint depends on the team, and the teams develop their sprint lengths where they test and adapt according to what suits them best. According to the respondents, the teams being interviewed currently develop in three and four-week sprints.

Once a sprint is finalized, the projects are reviewed and what to do in the next sprint is decided. The teams are using stories, which is a comprehensive description of something that should be done in the project. If stories have not been finalized in the previous sprint, they are moved to the next sprint while new stories are created. According to the respondents, there are difficulties in estimating the resources required to finalize a story. It depends on the person performing the story and its competences. All stories are prioritized and broken down into tasks. The tasks are detailed descriptions of what should be done in order to finalize a story. According to the teams, the broken-down tasks are one of the main gains from their transition of using agile methods and tools. It has resulted in an increased involvement of team members since it has provided understanding of the work and has created a way to include new employees.

Time limitation
The product development is stated to be limited to project cycles of three years where there is a set of defined steps that have to be performed, such as testing.

Not develop more than necessary
The team uses a backlog were tasks which have not yet been finalized or have low priority are stored. The stories and tasks are prioritized, and therefore, the respondents say that they only perform what is most prioritized. The respondents also describe that the product owner has contact with the stakeholders and acquires requirements before the start of product development. According to the respondents, contact with stakeholders results in the team knowing what to develop.

Customer focus
The product owner of the development team has contact with stakeholder, but the stakeholders are usually not involved in the sprints. Stakeholders are involved in the development process through the product owner if there is a risk of set requirements not being met or if the desired performance is not reached. The development team does not have any contact with the final customer.

4.2.2 Organizing Teams and Roles

Teamwork
The product development teams work cross-functionally where the team members have different competencies, experiences and task duties. According to the respondents, the implementation of the agile framework has made the product developers work in teams. The teams have shared the responsibility of tasks and solving problems. Previously, the teams were composed of a few senior employees with a lot of knowledge, authority, and responsibility. The senior employees were a powerful group, and new employees had difficulties being included and to learn from them. There was a challenge regarding not creating two teams of one, the seniors' and the new employees. The agile framework has helped to manage the challenge, according to the respondent. The respondents say that now everyone has an understanding of the tasks and everyone helps each other in finalizing them. The workload is more even, but it is a mutual commitment to finalize the prioritized tasks. Everyone should feel that they are participating, not just the senior employees, which makes all the employees learn and grow.

There have been difficulties regarding how to involve new employees while not jeopardizing the quality, and there is an assurance in the senior employees. However, the organization does not want only one or a few employees to have specific competence. There should not only be one employee with the ability to perform specific tasks since it creates bottlenecks. The goal is according to the respondents to create an even distribution of the competencies while not harming the quality since the price of making errors is enormous. The respondents describe

that their agile way of working has created more participation among all the team members since the team produces tasks themselves and are well described.

Cross competence
The competence has grown with team members being able to perform more tasks. Before the agile transformation, individuals were responsible for solving problems, senior employees made decisions, and it took a long time for new employees to become involved in the development process. The organization had issues where competence was kept within the senior employees. The new way of working with visual planning and creation of tasks and stories has, according to the respondent, resulted in the facilitating of involving junior employees. The competences of all employees are now used, and the workload is evenly spread among the teams. Since the tasks are well defined and produced by the team, everyone has understood and knows what to do. This has, according to the respondents, created flexibility within the team.

Self-organizing team
The team makes decisions together regarding how to develop tasks and stories. The team does, however, not make the final decision on what stories should be prioritized. If there are any problems, the team comes up with solutions together.

Roles
Since the new way of working was implemented, the roles within the product development have changed. The product owner role has changed from being a team leader to now owning the backlog and communicating with stakeholders. The product owner sets the scope, prioritizes tasks and acts as an interface. The team leader role has now shifted to be the scrum master who now has the primary responsibility is to lead the team. The team members, however, decide the tasks on their own instead of being given directions from the team leader. There is also a team manager who has the role of developing the team and find the best way for the team to work.

4.2.3 Communication

Open and spontaneous communication
The respondents describe that teams are placed together, and the communication within the teams are mostly held face-to-face. They have had issues regarding communication, which was due to that one team member was placed in another city. There was too much loss of information, which resulted in them realizing it was not a good way to work.

Communication with internal customers and stakeholders is made through the product owner, but there is rarely any communication with the final customer. There are many internal meetings, but one of the respondents explained that there is too much time spent on meetings. There is a desire to solve the problem, however the solution is yet to be found. Communication with external stakeholders is usually made through phone or online calls, where there are issues

regarding time differences. Therefore, most of the communication is made through e-mail.

Understanding of the development process among suppliers
There is a low awareness of the agile way of working among their suppliers and external customers. The product development needs to be adapted to the customer and suppliers, but it is not viewed as a problem. According to the respondents, lead time might be the one thing interfering with agile, but lead times are natural.

Documentation
The teams create detailed specifications to their suppliers and have many checklists in order to ensure the high quality of their product.

4.2.4 Stability

The respondents describe their way of working as a process which the product developers can rely on. The respondents also say that it is considered a stability that everyone knows who to ask if something is unclear. This is due to that everyone knows the team members' responsibility and knowledge areas and they can therefore easily help each other. The respondents also describe that they have many checklists which are meant to ensure the quality. The checklists act as an assurance since it is costly to develop something that does not attain in the desired quality.

4.2.5 General Findings

According to the respondents, the product development process has roots in agile. There was a need for change, and the upper management presented agile methods and tools. The new agile way of working was meant to shorten the development times and create predictability for when a new project could start. There were however difficulties in adapting the framework and seeing the relevance of it. Especially one of the teams were skeptical against being told to change, and they lacked knowledge about agile. The teams have applied agile methods and tools in similar ways but have adapted them to their team. They started with trying to understand the agile theories on software development in order to perform an interpretation of it and apply the tools which suited the team.

Every team within the organization have the authority to create their own way of working with the agile tools. The respondents describe the agile framework as being introduced from top management where the team at first did not know how to use it. They tried and for example, applied a visualization board. However, the team misunderstood the purpose of it and thought it was mainly for supervision rather than helping the teamwork. The team did not succeed with the implementation until they received help from an agile consultant coach who found the root cause of the teams' problems. The agile coach helped the team to an individualized solution which resulted in the team being able to see the importance of the visualization tool.

The respondents talked about the culture of being open to change. Each team has retrospective meetings where issues and reflections on their ways of working can be discussed and changed.

By having retrospectives, the teams are more willing to try new methods and tools since if they do not work, they can change during the next retrospective. This has, according to the respondents, helped the teams to find ways to work that suits the team. The respondents also say that the retrospective meetings have helped them to progress in their way of working continuously. There is a culture with fear of doing wrong within the organization. The fear mainly depends on the expenses of doing something incorrectly. To overcome this, the respondents say that they work in a team-oriented way where the team together has a shared responsibility.

The respondents described that they could not see any differences in developing software or products for the manufacturing industry. One of the respondents has many years of experience in agile software development. The respondent has been told that there are significant differences due to strict delivery dates and lead times in development of manufacturing products. However, the respondents explain that the development challenges in the organization are the same, regardless of software or product development. The respondent could, however, see differences in the complexity of the development where for example a webpage differentiates from building software systems.

4.3 Organization 3

The company is a leading Global supplier of innovative MedTech products with about 1100 employees.

4.3.1 Product Development Process

Flexible and dynamic development process

The development process is based on both stage-gate and sprints. The stage-gate acts as the foundation of the development process. The stage-gate and the sprints are integrated, the respondent explains that between every gate, the development team work in sprints, which enables the developers to deliver results. The product development is according to the respondent preceded by technical research, research on how to solve problems where features of the product are set.

Each sprint has predefined goals, which clarifies what should be performed in that sprint. When a sprint has been run, there is a demo stage where stakeholders are present, and there are discussions regarding achieved goals and next steps. The demo stage is a way to reflect on the project and gain awareness of success and failures in order to bring learnings into the next sprint. The respondent explains that the further a development project prolongs, the more knowledge is gained, which can result in re-prioritization of tasks. The sprints are a way to both build knowledge and to run a project and, in the end, write down lessons learned. Even tough tasks can be prioritized in different ways from sprint to sprint, it is challenging to change parts on the product according to the respondent. This is due to long lead times for many of the built-in components. According to the respondent, it is challenging to separate the parts and make them independent of each other.

The respondents explain that there rarely are new requirements during development. If there are new requirements, they usually arise internally, which, according to the respondent, can be handled by the sprint model. The respondent describes that they have challenges to change direction entirely, but it is easier today than before the organization had implemented sprints. If changes occur, it is important to review the advantages and disadvantages of the change. Hence, changes often result in an extended development period and longer time to market. The advantages need to be greater than the disadvantages in order to proceed with a change.

Short planning periods with frequent deliveries

A development project normally runs over one to three years, where a stage-gate model with seven gates is the foundation of long-term planning. The daily and operative work is according to the respondent regulated by agile principles in the form of sprints running for 2-4 weeks. Each sprint has a clear target and goals for what to achieve. During a sprint, there are scrum meetings two times a week where status of the project, what to do next and hinders are reviewed. The sprints are also, according to the respondent, a way to set a pace for the development.

The respondent describes that it is necessary to have long term planning when developing products within the manufacturing industry. However, the sprints visualize the product development by showing results along the way. Before the organization had sprints, a project would run until a gate, a long time would have passed, and it would be harder to know if the project was going in the desired direction. The sprints are now a way of presenting what has been done and to gain feedback.

Both stage-gate planning and sprint planning is visualized analogously with post-its on a board. According to the respondent, it works well due to that all of the employees in product development are located in the same building. Value is created by the employees being physically present. The respondent does, however, explain that there has been confusion within the organization regarding differences in the stage-gate process and the sprint process, that now has been resolved.

Time limitation
A development project is according to the respondent between one to three years. Time limitation is set at the start of a project. Each sprint is ongoing for two to four weeks, where details of what to do in a sprint is set before the sprint period starts. The respondent explains that time estimation is challenging due to unfamiliarity amongst the employees.

Not develop more than necessary
The customer and consumer are involved in the pre-study that the development project relies on.

Customer focus
At the beginning of a product development project, the scope is set where user needs are defined by their product owner and requirements on the products is set. Throughout the project, the product developers discover if the set scope is possible to carry through. According to the respondent, it is difficult to get input from consumers due to the organization developing an intimate product. Possibilities to perform consumer observations during the development are limited. It is complex to involve consumers and customers due to that the ones using the products are not the customers. According to the respondent, it is also challenging to involve the customer or consumer since it is hard for them to provide innovations. There is, however, a desire to have a greater customer focus, but there has not yet been a good way to include customers and consumers in the development process.

4.3.2 Organizing Teams and Roles

Teamwork
The product development is based on scrum teams consisting of 5-10 people according to the respondents. On a strategic level, the project team is cross-functional, but the more detailed tasks are, on a more operational level, the teams are divided after competence functions. As an example, the respondent describes a team of experts only working on the coating of the product.

Cross competence
The development teams have a scrum board where work tasks are linked to specific competencies. The development teams have cross competence, but in some cases, there are limited possibilities to take other employee's tasks. The respondents described that it is hard to find generic tasks which can be solved by everyone within the project team.

Self-organizing team
Each individual in a product development project has their role and knows what to do in each sprint. Everyone plans their work, but the plan needs to be accepted by the team. The work is calculated in hours, and each sprint is loaded with several tasks. There are levels of when an individual can make decisions by themselves. Otherwise, it is the upper management. If changes which are not included in the set requirements are made, then it is the upper management who is responsible for estimating the consequences.

Roles
The development consists of a project manager who can be described as the scrum master and according to the respondent, is the one setting requirements. During the project, the project manager communicates internally and externally with stakeholders about the project. There are also teams working with specific areas within a project. As an example, the respondent describes that one team works with the packaging. Within one of those teams, there can be roles such as constructors, product technicians, quality managers, and purchasers. There is also a project owner whose role is to carry the project trough and specify what to do. The product owner is according to the respondent, not the same role as the product owner described in agile.

4.3.3 Communication

Open and spontaneous communication
The whole product development is located in the same building. According to the respondent, it is a strength. The respondent says that it increases the flexibility, but it also hinders the documentation due to that fewer things are written down and instead spoken about face-to-face. There is also communication through and around the visual planning board. There is, however, one project ongoing between Sweden and Turkey, where the team uses and plans digitally.

Understanding of the development process among suppliers
The organization did not provide any input regarding this area.

Documentation
Before agile methods and tools were implemented, lessons learned, and knowledge were only documented but never used. Now retrospectives are a part of the process where knowledge and learnings are reviewed. As mentioned, the respondents explain that the employees do not prioritize documentation and therefore sometimes important information is not documented.

4.3.4 Stability

The current product development process does, according to the respondent, set a framework for what to deliver. The process also increases quality due to that each gate has certain activities which have to be completed. The respondents explain that if there are specific essential set steps in a framework, then there is less of a risk to neglect them. The respondents describe that it might not be the most efficient way of working, but if essential activities in the development process are not finalized, then it would be very inefficient. The stage-gate model is mainly applied due to quality assurance. The stage-gate model provides clarity in what to do, who should do what and, in some cases, how to do it. It creates efficiency in starting up tasks hence each gate describes what to do. The respondents say that the gates are like a handrail and if steps have to be taken way from what is said in the gate, then there is knowledge about why.

4.3.5 General Findings

The respondents explain that the organization has lost market shares over the past few years and does, therefore, need to keep up with competitors. The agile methods applied in the development process were chosen based on reviewing other companies which have tried agile and increased their output and tempo. The organization has described their way of applying agile as visual planning and scrum with sprints. The respondent described that they have increased transparency in the organization and gained greater participation in projects by applying agile methods and tools. The purpose of the sprints is not to provide new prototypes at each sprint. Instead, the purpose is to gain more transparency and knowledge. The developers get an understanding of the whole product development process.

4.4 Organization 4

A large global organization which develops and produces premium products within the automotive industry. The organization has its headquarter in Gothenburg with around 40 000 employees.

4.4.1 Product Development Process

Flexible and dynamic development process

The competition in the organizations' market is tough, and therefore, the organization needs to develop fast in order to stay competitive and to take market shares. The organization has, therefore, started to implement a new product development framework. The respondents explain that some departments within the organization started to implement Full SAFe one and a half year ago. The implementation is described to be a schoolbook example. None of the parts in the SAFe framework are removed or modified. One of the respondents does, however, explain that the implementation will result in a combination of stage-gate and agile due to that it is the logical way to develop. Today, the organization's stage-gate model and agile sprints are not integrated, but that is the goal.

The respondents say that a set plan is essential when developing products within the manufacturing industry due to that it is connected to many other departments, components, and lead times. For example, there is a factory which needs to prepare for production, marketing companies who need to prepare the marketing, and some already existing products need to be sold in making room for new ones. If the development is delayed, there will be many consequences which will result in huge costs. Therefore, the development process needs to be predictable in order to know when to start producing the product. According to the respondents, there are obvious limitations when developing complex products which cannot be overseen.

The respondents describe that the development should be open for new requirements for as long as possible, but some things are not possible to change late in the process. The product owners can prioritize what to do, but there are set dates were some activities need to be finalized. Those activities need to have high priority in being finalized. One of the keys to success is to understand the priorities according to one of the respondents.

Short planning periods with frequent deliveries

The product development is performed in sprints ongoing for four weeks while there is a gate every 14th week. The respondents refer to working according to the SAFe framework while still having to relate the development to the stage-gate model.

Time limitation

As mentioned in Flexible and dynamic development process, the development is limited to set dates and lead times. There are set dates for when, for example material for the product needs to be ordered, and production starts.

Not develop more than necessary
The product owner makes decisions regarding the product and what to develop. It is the product owner who is responsible for developing according to requirements and prioritizes the tasks in order to reach the desired goal.

Customer focus
The organization is continuously working on understanding their customers, using prototypes, and having projects involving the customers. The organization involves the customers by letting them use the products in order to gain feedback on how the product is used. Through the feedback information regarding what features customer uses and considered as value adding is found. There are, however, hinders regarding how far in the development process requirements can change. Some things cannot be changed when the development has gone past specific steps, and some requests cannot be changed due to standards and legal reasons.

4.4.2 Organizing Teams and Roles

Teamwork
The product development teams are divided according to their function of competence due to that there are managers responsible for a specified competence area. One of the respondents talked about a vision for teams to be cross-functional and working according to SAFe. However, the respondents explain the advantages of being divided into functions. For example, competences and new knowledge can easily be shared among others with the same competence. The respondents explain that in the best of worlds, cross-functional teams would result in competences increasing and the team encouraging each other to develop competencies needed within the team. About 20 years ago, the organization tried to work in cross-functional teams, but the respondents explain that it resulted in that knowledge and competence was lost.

One of the respondents describe that cross-functional, autonomous, and flexible teams can be a success factor for the organization. They aim for teams becoming as described but has according to one of the respondents not yet succeeded. The organizations have SAFe coaches who help the teams with their challenges. The primary purpose of having cross-functional teams is that they can focus on one component, but this requires clearly stated boundaries towards other components.

Cross competence
One of the goals of implementing SAFe is to shift from competence-based teams to cross-functional teams with cross competence, but the organization is not there yet.

Self-organizing team
All the development teams do not work according to SAFe yet. The goal is, however, for the teams to make decisions on their own. The respondents say that if there were tools and the right circumstances with available data, then the team should easily be able to make the right

decisions on their own. Everything should not be needed to be discussed during the meeting since it slows the development process. Today, the teams can make suggestions, but they are not responsible for making the final decisions.

Roles

The development teams consist of roles stated in the SAFe framework. Some teams have been adjusted, and some roles have been added. The respondents say that all teams have a scrum master, a product owner, and a line manager. Before the organization was working with SAFe, the line manager controlled the development process according to one of the respondents. Each component has a product owner where the product owner manages the requirements of the product and what to develop. The line manager has responsibility for the employees within the teams, coaches them, and is in charge of staff liability. The scrum master coach the teams in agile methods, the process and that the teams daily work with sprints. The changes in responsibility areas included in the new roles have caused some issues according to the respondents. Some managers do not like their role that does not include the same responsibility and control as before.

4.4.3 Communication

Open and spontaneous communication

The organization is located in many countries around the world and has many sub-organizations within it. Communication within product development is made through a software tool. One of the respondents describes that the organization has many communication and meeting channels. Communication is mainly according to the SAFe framework such as scrum and daily meetings, while some are inherited from the previous development processes. According to one of the respondents, the SAFe framework is built on communication, but it is always a challenge. There needs to be an understanding of what dependencies each component has in order to communicate.

Understanding of the development process among suppliers

To keep the costs down, the respondents say that the organization works with different suppliers. According to the respondents, some of the suppliers work more agile than others. Working together with suppliers that are agile is an advantage since the organization wants to be able to develop the product for as long as possible. The organization also wants to be able to set new demands during the development process. The organization strives towards working agile with all its suppliers, but the respondents say that it is challenging. It is challenging due to that the organization needs to keep costs down. A way of doing so is to compare suppliers against each other. In order to work agile with suppliers, there needs to be a partnership according to the respondents, and by working in partnership, the costs will be more difficult to lower.

Documentation
According to the respondents, the organization follows what the SAFe framework described as essential to document.

4.4.4 Stability

The organization develops complex products where the respondents explain SAFe to be a defined framework for how to work efficiently and quality assuring with product development. SAFe is according to the respondents a well-documented framework, with a web page and material which all employees can reach. The framework allows everyone in the organization to have the same language regarding working terms and roles. The SAFe framework has been tested in many organizations, but since full SAFe is chosen, there are some uncertainties regarding the upper levels. Therefore, the organization needs to test and find their own way of working.

4.4.5 General Findings

The implementation of SAFe is based on training, SAFe coaches, and with many people who are knowledgeable on the agile foundation. There has been a need for new employees in the organization in order to implement the change. The respondents explain it is due to that those working in the organization often have a hard time visualizing how to work differently. The SAFe framework was chosen based on that it has been tested before in other organizations. Another reason was that SAFe has a complete package with educations where employees can be trained. After all, the respondents cannot explain in detail why SAFe was the chosen framework since the top management decided it. It started with implementation within one department, but quickly, it was evident that in order to succeed the whole organization needed to have the same roles and way of working. It is according to the respondents essential to realize that the new way of working includes not only changes in the organization but also an entirely new way of how to develop and build the products.

A transformation is not natural, according to the respondents. The implementation of SAFe has been painful, according to one of the respondents. Everything has changed quickly, and one of the respondents describes that the implementation has to be made rapidly in order for the change to succeed. There is resistance against changing, which requires individuals within the organization who believe in the transformation to be the change leaders. One of the respondents does, however, explain that those who have not understood the framework are those who have the hardest time to adapt. To encourage changed behavior, there should be rewards to teams who have gone through the transformation or work according to the framework. The industry requires a change, and everything needs to be changed according to one of the respondents. It is not certain what the future will hold, but it is confident that the products will need to be changed, and it is required to happen fast. Therefore, there is an understanding of why the transformation is necessary among the majority of the employees.

The respondents cannot see any differences in product and software development, the main difference is often described as lead times and set dates, but the respondents explain that there

are lead times and set dates in software as well. The product is very complex with both software and hardware integration. Therefore, the way of working with SAFe and implementing it should be the same regardless of what is developed.

4.5 Organization 5

A global leading manufacturer of outdoor power products and innovative solutions for forest, park, and garden care with around 14 000 employees.

4.5.1 Product Development Process

Flexible and dynamic development process

The development within the industry is according to the respondents not as rapidly changing compared to other industries, but new requirements are in the periphery due to switching technology. The products being developed by the organization have a long-life cycle. Some of the products have not been changed since they were developed in the '90s. Some products demand more frequent development than others. A challenge which the organization is facing is the switching technology. A switch in technology means that the organization wants to integrate the software with its hardware products and change from fossil fuels to electric engines. The respondents say that the switch is a challenge, but it is necessary in order to retain market shares and to stay competitive on the market. Therefore, some teams in organizations have adapted some agile methods in their product development.

All product development teams and projects use the same stage-gate model, which is the foundation of the organization's product development process. The stage-gate consists of seven different gates where the content in the different gates is set and developed by the organization. The respondents say it is crucial that their development process is very detailed since it helps those working in the development projects to know what to do, which creates a good working structure. According to the respondents, is it easy to relate and understand the development process, since it contains clear checklists at each gate. The respondents do, however, explain the stage-gate process to be rigid.

The stage-gate process should reduce the risks of making mistakes, according to the respondent. Without structure and checklists, it is according to the respondents easy to forget essential activities in the development process. However, the respondents say that the process may still fail to include essential aspects. An example of this is that the organization sometimes fails to include customer requirements. The number of customer requirements included vary from product to product and may occur late in the process. As mentioned, each gate is very detailed, but it only says what should be done and not how it should be performed.

Initially, when starting up a new development project, user and requirement specifications with customer requests are concretized to measurable variables. After that, the variables are translated into a product specification. It can, for example, be customers requesting the product not to weight more than 12 kilograms. The product specification describes how the request can be technically solved. It is according to the respondents challenging to involve new requirements during the development process and are very rarely made. If new requirements

occur, the respondents say that an analysis of risks and rewards is performed, but those new requirements cannot be an excuse to why a project is delayed.

Short planning periods with frequent deliveries

Depending on the scale of the project, the time between the gates differ, but most often it is about six months. At each gate, the management decides if the gate-activities are completed and requirements are met. If so, the project can continue towards the next gate. Some teams within the organization have implemented and work in sprints between the gates. Therefore, they work in a hybrid of a stage-gate and a sprint-based process according to the respondents. One of the respondents says that the sprints create flexibility in their process, that the stage-gate process helps them to create stability and to confirm that the development project is going in the desired direction.

Previously, the organization had problems releasing products out on the market in time, projects were delayed with a higher cost than planned, and therefore, some of the development teams have adapted agile methods. The organization has a workstation where they can build prototypes, and this helps those in the development team to visualize and to be able to work faster according to the respondents. This due to that they can rapidly test ideas and know what ideas to continue developing or not. Another way the organization has implemented visualization is through a planning board where they use a backlog, stories, and tasks.

Time limitation

The organization has time limitations in their product development but sometimes have challenges to keep the project within the set time limit according to the respondents. As mentioned, the product which the organization develops is a conservative product that does not demand fast development and fast time to market according to the respondents. The project also has time limitations based on the stage gate model and its set gates. The respondents say that the goal is to launch products according to a plan so that the market and customers can plan to phase out old products and spare parts.

Not develop more than necessary

The respondents explain that a project starts with specifying customer requests and concretize them into measurable variables. According to the respondents, this helps to develop what the customer requests. The respondents explain that the development is finalized when a customer is willing to pay for the product. One of the respondents also explains them working according to a backlog in order to prioritize tasks and stories.

Customer focus

The customer requirements are considered at the start of the project. During the project, the customer is rarely involved. The respondents explain that the development of a product is not finalized until a customer is willing to pay for the product. During the development process, there are limitations regarding if new requests can be handled. If new requests occur, then they have to be carefully considered. Customers often share requests with the sales department since

they are the ones with customer contact. After that, the sales department share the knowledge with developers, the customer is therefore not involved during the product development. Changing according to the new requirements is explained to require many hours of testing and leads to longer development times. Hence, the advantages and disadvantages of a change need to be considered.

4.5.2 Organizing Teams and Roles

Teamwork

The majority of those involved in the development projects within the interviewed teams are located in the same building. Other departments in the organization are located in other Swedish cities or abroad, for example, the assembly. The product development within the organization is divided according to the product category in four different divisions. Each division consists of its development teams where each division has their own way of working. The respondents represent two different divisions; one of them has implemented agile methods and tools while the other has not. Both divisions have implemented a more team-oriented way of working and work in cross-functional teams. The teams are not located together and sit in their functions. They do, however, have regular meetings together to discuss the projects. The respondents explain that they want everyone in the teams to be involved and that the team together own the project and solve problems together. They want those working in the teams to help each other, to supervise each other and to have an increased cross-border way of working. Working cross-border will eliminate the different functions to be protective of its territory according to the respondents.

Cross competence

The organization does not have cross competent teams according to the respondents.

Self-organizing team

The teams have the authority to make decisions regarding the daily work, the managers of the different divisions are decision makers of the product, and the chairman makes the final decisions at gate meetings. There are, however, some teams not located in Sweden, where the respondents explain that there are cultural differences regarding decision making. The respondent describes that the teams located abroad expect the manager to make decisions and do not feel comfortable doing it by themselves.

Roles

Each division has its own R&D director who decides how the specific division should work. There is a Project Management Office at each division which sets the project plan and budget for each project. The different roles in the product development teams are project manager, R&D, production, design, test, compliance, purchase, sales, and product owner. The purchase department is located in another Swedish city. The respondents argue that sometimes, roles are a bit too flexible, those working in the development teams might do things that are not included in their job description or are related to product development. It can, for example, be how the

transportation of different product parts should be organized. This is according to the respondents, not a task that should be solved within the product development team.

The product owner has a close relationship with the sales department, which in return has contact with customers. Through the sales department, the product owner can discover customer demands and changes that the customers require for existing products. The teams work closely with the product owner in order to gain input on what the customer wants. The product owner is responsible for finding customer segments and new markets. The product owner is involved during the whole project and especially at the gate meetings.

4.5.3 Communication

Open and spontaneous communication

The respondents say that the majority of those working in the teams are located in the same building. Due to this, communication is mostly held face to face. The teams located in the same building have informal meetings daily and two meetings a week where they discuss the status of the projects and each team members working status. Monthly, there is a management meeting where the project managers review the status of the project time plans, budgets, scopes, and quality. Once a week, the managers of the different departments have a meeting where the different projects and deviations in the plans are discussed. At those meetings, the managers use a visualization board to visualize the progress of the different projects.

When parts of a team are located abroad, they mainly use a virtual board, Skype and OneNote to communicate. One of the respondents says that being located in different countries is challenging due to differences in time.

Understanding of the development process among suppliers

The respondents explain that the organization is dependent on their suppliers due to that the organization only assembly parts to a finalized product. Much value is found in the supplier material. Therefore, there has to be a good partnership with all suppliers. The respondents describe that the organization needs to be good at ordering product parts in time and detect suppliers who have risky lead times. The product parts being ordered from suppliers is in a low volume but has high requirements, it is therefore an issue finding the right price. An established supplier base with predictability is a must since new suppliers' equal high risks.

Documentation

The respondents say that previously, documenting was a problem due to either documented too much or too little. There has been a culture of not documenting since it has been seen as something that does not bring value. The organization therefore now tries to find a balance of what is essential to document and how to document it.

4.5.4 Stability

The organization has a defined product development process which is supposed to suit all projects regardless of how large the production of the product will be. It is according to the respondents a stiff process since it might not fit all projects. However, it is a model to lean on, a checklist for what to do and if they are followed, then the work gets well structured. The process and its activities are therefore covering all areas, and there is a list of specified activities for each gate. Since there might be activities not suitable for a specific project, some activities can be removed. It requires an agreement regarding what activities to remove according to the respondent. The stage-gate process does, however, not ensure that customer requirement is met, but it enables that essential activities get completed.

In order to proceed after a gate in the stage gate process, the project needs approval by the management team. If some activities are missing, then a project is given more time to finalize them before moving to the next phase. One of the respondents argues that the stage-gate process is in conflict with the agile way of working. New requirements cannot come in, and changes cannot be made whenever due to that if something gets changed, then it affects other components and require testing for many hours. There has to be a review of the risk and reward of a change, and the respondent argues that it might be better to launch a product and after that improve it. Another respondent argues that agile and stage-gate could work together in a hybrid due to that it could solve the rigidity within the stage-gate model. The respondent explains that agile sprints could work within each stage and that the stage-gate model provides a structure.

4.5.5 General Findings

The respondent explains that those teams who implemented agile methods and tools did it six years ago due to that the R&D director had an interest in the agile framework. The respondent further explains that it is impossible to analyze if the implementation has given any result. The agile teams had chosen the SAFe framework but have however, only implemented some parts. The respondent argues that implementing SAFe framework straight off does not work.

4.6 Organization 6

A global leading manufacturer of additive manufacturing solutions for the production of metal components to high quality demanding markets. The organization consists of around 200 employees.

4.6.1 Product Development Process

Flexible and dynamic development process

The organization is market leading with a unique technique and new and revolutionary technical solutions for highly demanding markets. The organization's product development process has its roots in SAFe for lean enterprises, according to the respondents. The organization work according to the framework but has adapted it for the organization. They use both stage-gate and sprints for planning the development process. The stage-gate is used at an upper management level while the development teams use sprints. The stage-gate and sprints are not synchronized, and it is according to the respondents a problem due to that the product development department works agile while the rest of the organization does not. The respondents explain that the stage-gate process and the sprints are not synced due to agile immaturity within the organization. The agile way of working within product development is new, and they have not had enough results yet for the whole organization to implement the framework. The respondent did, however, claim implementing SAfe in the whole organization had not been discussed yet.

The development process is divided into three-week sprints with scheduled quarterly program increments (PI) planning. One of the respondents explains that when developing manufacturing products, it is difficult to present a finished product or prototype after a quartal. This due to long lead times compared to when developing software. There can be a lead time between four to twenty weeks for a prototype, and after that, it needs to be tested, reviewed, and then tested again. Due to lead times, the product development does not differ that much from a stage-gate process, and it is according to the respondents the logical way to do it. According to the respondent, hardware teams are more dependent on external competences for the development than in software development. Software developers can, to a broader extent, solve problems on their own and do not, for example, have to depend on external lead times.

During the product development process, each team has a screen which visualizes the current sprint, stories, and tasks. One of the respondents says that the screen helps the teams to know sprint status and that the screen assists the team to remember the scrum board. Daily meetings are held within the teams where the ongoing sprints are discussed. This creates transparency, according to the respondents. The teams work according to tasks which have been prioritized by the product owner. During the program increment, planning decisions are made regarding project prioritization.

The product development is based on concept research, which is the groundwork for the product requirements according to the respondents. Changes on the product are usually presented during the design review, which can occur whenever results can be shown within an increment. Changes are however, rarely based on direct contact between developers and customers. It is instead based on customer requirements provided to the product owner from internal stakeholders who has customer contact, such as product management or customer support. The end customers require high quality and have quality requirements where changes in products need to be deeply validated. Therefore, some customers have a hard time accepting new product updates.

Short planning periods with frequent delivery

When developing new products, a long-term project plan is set where the product should be ready after around two and a half years. The plan includes all steps which are needed to take in order to finalize the product development. The development plan is divided into increments, and within each increment, there are between three to four sprints. Each increment ends with a quarterly program increment planning which includes two days where deliveries to development projects and product sustaining activities are reviewed, analyzed and prioritized. The project leaders and product owners inquire about what is needed in order to keep the organization moving.

After every second sprint, there is a sprint demo where each team presents what they have developed in the sprints. Previously, there was a demo presentation after each sprint, but the frequency has recently been changed to every two weeks. They try to find the frequency which suits the organization best according to the respondents. The respondents explain that it is important to find a balance of what that is important to present at the sprint demo, it should not involve too many technical details, but neither be too comprehensive. At the sprint demo, there are stakeholders and teams present, it is, however, optional to participate. The purpose of the demo is to gain input from internal stakeholders, to open up communication, understanding, and transparency within the organization. The organization has however had some challenges regarding the sprint demo, where not everyone has found it valuable nor seen the purpose of it. Optional participation at the sprint demos might be the reason why key stakeholders are not present which can result in valuable input being lost.

Time limitation

There are time limitations within a set development plan, one of the respondents explains that the product development process of a completely new product is around two and a half years. The time limit is depending on if it is a new product being developed or the development of improvements on existing products. There is also, as previously mentioned, time limitations regarding lead times that the development teams need to take into consideration when planning. There are also time limitations regarding lead times, as an example one of the respondents explains that it can take between four to twenty weeks in order to receive prototypes.

Not develop more than necessary
The organization work according to a backlog. Every team has tasks which should be performed within each sprint where the product owner prioritizes them. The respondents say that it is essential to understand which tasks everyone is responsible for, what is required in a sprint and how prioritization of tasks can benefit the team to be more efficient. To enable prioritization of tasks, a foundation of knowledge about the team's competence areas needs to exist.

Customer focus
Requirements are often set internally, from internal customers and from those who have contact and work close to the external customers. The product development teams rarely have any direct contact with the end customer, but the product owner on the management level has contact with them together with sales and support. Input and new requirements during the development is lifted before the PI planning, but during the PI planning stakeholders can participate.

4.6.2 Organizing Teams and Roles

Teamwork
Almost all teams are located together in cross-functional teams. According to the respondent this has increased the teamwork feeling, knowledge sharing, and collaboration. The teams are shaped differently based on product area and competencies required, but the teams, however, share competences between each other. Previously, teams were divided into functions which resulted in the function lacking in understanding of some task's purpose. There was also a lack of a comprehensive understanding. The software developers are however still placed separately which one of the respondent's views as a disadvantage. This due to some knowledge and a comprehensive understanding of the whole product with all different functions are a loss. The respondent says that it could be more efficient if they were included in the other teams. When the teams were competence-based teams, the organization tried to implement agile tools such as sprints but did not change the team structure. Trying to implement agile tools without changing the team structure to cross-functional teams was difficult since the functions were dependent on each other's competence.

Working in teams enhances the knowledge shared, and everyone within a team together has responsibility for the work. One of the respondents explains that working according to a list of stories and tasks can result in team members working on and completing tasks without understanding the correlation to other tasks, the bigger picture. This can result in the quality being lowered.

Cross competence
The teams are cross-functional, but partial cross competent which according to the respondents, means that they can help each other and perform some tasks outside their expertise. To have cross competent teams where everyone can do everyone's work would be inefficient according

to one of the respondents. One of the respondents does, however, explain that some tasks that are outside of the development area are performed. An example is when developing completely new products, and then developers need to take some of the purchasing department tasks due to technical expertise.

Self-organizing team

The respondents talk about increased ownership of the tasks within the team. Everyone in a team has a shared responsibility. There should be transparency of the tasks, and the team should make decisions together. The teams decide their work, how it should be organized and the tasks which, according to the respondents, create a feeling of ownership. The team is responsible for their components and that the components operate according to requests and safety demands. One of the respondents does, however, explain that some teams have issues regarding ownership for their tasks. This due to that the upper management still have ownership over some decisions which can limit the teams.

Roles

The organization has adapted roles according to the SAFe framework, but the roles are adapted to the organization. There is a product development manager, product owner on both management level and within each team, a scrum master for each team and line managers. The organization has not implemented the SAFe framework at the top of the organization. For example, roles such as product manager towards the market, project managers and upper management are still working according to a stage-gate model and in traditional roles while the product development who works in agile roles and sprints. The traditional way of working and the agile way of working has not been coordinated at all levels.

There is a line manager for every development area, and every development team has a product owner and a scrum master. The line manager, product owner, and scrum masters work descriptions and responsibility areas are not understood within the organization. One of the respondents explains that tasks are similar and collide with each other. The product development teams vary in size and competences, and if one team does not have a competence that is needed, then it can be borrowed from another team. The respondents describe that the product developers are part of the whole production chain. Tasks can be related to the stages both before and after the product development and belong to other departments such as purchasing, aftermarket, and spare parts. The respondents describe that those in the development teams sometimes perform those tasks and that it is an advantage to be able to work on tasks outside their role. It can, however, result in work overload.

4.6.3 Communication

Open and spontaneous communication

The whole organization is located in the same building. Everyone within a team is placed together which according to the respondents increases the feeling of teamwork and collaboration. It also favors communication among the team since they can have daily stand-

ups where the ongoing work can be discussed. Working in cross-functional teams has according to the respondents increased communication, and specific competencies can be shared which helps everyone within the team to better understand the whole product development chain. Improvements regarding the communication could, however, be made and the respondents explain that it would be preferred if the purchasing department and software developers would be more involved in the teams. Then they could participate when plans and expectations were set and come with input which would provide a better understanding of the project and shared knowledge.

The respondents describe PI planning as a way to enhance the communication within the organization since project status and expectations are presented. It is an event where many roles within the organization are present. One of the respondents does, however, discuss that despite having ways to communicate it still requires individuals who are willing to communicate.

Understanding of the development process among suppliers

The respondents say that their suppliers most certainly do not know that they use agile methods and tools, requirements towards their suppliers do not change regardless of if they themselves are working according to the agile framework or not.

Documentation

According to the respondent, there is a lack of structure in how decisions are documented. The product developers do however use a computer program to communicate stories and tasks which also is the base for the information on each team's screen. According to the respondents the organization is lacking in documenting gained knowledge form projects. The organization has however improved their knowledge sharing since the team's starting to work cross-functionally. There is now more transparency, and there is a better understanding of the development process compared to previously when working in function-based teams.

4.6.4 Stability

When the organization started to transform towards agile product development, they had issues regarding defining their way of working. It resulted in uncertainties regarding the daily work for those working in the product development process. For example, there was no structure to help the employees to work in the same way towards the same target. The issues lead to the organization changing their way of working again, and they took help from a SAFe coach who helped them to adapt the SAFe framework to the organization. Some of the uncertainties which came up during the first agile trial still remain today, but according to the respondents, the clear structure within SAFe has resulted in uncertainties starting to reduce. Now there is a framework that shows what to do and why in order to reach the desired goal. Everyone works towards it in the same way.

4.6.5 General Findings

Since the organization chose to implement agile and SAFe the number of employees has grown from around a total of 100 to 200 and from 30 to 60 employees in the product development

department. The expansion has made it difficult for the organization to understand if changes and difficulties are related to the expansion or the SAFe framework.

The organization has worked with the SAFe framework for one and a half year where they initially struggled. The framework was adapted without changing the organizational structure which resulted in it not working. After six months the organization realized that it did not work well and there was no thought-through idea before implementing the framework. When the implementation failed, the organization decided to take help from a SAFe coach in order to get on the right track. The respondents say that they are starting to work in a correct way, but there are however still improvement areas. The respondents explain that there have been ups and downs, but for the past six months, it has been more stable. The reason why the organization chose to implement the SAFe framework was that the previous product development manager had worked with SAFe in another organization. The respondents say that unlike when they only tried to implement some agile tools, SAFe offered a more comprehensive structure for the entire organization which was important for their problems.

When the SAFe framework was implemented there were educations held in how to work according to it. Today, when new employees are employed, they get introduced to the framework by their team. One of the respondents explains that in the beginning when SAFe training was held the employees had trouble relating the framework to their daily work since they had not started to work with it yet. The respondent further says that it is difficult to remember everything said in one training and to include new employees in the framework. Due to this, the organization faces issues regarding how to maintain knowledge gained from SAFe training according to one of the respondents.

The organization uses retrospectives in order to improve their way of working, and there are two kinds of retrospective meetings. During the meetings improvements on the work are discussed. One of the retrospective meetings is with representatives from each team together with project managers while the other meeting is retrospectives within each product development team.

4.7 The Analysis Framework

Based on the empirical data, the organizations will be graded depending on their agility. However, the result does not equal how well the organizations succeed with their product development. Table 2 only implies how much of the agile framework each organization have in their development process. The grading stretches from 1 to 3 where 1 equals a low amount of agile methods and tools, 2 equals partly using agile methods and tools and 3 equals using agile methods and tools. The agile methods and tools presented in the theoretical framework will be compared to each organization's development process. Each organization will be given numbers for each method and tool which will result in a number defining the organization's usage of agile methods and tools. The total grading of each method and tool, as seen to the right, describes which method and tool most commonly used.

Table 2. The Agile Framework with grading

Agile Framework	Org. 1	Org.2	Org. 3	Org. 4	Org. 5	Org. 6	Total
Flexible and dynamic development process	2	1	1	2	1	2	9
Short planning periods with frequent deliveries	3	3	3	2	2	3	16
Time limitation							
Not develop more than necessary	2	3	2	2	3	3	15
Customer focus	2	2	2	2	2	2	12
Teamwork	2	3	2	1	2	3	13
Cross competence	1	3	2	1	1	2	10
Self-organizing team	2	3	2	1	2	3	13
Roles	1	3	2	2	2	2	12
Open and spontaneous communication	3	3	2	1	2	3	14

Understanding of the development process among suppliers	3	1	1	2	2	1	10
Documentation	2	2	1	2	1	1	9
Total	23	27	20	18	20	25	

4.8 Expert interviews

Interviews have been held with experts within product development, project management, and change management. The experts have worked as a project and management consultants for many years and does not represent a specific organization.

4.8.1 Expert 1 - Product Development and Innovation Expert

Expert 1 has worked with projects and project models in both big, medium and small companies for many years and has expertise in handling development processes. The expert has over 20 years of experience within its area of expertise.

Throughout the years the expert has gained valuable knowledge and learnings. One of them is to differ between matter and process, where matter can be explained as factual things such as time, money and technical possibilities. The process can be described as the workflow, processes, the people, leaders, and stakeholders. It is important to handle the process between people and not to get stuck in the details. An organization go far if working with the process and if they understand its market, customer and receiver. In order to understand these areas, it requires the right competencies within the organization. If the right competencies do not exist, it is important to be aware of this and find these somewhere else. It is also important to have a cross-functional approach between functions within an organization in order to increase understanding.

Furthermore, Expert 1 states that when working in projects, it is important to control the decision-making processes, clarify who has the authority to make decisions and what decisions the authority includes. If not made, it will harm the organization. When working in product development projects, it is important for decisions to be taken by someone outside the project team. This can ensure that the decision is beneficial for the organization and not taken with any bias. The project team or leader can provide suggestions but should not be the ones making final decisions. There has to be someone who can understand if suggestions are moving in the right direction according to the organization and if it is reasonable.

Expert 1 also explains that organizations need to know when to shut down projects and make tough decisions, this is the decision maker's responsibility and has an important role which is crucial for the organization. The reason why organizations do not shut down projects in time can be due to the amount of time and money invested. There needs to be a realization regarding if a project starts moving in the wrong direction, then it needs to be shut down since the project will not succeed. The further it goes, the more it hurts to shut down due to the amount of money and time that has been spent. Instead of basing project prioritizing after internal interest it should be driven by customer requirements and what the customer desires. Then the projects will not yield the risk of being irrelevant.

The expert explains that other project management frameworks have agile tendencies in them, without being named agile. There is for example frameworks that have the same basic idea as sprints, which includes an unfinalized plan from the start and where the product development is increasingly specified after each gate. The project could then receive change in the development plan, details and resources. The product development did not work according to outspoken sprints, but the development process has agility in it.

The expert described a product development project where visual planning and sprints were implemented, it worked well, and there were influences of lean. The project had a set-based way of working where the least good idea was removed. Although new tools were implemented, it came down to being able to develop a product in order to launch it. Before product development can be completed specific steps have to be taken, such as the product being validated, verified, quality assured and registered with the authorities. There are also aspects such as packaging and production tools which have to be developed and ready in order to launch. The product development has to be finalized, and all product parts ordered, then there is a lead time until the order is received. Due to this, the expert explains that it is challenging to work in sprints the whole way through development. There are set dates and lead times for all of the mentioned activities which the product development has to consider. Expert 1 argues for that sprints with frequent decisions and changes functions well at the beginning of a product development project. However, the closer launch the project approaches, the more focus should be put on finalizing the product in time, which in that phase of the process requires a set plan.

Expert 1 explains that agile methods and tools are beneficial due to that they can handle learnings that occur along with the development. The product can be changed during development when more knowledge is gained, and the way of working can be developed. The communication is also an advantage in agile, but it is always important and an aspect in many project management frameworks. It is valuable to have frequent communication with stakeholders and decision makers during development. It will result in them having a better understanding of the development process, and better decisions can be made. Through frequent communication, there will be an understanding of why certain things have been done and what has been tested which results in understanding why the product ended up as it did.

The expert says that there is much discussion regarding agile among organizations. A lot of them try to implement agile methods and tools while lacking a more profound knowledge about the framework. In some cases, the framework has been implemented in a more complicated way than is necessary. There are also examples when organizations have taken it to the extreme with agile and use it as an excuse for bad planning. The expert states that there has to be high awareness regarding the organization's way of working in order to be agile and for projects not to slack.

The expert states that when implementing agile, there is an advantage if someone with a deep understanding of the framework can run the transformation. There has to be an understanding

of agile in order to be comfortable in a change. The change leader has to think agile and not to get stuck in the post-its. The expert claims that many organizations implementing the agile framework have misunderstood its purpose and think it is about visualization boards with post-its. An organization needs to be able to set goals, plans, time limits and cost limits, and it does not work to think "it goes as it goes." For example, when going into a sprint, there has to be awareness of what to do within the sprint. The flexibility which comes with agile should not be at the day to day work but rather at the end of a sprint. An organization does not only require an understanding of limits but also regarding what agile tools and methods that are relevant for desired goals and can be adapted in the organization. The agile methods and tools need to be understood and taught before they are used. The organization needs to learn how to use them in order to be able to know when not to use them. If one does not understand, then one cannot see when it is reasonable not to use the methods and tools, why they are less important or not needed.

The expert discusses differences in software and product development and states that in software there are fewer steps since it does not include preparation for production. Manufacturing products have lead times, which can be for months to years. An example was when the expert was in a project, and there was a need for a new machine in order to produce the newly developed product. The lead time for the machine was one and a half year. There was, according to Expert 1, nothing to do about the lead time but if the product changed during that time, then it would be even longer. In software development, the developers can usually change small parts and the software will still function, such as if a button on a machine should be automized or if it requires three clicks. There are more small decisions in software development which easier can be taken than when developing manufacturing products. In software development, a solution can grow over time which is not possible for a manufacturing product. When developing manufacturing products there are more external dependencies than software, in software development, the developers do often have abilities to control the whole development chain themselves.

When implementing a new way of working it is essential to have support on a management level. The expert believes that the best way to implement a change is step by step rather than through a dramatic change. Continuous improvement with management support and control is the best way to succeed. In cases where there is a crisis, win or lose situations, then drastic and dramatic changes are more necessary. The expert claims that there has to be a crisis in order to impose a radical and dramatic change. If an organization is not facing a crisis or a radical change, the implementation should be made continuously over time. It is also essential to understand that change takes time, it takes years and many projects to adapt, it is, therefore, essential to have coaches and to support resources to each role.

4.8.2 Expert 2 - Project Management Expert

Expert 2 has worked in numerous organizations, first as a technical consultant, thereafter as a project manager to now working with helping organizations with leading projects. The expert has over 25 years of experience within project management.

The expert describes that the same mistakes are made within most organizations. There are a framework and documentation of how to work according to it, but there is not enough time put on educating the organization in how actually to work with the framework. The expert describes a situation where an organization succeeded in changing their way of working. The organization prioritized the systematically continuous work with the new framework. They had put an enormous amount of time on education and, there were posters on walls which, reminded the employees of the framework, and subject matter easily accessible for everyone. There were reminders everywhere, and the framework could not be forgotten. This way of handling a change is not common among many organizations. According to the expert, there is a lack of enough understanding of the importance of everyone having the same knowledge.

Expert 2 states that in order to implement a new way of working there has to be a purpose and it has to be communicated, substantiated and have support from upper management. A new way of working cannot just be implemented and then put on a shelf. A new way of working needs to be maintained and supported. If the change is only presented and performed once, then it will not become a part of in the organization. As an example, Experts 2 discusses the SAFe framework, if the organization is supposed to adapt a framework such as SAFe with set roles, then there has to be something to relate to in the existing organization. If there are not any defined roles and responsibility areas before the implementation of, for example SAFe, then it will be difficult to relate and adapt a new framework.

The expert also discusses issues regarding organizations having too many ongoing projects. There should not be too many projects ongoing at the same time. Expert 2 gave an example of an organization where there were 29 projects ongoing at the same time, run by three projects leaders. The reasons why there were many projects was due to no one was reviewing the projects. Therefore, no requirements on why projects can join the project list were set. The expert claims that there have to be reviewed regarding resources, and employees should not have all of their hours planned, there needs to be at least 20 percent available.

A common mistake within project management is working with the wrong things. A project should not be ongoing forever if desired results are not reached. There are often many resources put in the project, and therefore it can be receiving to shut down. The main reason behind projects being run for longer than they should are that there is no decision maker, someone who knows what the goal is and what directions to move in order to achieve the goal. If there is not anyone deciding, reviewing and owning the project, then the project is in a vacuum, and the project will go on without any links to the surroundings. The weaker the link a project has to a project owner, the harder it is to develop something that the customers want. It is common that project leaders take ownership of projects if there is no project owner who can come with input. The project plan and its activities are then built on the project leader's own insights with no one else available to reflect on the decisions. This can result in the project starting and being run until someone, often upper management, realizes what is happening. The role of someone setting requirements on projects and its existence is hugely important. The project leader role

should however not be excluded, and it is crucial. The project leader role should mainly be to break down bigger goals into smaller tasks.

The expert discusses agile project management and explains that agile methods and tools can be found in other project management frameworks with methods and tools such as prototyping, testing, and changing. The best thing about agile in product development is that it is a way of attacking a problem that the traditional ways of working lack. The traditional ways lack in trial and error while the agile has set trial and error in a systematic way of working. It is, however, the same lack of knowledge about a project at project start regardless of using agile or traditional methods, but the agile methods have a way of handling the unknown. The expert states that agile can be used in all industries, but there needs to be knowledge of how to handle set dates and decision making. Running projects over the time limit are costly, and if there are set dates and a way of working which does not take the dates into consideration, then a project will not succeed.

The expert discusses the importance of having perspective on the amount of time tasks will take in order to make a time plan and agile sprints are a way to handle unknown projects. The expert explains a situation if a project duration is uncertain, then agile sprints can be used in order to work and check if the project moves in the desired direction.

4.8.3 Expert 3 - General and Change Management Expert

Expert 3 has been working at a well-known management consulting firms, has worked as a product development manager and is now a change management consultant. The expert has 15 years of experience within its area of expertise.

Expert 3 explains that most organizations have challenges and problems, but the answers to their problems can almost always be found within the organization. Organizations are however usually lacking in taking advantage of it. Therefore, consultants are used due to that they can go past the organization politics more easily and come without preconceptions. The expert claims that almost all organizations are alike and have common issues, despite the industry. This due to that there are people working at the organizations, and therefore issues are often the same.

Organizations who are controlled by processed often have processes documented but rarely work according to them, individuals work in their own best way. Therefore, everyone works in various ways which result in quality reduced. It is however often an unawareness and not discovered until changes are needed and processes are analyzed. Larger organizations are commonly more difficult to change, peoples are creatures of habit and do rarely want to change their way of doing things. Changing a whole organization with many individuals is therefore much more difficult. The expert explains that driving a change requires a lot more time and resources than many organizations expect.

The expert explains that organizations commonly lack in prioritizing between time, cost and quality. When developing there is often a short startup period where the product is specified, and the plan of the project is quickly made. Thereafter, the project is run which results in most of the time is spent on developing according to specifications and a plan which has been quickly put together. By handling product development, the starting phase will most certainly be lacking, and the product will end up not being a success. Having a quick startup phase might be viewed as a way to lower cost and time and is a result of techniques and customer requirements changing faster than ever. The expert argues that the agile framework can solve this problem since in agile, quality is the highest priority compared to time and cost. If there is an organization working with a traditional product development framework and are very good at it, the expert argues for agile not to be implemented. It implies an equal amount of resources for quality, time and cost. The expert says, there is no meaning in trying to fix something that is not broken. If the organization puts too much time on the product development phase without focusing on quality, have late -and costly projects, then changes are necessary.

Expert 3 provided an example of a way to develop products in an iterated way. If the development process starts with an idea such as "We should develop a vehicle that people can use to transport themselves in the city", then in the first development round a skateboard is prototyped, thereafter it is iterated and in the next step it becomes a kick bike with a motor, then it gets iterated again, and in the end it could become something like a "Voi". A mobility company offering electric scooter sharing in partnership with cities and local communities. If the development is made in an iterative way, then learnings can be made during the development process. This way of developing can be performed at the same time as when using a traditional method, but now the results are more fulfilling of the customer need. In traditional development methods, the work is more synchronous and in steps. When one developer has completed its part, then it is handed over to the next developer who develops his part. Working agile compared to traditional results in the team's competencies are shared. It does, however, require that the developers work towards the same goal and be present. If for example there is a daily meeting, and a developer is not there, then it is difficult to gain that input and work according to what the team has decided. The expert does also claim that working agile is difficult if not being located together within the team. Only communicating through digital solutions will not create the same group dynamic as when having face-to-face meetings.

The expert discusses that there is a myth regarding the perfect organizational leader, a leader who knows everything. The expert does, however, explain that it is not a good way to go. What if the leader does not know everything or is incorrect? Then the result will be just as bad. Therefore, the expert argues for agile being an excellent framework to use when developing. It is useful due to that everyone works towards the same goal and together reviews the goal towards the customer. When working in agile teams, it is most likely that the teams are small, and that the cooperation is primary. Those within the teams drive the development together with their shared knowledge. Furthermore, it requires that everyone works toward the same goal, but if someone in the team does not agree or work in their own way, then it is more visual than if working in a line organization. Agile teams are more fragile than working in functions

since the team requires everyone to be agreed on what to do and how to develop in order to succeed. The expert also claims that it is difficult to have successful agile teams if not everyone within the team is located together. If some within the team are located in another city or country, the foundation of the agile philosophy for agile teams will be lost. If the teams, for example, have a visualization board and not everyone can be present during meetings related to it there can be information and knowledge lost within the team. The experts say that there is no digital tool available today that can fill and compensate for the distance gap. Moreover, the expert claims that being agile requires the organization to adapt to the framework fully. An organization should not work both according to agile and a stage-gate model simultaneously. Agile should not be adapted within limitations which are created by the stage-gate model.

The expert describes the differences between software and product development. Development of products need to relate to industrial manufacturing, which software development does not. The software can be developed in smaller scales, let a few people test, then re-develop. It is more difficult when developing manufacturing products. For example, when developing a new rearview mirror, then it has to be prototyped, have tools, be cast, transported to the factory, and it can take a few months. The software for the rearview mirror can, however, be changed much more rapidly. If the software and product development are not synced, then the software might not fit the product. A change in software can require changes in hardware in order for it to function. There need to be defined interfaces for what can be developed and not.

The expert discusses the product owner role within agile. The role is not new but has prior to agile been divided within functions. Instead of each function having their own responsibility it has now been located to one role within each team. The expert explains that the role many times is confused with the project leader. The project leader can have product owner authorities, but it has to be clearly defined. The roles within an organization should be clearly defined, and there needs to be the right individual for each role. It does, however, require the organization to have the same language and definitions of roles and terms. Otherwise, it does not matter how to work. For example, if the definition of what is left and right differs, then the organization will probably not succeed.

5. Analysis

Traditional development frameworks can be considered slow moving and rigid (Stoica et al., 2013). The agile framework can according to Rico, Sayani och Sone (2009), ensure higher return on an investment compared to traditional frameworks. The agile framework is also considered faster and more efficient than traditional frameworks since it is built on short and iterative development cycles with fewer people involved. This enhances possibilities to be flexible in facing market changes and to spread risks over time.

Product development is one of the most important yet riskiest and uncertain challenges within an organization (Cooper and Kleinschmidt, 1987; Rico, Sayani, & Sone 2009). Therefore, organizations facing issues of rapidly changing technologies and fast changing markets have started to search for new ways of developing. Agile has been widely debated during the previous years, where many organizations within the manufacturing industry have started to shift towards it. There are believers and disbelievers regarding whether agile can function in product development within the manufacturing industry. It is a fact that organizations within the manufacturing industry face issues related to shorter product life cycles and fast-changing markets (Sommer, 2015). As software technology rapidly evolves, the hardware had to keep up and today development of products faces the same issues. Software developers could not resolve their issues by using traditional development methods (Cooper, 2016). Therefore, the studied organizations are all within the manufacturing industry. The organizations face similar issues, not only issues related to external influences, but also similarities in project plans and costs being exceeded while being on competitive markets. Despite all the organizations being within the manufacturing industry, there are mainly differences in how complex the product is. For example, Organization 1 produce products within the food industry and Organization 5 produce products within the automotive industry. Thus, there is a big difference between how many people there are involved in the development process, how many components there are, the amount of manufacturing tools, suppliers and how long product development time the product requires. It is therefore of importance to value their differences when comparing the organizations and their way of developing products.

The agile manifesto consists of four values and twelve principles which should be followed. They are developed by software developers, mainly for software development. There has not yet been a translation to development of products, therefore the values and principles are easily misinterpreted. Merisalo-Rantanen et al. (2005) do however state that the foundations of agile principles and values have been around since the 1960s. This could be assumed that agile is adaptable even for product development in the manufacturing industry. Cobb (2005) also describes that agile values can be applied in the products development within manufacturing industries.

5.1 Product Development Process

In this section, an analysis regarding the product development process will be presented. Areas such as flexible and dynamic development process, short planning periods with frequent deliveries, time limitation, not develop more than necessary, and customer focus is included.

5.1.1 Flexible and Dynamic Development Process

The agile manifesto, value number four states, "Responding to change over following a plan" (Agilemanifesto, 2001). A flexible and dynamic development process enables product development to embrace change rather than neglecting it. The flexibility mainly comes from an incremental and iterative development process (Beck et al. 2001), where the project plan, scope, and goals can be adaptive (Cooper, 2016). The scope with basic requirements must be set to grasp what to develop, according to Kerzner (2017). The product development process and its plans should, according to the agile manifesto not be too fixed from the start (Kerzner, 2017).

As presented in Table 3, there are some differences between the studied organizations' development processes. The grading regarding what extent the organization has a flexible and dynamic development process is one of the lowest. The reason why the organizations have a low total grading depends on different aspects. Majority of all the organizations have a set scope with set product requirements and a plan from the start. It means that the product development work according to the set scope, requirements, and plan. A set scope from the start hinders possibilities to change and makes the process inflexible (Beck et al., 2001). As Sohi et al. (2015) describe, knowledge about the requirements, the customer and their needs are low at the start of a development project. The end of a project, when most knowledge has been gained, is also the most expensive time to change according to Expert 3. If an organization develop according to a set scope and plan, it can be hard to follow the second agile principle. "Welcome changing requirements, even late in development. Agile processes harness change for the customer's competitive advantage." (Agilemanifesto, 2001). The second principle point out the welcoming of changes and prioritizes the ability to change even late in the process. If an organization develops according to this principle, the products are more likely to be developed according to the market and customers. This since the development continually changes according to customer requirements. The welcoming of changes based on customer requirements will reduce the risk of the product ending up being irrelevant and a flop (Highsmith & Cockburn, 2001). Flexibility increases the chance of developing a product which brings value for the customer as stated by Nyman (2010).

Expert 1 claims that a project should not be based on internal interests, it should be based and driven by customer requirements and needs. However, Expert 1 also claims that when developing products, it can be hard to be flexible and make changes the close to launch. Hence, Expert 1 suggests organizations to have a flexible process from the start, and when approaching launch, a more set plan should be followed. The values and principles are developed for software development. Therefore, they can be hard to strictly follow for an organization

developing products within the manufacturing industry. If the product is complex, with many parts, dependencies, and long lead times, it can be difficult to finalize the product in time if changes occur late in the development process.

Organization 4 develops very complex products. The more complex products, the longer it often takes to develop. A development project can be ongoing for years, years of when changes in the market, technology, and customer requirements can occur. Hence, flexibility within the development process can be viewed as very important. Flexibility in the development process could ensure higher customer satisfaction as the product will be relevant. The product will not be developed according to what was relevant several years ago, when the project began. To not increase cost and project time, it is crucial to consider when, in the process, it is crucial to stop adding new changes.

Organization 4 faces market changes with many competitors, which requires them to change their way of developing. The development needs to increase speed, with possibilities to change direction during development. Some departments at the organization have recently chosen to implement the SAFe framework, but the respondents explain them to work with both stage-gate and sprints while they are not integrated. The organization develops using stage-gate and sprints due to the importance of a set plan. A set plan is required since the development is connected to other departments, component, and lead times. The development process needs to be predictable since it is dependent on external parts according to one of the respondents. Despite the organization implemented SAFe one and a half year ago, they are still in the upstart phase, and the results of the change cannot be seen yet. This is due to the organization being big and developing a complex product. Organization 4 has understood that their development process needs to change, but they only score a two since they are at the start of their implementation. Since the product is complex, there are limitations to achieve full flexibility along their whole development process.

Organization 6 is market leading in their industry with a unique technique. The organization has also implemented SAFe in their product development. The organization develops using both stage gate and sprints for planning their development. The two methods are not synchronized due to agile immaturity within the organization. The upper management uses the stage-gate while sprints are used within the development teams. The product development work according to agile through the SAFe framework, while the rest of the organization do not. There can be issues if there is a lack of agility within the whole organization if the development teams are flexible in their work while for example, purchasing have long lead times. Then the agility within the teams might be hindered by internal dependencies. Since the organization is relatively small, the conduction of empirical findings provided a good understanding of the whole organization. It was evident that the SAFe framework mainly was focused on the product development rather than the entire organization. The organization argued that if more departments worked agile, the product development would be improved. This can be confirmed by Measey (2015), who argues for that successful implementation of agile requires an agile mindset within the whole organization. This can be related to all of the organizations since it

helps organizations working towards the same goals. As Expert 3 and Holmdahl (2016) states, all employees need to strive for the same goal and have a shared understanding to be successful.

Organization 1 does not work according to a specific framework, and it is a relatively small organization with a low complexity product compared to the other organizations. The organization has created and adapted their development process to their needs. The scope is not always completely set from the start. Hence, the scope and requirements can be viewed as somewhat flexible. The development does, however, follow a plan with specific activities, activities which need to be performed until a specific date but not in a specific order. The process is in some ways related to a traditional stage-gate model. There is, however, flexibility in the process where what to develop is revealed throughout the process, and changes can be made when desired. As one of the respondents explained that if the consumer test show results which require them to shift focus, then there are possibilities to do so. This show that changes late in the development process can easier be handled if developing a less complex product with few parts. As Cobb (2015) describes, a project being developed through traditional development frameworks can be viewed as a weakness if the organization is in an uncertain marked with changing requirements. According to the empirical findings, Organization 1 does not face an uncertain market with changing requirements during their development process projects. Since the majority of the development process is ongoing for six months, there are a low amount of changes in the market during that period. The organization is small, with few dependencies, and the whole organization is located in the same building. These aspects can also increase flexibility and simplify the ability to be flexible. Organization 1 have a close relationship with their suppliers and work with only a small number of suppliers which increase their flexibility. According to the respondents from Organization 1, they can receive products from their suppliers rapidly. The organization's product development process suits their market and products. The organization does, however, constantly need to develop new products to take market shares and develop a new and interesting product for the consumer.

Flexibility in performing and prioritizing tasks to even out the workload is one of the success factors behind the product development within Organization 2. The organization strives towards a flexible development team, rather than a flexible development process in the sense of changing according to new requirements. The development does, according to the respondents, have roots in agile and was chosen as a method which could solve their problems. Problems such as uneven workload, involving new employees in work and share knowledge. The organization's development process can be viewed as somewhat inflexible hence the scope, and product requirements are set from the start. There are, however, questions regarding if there are needs of being more flexible in the development process. The respondents explain that there rarely are any new requirements or changes during the development process. Therefore, working on enabling more flexibility might be none value adding. Agile tools have been implemented with the use of an agile coach in the areas where needed. The framework was also customized to each team, which could point out that the agile coach did not see any significant problems in the area.

A stage gate model with sprints within each stage is used by both Organization 3 and Organization 5. Within Organization 3, there is flexibility in the development process through working in sprints. How to develop is not predefined, but there are certain activities which have to be finalized until a gate. The sprints are mainly to build knowledge and be able to prioritize the product development related tasks. What to develop and product requirements are defined before the product development starts and is based on pre-studies. The respondents explain that even tough tasks could be prioritized, it is difficult to change the product, hence, it is not built in components, and parts cannot be separated from each other. Therefore, the development is lacking in the flexibility which the agile framework promotes.

The studies teams within Organization 5 are divided into two different divisions, where one of them develop products using agile methods and tools. The division using agile tools has implemented sprint. The sprints do, however, need to be related to a stage-gate model. All divisions within the organization work according to a stage-gate model. The stage-gate model has predefined activities which need to be finalized at each gate. However, the gates only include activities that should be performed, not how they should be performed. Therefore, the division works in sprints and stage-gate combined. The product requirements are set from the start where requirements rarely change throughout the development. Organization 5 develops products in a field of business that does not change as fast as other business. Thus, a more agile development might be non-value adding. The customer requirements, according to the respondents, do not change that rapidly. This can be an answer to why Organization 5 does not find it necessary to focus on making their development more flexible.

The stage-gate is a way of increasing quality for both of the organizations due to that the risk of missing important steps is reduced. Within Organization 5, there might need to be considerations regarding why teams and divisions work differently and how much flexibility the sprints provide. Perhaps they are excessive, or they create a lot of flexibility that other divisions can learn from. From the empirical data and Expert 1's knowledge, it is evident that the amount of flexibility within an organization's product development process depends on the product's complexity. Expert 1 claims that the majority of product development within the manufacturing industry is more complex than software development. Therefore, the flexibility which agile promotes can be hard to fully adapt to some organization. The agile framework urges for a flexible development process, but as the framework is developed for software, it might not be applicable in the same degree in the manufacturing industry.

As value number four states, responding to change should be preferred over following a plan. It does, however, not imply the development to be run without any plans. Expert 1 claims that when implementing agile, it is easily taken to the extreme, and some organizations blame the agile framework when they do not have any plans and cannot finalize the project in time. The agile framework does also not imply working without any processes and tools, which value number one might be interpreted as when developing a product which is going to be manufactured their aspects which software development does not have to consider. All studied organizations in this thesis are organizations that succeed in their field of business and to

succeed, they must develop what the customer requests. It can, therefore, be interpreted that all of the organizations know their customer well enough to develop what they require. Despite this, all organizations could improve their flexibility, especially at the start of development. As Expert 1 claims, there needs to be a set plan closer to launch than at the start of a project.

All organizations could enhance their customer focus through the whole project and create a plan or strategy for how to do it. The empirical data shows that most of the organizations mainly focus on the customer at the start of a project and when the project is finalized. This does not mean that all organizations need to make changes until the day before launch, but the customer focus can be increased for all organizations. How late in the development process changes can be made is up to each organization. Layton (2012) and Cobb (2015) says that if an organization collaborates with customers through the whole development project, the organization will have an advantage and will satisfy the customer. Learnings come through the whole development project. Therefore, changing according to the learnings will make the product better (Layton 2012). If changes occur late in the development process, it is important for the organization to analyze if the change brings value to the customer. To understand what the customers find value adding there needs to be a close relationship (Cobb, 2015). Organization 5 works like this, it does not make their process flexible, but it makes them choose changes which are value adding for the customer. Changes late in the process rarely occurs. If changes more often would occur late, Organization 5 would need to make their process more flexible.

Before implementing agile methods and tools, an organization needs to analyze how it could benefit the organization, if it could solve any issues or make the products more attractive to customers. Organization 2 received help from an agile coach and thereby made the implementation suit their organization. For them to have a more flexible process would probably not make their development better. For them, the flexibility is important in the team rather than the development process. Cobb (2015) explains that the traditional product development framework can be a weakness for organizations that have an uncertain market with changing requirements. Hence, this can be an answer to why the total grading is low in this area. The majority of organizations are not facing uncertain markets with rapidly changing requirements. Expert 3 does however claim that markets and requirements change faster than ever, which in the future might require an organization to work more agile in order to lower cost and development time. In the future, organizations could benefit having a quicker startup phase than today since the development probably will change their course during execution.

Table 3. Flexible and dynamic development process

Agile Framework	Org. 1	Org.2	Org. 3	Org. 4	Org. 5	Org. 6	Total
Flexible and dynamic development process	2	1	1	2	1	2	9

Main findings

It is important to develop a product which satisfies the customer needs to gain profit. It is, however, equally important to finalize the product in time and with the desired quality. Hence, to develop with greater flexibility at the start of the project and according to a set plan the closer to launch can be a way to work with both flexibility and stability. A flexible and dynamic development process can depend on how complex the product is and how long lead times the product has. An organization without a fully flexible development process does not equal lack of customer involvement. The customer can still have a large influence on the product. It is up to the organization to understand how flexible their process should be and how to involve the customer in the right way.

5.1.2 Short Planning Periods with Frequent Deliveries

Within the agile framework, short planning periods with frequent deliveries are preferred. This is made through planning the development in sprints, commonly between two to six weeks (Cockburn & Highsmith, 2001). At the end of each sprint, results should be reviewed with stakeholders such as customers. The frequent deliveries of results and involvement of stakeholders' result in the development team, knowing that they are on the right path. Information that should be revealed throughout the development process is mainly what the customer wants, what features the product should have, the price which the customer is willing to pay, what features can be removed in order to reduce costs but still keep the customer satisfied, competitors and changes in the market (Mital, 2014).

Short planning periods and frequent deliveries of results can be related to the agile value number four, were responding to change is more important than following a plan (Agilemanifesto, 2001). A sprint is not planned until the previous sprint has been finalized. Being able to plan the sprints based on gained knowledge enables the development process to be flexible. Each sprint can change direction, and the development can be changed to following new goals that will satisfy the customer. This related to an argument by Expert 1, there needs to be awareness of what to do within a sprint. The fourth, agile value does, however, not imply the product development process to be without any plans, as often misinterpreted claimed by Expert 1. According to Gustavsson (2016), the agile framework can be divided into five planning levels where some of them are plans of early development stages. These early planning stages ensure the project direction and enable an efficient project with overall visions and goals. The planning levels are, however, not very extensive or rigid where they can change during the development process when more knowledge is gained (Gustavsson, 2016).

The frequent deliveries of results can also be related to the agile principle number one, "Our highest priority is to satisfy the customer through early and continuous delivery of valuable software". In the manufacturing industry, it can be translated to delivering value-creating project results (Nyman, 2010). As agile prioritizes customer input, the frequent deliveries of results can increase communication. It can be assumed that involving the customer in the development process requires the customer to know what they want, or for the product owner to know how to translate customer requirement. It also requires the right stakeholders to be

involved, those who can provide valuable input. It is not only the customer who needs to understand what they want. Expert 1 claims that an organization can come far if working with understanding their market, customer, and receiver. There need to be competencies within the organization who can understand these areas.

Developing using sprints make it possible for the development to welcome changed requirements during the development. This can be related to the second agile principle, "Welcome changing requirements, even late in development. Agile processes harness change for the customer's competitive advantage.". The principle is, however, made for software development and can, therefore, be interpreted differently in the manufacturing industry. Welcoming changes in the development process should increase flexibility, but it should not delay the project. Therefore, lead times and impacts on the development process need to be considered if new requirements are welcomed.

Expert 2 claims that one of the main project management issues is that there often are too many ongoing project and projects being run longer than they should. The reason for why their problems occur are often due to lack of reviewing where projects are run until someone at upper management questions the project. If the projects instead were to be organized in sprints, there would be a continuous reviewing and could be less of a chance to have an irrelevant project. This can be an argument to why an organization should work with short planning periods with frequent deliveries. Expert 1 also claims that projects often continue for too long, and the longer a project is run, the harder it is for an organization to shut them down.

All organizations succeed with having short planning periods and frequent deliveries and are therefore provided high grades as seen in Table 4. This is one of the methods that the organizations succeed with best. Based on the empirical data, the majority of the studied organizations have found the use of frequently reflecting on the progress through developing in sprints. Organization 3 work according to a stage-gate process, and between every gate, they work in sprints. The respondent from Organization 3 explains that sprints help those working in the product development to continually move forward in the process which motivates the employees. This can be related to the fifth agile principle, "Build projects around motivated individuals. Give them the environment and support they need and trust them to get the job done." (Agilemanifesto, 2001). Having a product development framework which increases motivation will assumingly promote wellbeing and collaboration (Gustavsson, 2016). Using sprints which are not pre-planned can provide more profound satisfaction since set processes and tools do not hinder the team in the development (Measey, 2015). Based on Cockburn and Highsmith (2001) and the empirical data, developing in sprints can increase the motivation. Sprints can make the employees dare to develop "outside the box" due to them only being a few weeks until next sprint.

Developing in sprints can also reduce costs since the development should be based on input which enables the product to be relevant to the market. Since the development continuously is reviewed, there are then low possibilities of the development going in the wrong direction and

the product ending up being undesirable. Therefore, there will be a low amount of incorrectly developed products which would require re-work. Re-work could be considered to be non-value adding for the customer and therefore, a waste while it could be considered as a learning for the organization (Jasti & Kodali, 2015). The respondent from Organization 3 explains that before developing in sprints, there were six months between every gate. During this period, there was a lack of reviews and reflections regarding the project direction. Developing in sprints means that the organization develops in shorter time cycles. After each sprint, the development is reviewed, and progress reflected. This in order to ensure that the development is heading in the right direction. If not, the direction needs to be changed in order to satisfy the customer (Cockburn & Highsmith, 2001).

The stage-gate process increases quality for both Organization 3 and 5. The stage-gate process enables that certain activities to have been completed before a certain time in order to follow the time plan. To combine a stage-gate process with sprints can help organizations to handle lead times in a good way since it includes having set time limitations for when tasks should be finalized. Agile value number four, "Responding to change over following a plan" could be interpreted as combining a stage-gate process with sprints. The sprints allow changes in the process while gates enable that the development is according to plan. There could, however, be issues if the stage-gate takes over since responding to change should be more valuable. The stage-gate should benefit the organizations in knowing that they are on the right track, and where in the process they are and to increase quality. The stage-gate should, however, not hinder the ability to respond to change. The stage-gate process should act as support to the sprints if the organization desires to work according to the agile value number four. A way of being flexible while still relating to lead times is to be more agile in the start of the project, as Expert 1 suggest, and gradually work according to a more set plan closer to launch.

Organization 5 develops in sprints integrated with a stage-gate model. The organization has a set stage-gate model for their development, one of the product divisions work in sprints within each stage. The division within the organization claims to work in a hybrid between sprint and stage-gate, as seen in Figure 9. The sprints have created flexibility in the development process, while the gates create stability. The majority of organizations uses a hybrid model, which might be assumed to be one way to implement agile in the manufacturing industry.

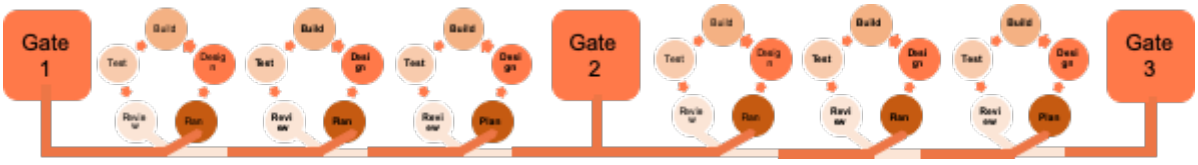

Figure 9. Stage-Gate and Sprints (Created by the authors, 2019).

Planning the development process in sprints could be interpreted as a relatively simple, agile tool to grasp. It might be the reason why the majority of the studied organization have implemented sprints. Only implementing agile tools does not ensure that the organization is

agile, according to Measey (2015). In order to implement agile, Measey (2015) states that organizations need to start with an agile mindset. If only implementing sprints, without the agile mindset, values, and principles, some of the central values in the frameworks might be lost.

Organization 6 has implemented sprints with sprint demos where results are being shown to stakeholders as the agile framework promotes (Cooper, 2016). The respondents explain that the purpose of the sprint demos is to gain input from stakeholders, to open up understanding and transparency within the organization. However, they stated frequent deliveries to be difficult since there are long lead times, even for producing prototypes. The demos have recently been implemented together with the SAFe framework, and they are still in the process of adapting it to the organization. Everyone does not find the demo valuable and its difficulties in how to present results during demos in order for not to be too detailed. During the sprint demos, it is important to make trade-offs regarding how to continue with the development. Showing results should increase responsiveness to changes in the market and requirements (Cooper, 2016). It does, however, require input from stakeholders, and since the organization explained there to be difficulties in involving important stakeholders during the demos, there might be a lack of understanding the purpose. There was also optional participation, which might result in the stakeholders not understanding the importance of participating. If the stakeholders are not participating the value of the sprint demos might decrease.

Organization 2 develops in a similar process as Organization 6. Organization 2 has decided their development project into sprints, where the overall project plan is ongoing for three years. The sprint lengths depend on the development team but are commonly ongoing for three to four weeks. Once a sprint is finalized it is reviewed and what to be made in the next sprint is decided, just as Schwaber & Sutherland (2017) promotes. The sprint has enhanced the teamwork since each sprint consists of stories and tasks created by the team themselves. The sprints have also made prioritization of tasks simpler since all tasks are described, everyone can understand them. Involvement and better understanding among the team members are one of the main gains from adapting the agile framework according to one of the respondents. By continuously delivering a result, there can also be measures of progress as related to the agile principle number seven, "Working software is the primary measure of progress.".

Organization 4 has implemented full SAFe but is still in their startup phase. The organization has divided the development into four-week sprints with a gate every 14th week.

Furthermore, Organization 1 does not develop according to an outspoken framework, but according to the respondents, the organization's development process is similar to a stage-gate process. Organization 1 have projects that run for six months, compared to the other organizations in this master thesis, Organization 1's projects could be considered short. Many of the other organizations have six months between the gates. This means that Organization 1 finalizes a whole development project during what equals one gate within some other organizations. The organization delivers result through consistently testing the products

through an internal test panel. The frequents tests and deliveries of result can be somewhat similar to a sprint and created possibilities to make changes during development. The respondents from Organization 1 say that they constantly test the products internally by a test panel when they develop. During the development period, consumer input is gathered through a consumer test. This indicates that the organization way to work in their project reminds of working in something similar to sprints. Organization 1's way of working creates flexibility and ability to make changes along the way.

Table 4. Short planning periods with frequent deliveries

Agile Framework	Org. 1	Org.2	Org. 3	Org. 4	Org. 5	Org. 6	Total
Short planning periods with frequent deliveries	3	3	3	2	2	3	16

Main findings connected to short planning periods with frequent deliveries
Combining stage-gate with sprints can be a good way to increase quality and stability while still having possibilities to change direction within each sprint. This results in a developed product that is relevant for the customers. Sprints can assist the stage-gate process to be more flexible and to create motivation. The stage-gate should not hinder flexibility within the sprints and only work as a support if the organization strive to be agile.

5.1.3 Time Limitation

Time limitation is a category which has not been graded due to that it is an aspect which all organizations within the manufacturing industry needs to be consider. There are, however, differences in time limitation depending on the market and product-life-cycle, a cycle which tends to become shorter (Holweg, 2008; Sabadka, 2013). For example, Organization 1 needs to limit its development process due to a release window every sixth months. Within the agile framework, one might assume that value number four “Responding to change over following a plan” equals not setting a plan, and therefore, not set a time limit for the project. According to Layton, (2012), a project can have a set time frame, but there should be abilities to assess the time during execution. As knowledge grows during execution, the time limit can be more accurate. Gustavsson (2016) does, however, claim that within agile, there should be set dates included, but only if they are considered beneficial.

Time limits are an issue within the manufacturing industry, and all the studied organizations have a set time limit for when development needs to be finalized. This is due to that there are lead times and dependencies which development organizations need to consider. This is one of the main differences between software and product development. As Expert 1 explained, within product development, there can be months of lead time in order to receive a machine which will produce the developed product. If the project is ongoing and changes made after the

ordering date and during those months, then it will be even longer lead times and higher costs. Expert 1 argues for working in sprints with frequent decisions and changes works well at the beginning of a product development project, but the closer to launch the fewer changes there should be. The focus should instead be on finalizing in time, and for this, the expert claims that a set plan is required.

Respondents from Organization 2 and Organization 4 do not find major differences in developing products compared to software. Both Organization 2 and 4, especially Organization 4, develop highly complex products. Hence, with this empirical finding, the ability to implement the agile framework not only depends on if an organization develops software or hardware, but it can also depend on the product's an organization's complexity. Expert 1's knowledge and learnings combined with findings from the organizations shows that if lead times affect the product development process, there needs to be a plan for how to handle the lead times in order to finalize the product in time.

Organization 1 has a partnership with its suppliers, which has reduced lead times and increased flexibility. It can, therefore, be assumed that partnership with suppliers might be beneficial in order to reduce lead times. Organization 4 do, however, state it to be challenging working agile with suppliers. Hence, a partnership would lower the possibility to reduce costs. The organization commonly compare suppliers against each other in order to reduce the costs.

Main findings connected to time limitation
All of the organizations have time limitations for when the product development needs to be finalized. This is due to lead times, which cannot be neglected within the manufacturing industry. The more complex a product or organization is can be the measure of how well agile can fit an organization rather than if there is the development of software or manufacturing products.

5.1.4 Not Develop More Than Necessary

Within agile, there is a desire not to develop more than necessary, a desire which might be seen as influenced by lean. Within lean, the focus is on creating value and reducing the things not adding value, also known as waste (Holmdahl, 2016). Within the agile framework, prioritization of tasks based on input from the sprint reviews can confirm that what the product being developed is relevant and the work value adding (Cooper, 2016). The grading of each organization is seen in Table 5.

Organization 1 has limited capacity in how many products they can develop since their customers have limited capacity to order a different product. When the organization develops a new product, they often need to consider that they will remove an already existing product from the market. The majority of product development projects only run for six months, which means that the time and resources put on a development project is relatively low compared to the other organizations. Sometimes the organization develops limited editions which can be somewhat odd products in order to ensure that people talk about their products and thereby

increase marketing of the product and their brand. It can seem irrelevant and that the organization develops unnecessary products by developing odd products for the consumer, but for Organization 1 these kinds of projects are beneficial. Since the projects run by Organization 1's have lower costs then other organizations in this study, the organization can, according to the respondents, market themselves through developing odd products. What is considered necessary or unnecessary to include in a product differ between organization and projects.

Organization 2, 5, and 6 all use a backlog to prioritize the development tasks. The prioritization can enhance the organization's ability to work on the most vital tasks first. Prioritizing tasks does, however, require the product owner to have knowledge and understanding of what tasks to be performed first since the product owner is responsible for the backlog (Awad, 2005). Prioritization of tasks can ensure the product to be competitive and useful on the market while according to Schwaber and Sutherland (2017) as irrelevant tasks can be reduced. The prioritization can also reduce waste for performing tasks not relevant for the project. Using a backlog also increases a shared understanding of tasks and its prioritization. The backlog can benefit the organization since everyone works towards the same goals. Using a backlog with defined tasks can benefit the teams in knowing the requirements to finalize a task (Schwaber & Sutherland, 2017).

Agile principle number ten, "Simplicity--the art of maximizing the amount of work not done--is essential," can be interpreted as not doing more than what is adding value for the customer. The principle is about not developing the product more than necessary, and it should be developed to be able to do the requested job and not more (Nyman, 2010). It is of importance to understand that using a backlog does not solve the problem of over-developing. Close and regular communication with the customer is required to succeed in this area. Hence, when using a backlog, an analysis of what is considered important for the customer should be performed and the prioritizing of tasks should be made to finalize the project in time.

Organization 1 include the consumers during the development process by sending out product tests to receive response through a survey. All of the organizations conduct pre-studies before product development, where some of them involve customer needs. Organization 3 and 5 both perform a comprehensive pre-study before starting up a product development project to gain knowledge about customer requirements and needs. Organization 2 and 6 explained that they have a product owner who continuously has contact with stakeholders. The product owner also communicates customers' needs and requirements to the development teams, as Gustavsson (2016) suggests.

A common issue within project management is finalizing a project, and within agile product development (Gustavsson, 2016) states it to be even more of a problem. This can be due to that there is no clearly defined end, this might be a result of adapting the value "Responding to change over following a plan" in a wrong way. When working with a backlog and tasks, the tasks need to be clearly defined to understand when they are considered finalized. Expert 2 described a common project management mistake which can be related to unprioritized tasks.

The expert explained that a project should not be ongoing forever if desired results are not reached. There need to be clear goals which need to be reached, and there needs to be someone who makes sure the development is going in the direction towards the goal. It is important that projects are shut down if the project does not head the desired direction. It requires a decision maker while many development projects commonly lack in having a decision maker role. This results in the development lacking direction, the weaker decision-maker role, the higher risk of developing a product that customers do not want.

Organization 4 also makes a comprehensive pre-study where they, for example, collect and use data from when customers have used their products. Through the data, the organization can analyze how the customers use the products. Thereby, they can see which parts of the developed product that are used or not. This is a way to study the customers and their actual needs since it might be hard for the customer to give input before the product is developed or used. According to the respondents, Organization 4's projects are costly due to that they develop a very complex product which takes about two and a half year to develop. A way to lower project costs could be to shorten the projects development time, but would an organization benefit from doing this? A common misinterpretation within agile is that the framework shortens the project time. Since the product development project continuously is reviewed through working in sprints, it is less of a risk to make wrong decisions (Cooper, 2016). Therefore, the agile framework can increase the possibility to run a project during a shorter time than using traditional frameworks. The agile framework will however, primary enhance the potential to develop a product that will satisfy the customer. The agile framework uses an iterative development process, which makes sure the product to be desired by stakeholders and customers (Awad, 2005). It is, therefore, lack of re-work, unexpected costs, and overrun project plans. Agile can be considered as faster than traditional development framework, according to Layton (2012) since it reduced uncertainties, which results in the project not running over time.

Organization 2 uses a backlog and visualizes the work with a visualization board. Layton (2012) and Awad (2005) describes that using a backlog makes the work more visible, plans, and requirements are shown to the scrum team. The visualization board also shows what tasks the team should perform while the backlog shows their prioritization. The backlog and visualization board create clarity for everyone in the team since it visualizes what should be done. The visualization board is of great help for Organization 2. It helps them know what to do, how to prioritize the work, and the team to collaborate.

Table 5. Not develop more than necessary

Agile Framework	Org. 1	Org.2	Org. 3	Org. 4	Org. 5	Org. 6	Total

Not develop more than necessary	2	3	2	2	3	3	15

Main findings connected to not develop more than necessary
Using a backlog can benefit the product development process to prioritize the work and to do what is important first. It is important to involve the customer to know what is most important when prioritizing the tasks. There has to be a decision maker which can ensure that the prioritization is related to customer requirements. Prioritization does not equal shorter projects but rather benefits in understanding what to develop.

5.1.5 Customer Focus

Within the agile framework, satisfying the customers are one of the highest priorities. Having a close relationship with the customer can be connected to almost all other methods in the framework as well as many values and principles found in the agile manifesto. By early and continuously involving and delivering value to the customer throughout the project, it is less of a risk to develop something undesirable (Cobb, 2015). Value number three, customer collaboration should be valued over contract negotiation, can be related to that the customer should be involved from the start. Abstract goals should be set from the start, and throughout the development, more detailed goals should be established together with the customer (Cobb, 2015). Having a contract from the start with all requirements stated, as in traditional development frameworks, creates rigidity and limits the development. By including the customer during the development process, new needs can be found. If there is an external customer, including them during the whole process will ensure that no surprises occur at the end (Cobb, 2015).

The majority of organizations within this thesis lack in involving the customer during the product development process as seen in Table 6. The organizations succeed in their field of business, which indicated them to develop products which match their customer's requirements. There could, however, be improvements in including the customer more frequent during the development process. It is also of importance to distinguish between customer and consumer according to Expert 1. The expert claims when manufacturing products for consumer, it is more important to involve consumers than customers. It can, however, be difficult to include consumers in the development process in the way customers are promoted to be involved. The consumer can be involved in the way Organization 1 and 4 involves them, through tests and data collection of consumers using the product.

For the majority of projects, Organization 1 does not involve the customer during the project. The customer's requirements could be included in the scope, but when the project starts, the customer is often not included until the project is finalized. The organization does, however, include the consumers during the development process through external tests. These tests are of great value since the external tests with the consumers can strengthen that the organization's

developed product is wanted by the consumer.

Moreover, when including the consumer, the organization can also make changes in the product and make decisions based on the result from the external tests. Organization 4 involves its customers in the development process through data collection of the customer using the product or projects with the customers. There are however limitations in how far along the development customers input can be considered due to regulations and time limitations.

Within Organization 2, there is mainly contact with internal customers and stakeholders if there is a risk of set requirements not being met. Despite the organization working in sprints, there is lack of involvement of stakeholders within them. The respondents explain that there is no contact with the end customer nor the consumers. The product owner of the development team does, however, have contact with stakeholders and input can be gained throughout the development process. Organization 3 has based their development on pre-studies, which results in product requirements being set from the start. The respondent explains that both customers and consumers need to be considered when developing, there are, however, difficulties in involving both of them. The consumer is difficult to involve in the development process. Hence, it is an intimate product while the customer lack in providing input on innovations for the product.

When developing products within the manufacturing industry instead of software, there are according to Expert 1 often more lead times and dependencies which need to be considered. To finalize the development in time can be assumed to require limitations regarding how long in the process, the customer can provide new input. If there is a lack of limitation, the project might overrun the project plan and be delayed. Organization 3 and 5, for example, performs an estimation of how much a change affects the project. If changes occur late in the project, an analysis for its consequences and how a delay would affect the project is performed. This results in an understanding regarding if it is worth carry out the change or not.

Value one, tree and four can all be connected to customer focus, due to that the values stand for the individual and interactions, customer collaboration, and the ability to respond to change. Principle one, two, three, and nine can also be connected to customer focus in which satisfy the customer (Agilemanifesto, 2001). The mentioned values and principles can be connected to other methods within the framework. For example, when prioritizing customer collaboration, it is important to have a clear role for whose responsibility it is to close contact with the customer (Gustavsson, 2016). Some other methods that are important and connected to customer focus are flexible and dynamic development process, short planning periods with frequent deliveries, and not develop more than necessary. For example, to gain an understanding not to develop more than essential for the customer, the organization needs to have customer collaboration.

Table 6. Customer focus

Agile Framework	Org. 1	Org.2	Org. 3	Org. 4	Org. 5	Org. 6	Total
Customer focus	2	2	2	2	2	2	12

Main findings connected to customer focus

In order to create flexibility, there must be a collaboration with the customer throughout the development process. A close customer collaboration increases the possibilities of the developed product to be made according to customer needs. Developing product to be manufactured differs from software development but also how complex the developed product is since there is a limitation in how far in the process new inputs can be considered.

5.2 Organizing Teams and Roles

In this section, analysis, and discussion about teamwork, cross competence, self-organizing team, and roles are performed

5.2.1 Teamwork

Within the agile framework, teamwork is one of the main focus areas, as many of the values and principles involves teamwork. Firstly, the value number one raises the importance of individuals and interactions over processes and tools. The value is said to increase problem-solving, communication, and wellbeing among the employees since the individuals are more satisfied when not being hindered by processes and tools (Measey, 2015). As Denning (2018) describes, the development team is coordinated by work cycles and customer feedback, rather than plans, rules, and reposts.

As stated by principle number five, projects should be built around motivated individuals where they should be provided the environment and support they need, with trust in them to get the job done. Principle number eleven also states that the best designs, requirements, and architectures emerge from self-organizing teams. Having agile, self-organizing teams requires motivated individuals since they have the responsibility for their tasks (Marmgren & Ragnarsson, 2001). The management should not control the team's way of working. Instead, the management should guide and remove obstacles which can hinder the team from performing their best. Working in self-organizing teams requires there to be an organizational culture with individuals who are motivated to organize the work themselves. If the team lack motivation, it can be difficult to provide good results. Hence, no one controls them.

The scrum methodology is commonly used when agile is used within teams. The team should be small, cross-functional, and build on different competencies. The different competencies are needed since the teams should be independent with a low amount of knowledge required from anyone outside the team. This will not only make the team more flexible, creative, and productive but also reduce waiting times (Gustavsson, 2016; Schwaber & Sutherland, 2017). Expert 3 also brings attention to the benefits of agile teams and close cooperation. It is beneficial since everyone within the team works towards the same goal and drive the development together. Expert 1 discusses not only cross-functional teams but also cross-functionality among functions within an organization to increase understanding.

There are mainly three of the organizations who are outspokenly working in cross-functional teams, Organization 2, 3, and 6. All of the three organizations has been given high grades as seen in Table 7 and have gained value from applying agile methods and tools on their development teams. Ever since Organization 2 implemented the agile framework, the teamwork has improved tremendously. Previously, the main issues within the teams being interviewed were uneven workload and lack of shared knowledge, authorities, and responsibility areas. Senior employees had most of the knowledge, whereas new employees had a hard time being involved in the development process. The organization had defined issues

which they resolved using agile methods. Now, the team has an understanding of each other's tasks. The knowledge is shared where more than one can perform a task, and the workload is evenly distributed among senior and new employees. The team also creates tasks and can, therefore, be seen as self-organizing.

The product development in Organization 3 is based on scrum teams of 5-10 people. The respondent explained teams to work differently depending on levels within the organization. On a strategic level, there are more cross-functional teams than on an operational level. It is of importance to not have too large teams, according to Gustavsson, (2016) there should be possibilities to look everyone in the eye since large teams hinder communication. Organization 3 said that implementing agile methods and tools has increased transparency in the organization and greater participation in projects. The product development within Organization 6 is divided into teams based on a product area and required competencies. The organization recently implemented SAFe, from being located in functions to cross-functional teams now being located together, sharing knowledge and collaborates. Previously, the functions lacked in understanding of each other's tasks, but through the new team orientation, the understanding has increased.

Moreover, according to one of the respondents at Organization 6, a comprehensive understanding of the whole process is gained from working in cross-functional teams. Self-organizing teams, as principle number eleven argues for, is seen within the organization. The teams decide their work, tasks, and how it is organized. There is a feeling of ownership where each team has responsibility for their development area, which, according to Marmgren & Ragnarsson (2001) increases the motivation. The organization strives towards making more teams cross-functional and to involve more competences within the teams. The respondents from Organization 6 explain that to gain an even broader understanding of the product and process, it could be beneficial to include the software developers in the cross-functional teams.

Organization 4 has implemented the SAFe framework and are currently in the implementation phase. They have not yet implemented cross-functional teams. It is, however, one of their future goals. The respondents from the organization claimed to have tried working in cross-functional teams about 20 years ago, and it resulted in knowledge and competencies being lost. The organization did, therefore, went back to working in functions of competence. Today, the organization is divided into functions of competences where they are located in different buildings, cities, and counties. The respondents explain finding the relationship between who needs to sit close requires a lot of work.

Furthermore, the respondents explain that the primary purpose of having cross-functional teams is that they can focus on one component, but this requires clearly stated boundaries towards other components. To succeed with the SAFe transformation, the organization would benefit from establishing cross-functional teams. It can moreover be confirmed through the first implementation within Organization 6. They tried to implement the agile framework without changing the organizational structure where they still worked in functions. The

organization failed with the agile implementation and quickly realized that they needed to build the development around cross-functional teams. The second implementation was based on SAFe, and both organizations implemented the framework at the same time. Organization 6 is much smaller than Organization 4, hence which can be assumed to be the reason for why they found the mistake so quickly. The respondents in Organization 6 state that working in cross-functional teams enhances knowledge sharing and has increased the understanding of the product and its correlated components. This is related to a statement made by Denning (2018). Agile cannot be implemented as a new method in an already existing management practice since agile is an entirely new and different way of managing.

Organization 5 has two different teamwork approaches, depending on division. The division with agile methods implemented says that those working in a team should help and supervise each other through a cross-border way of working. It can be related to the agile framework with similarities to the agile values and principles. There is, however, one difficulty and an issue that might hinder the organization in gaining all the benefits of agile teams. As previously described, face-to-face interactions are most beneficial. The division does not have all of the members in a team located together. As Expert 3 explains, agile teams require close collaborations with shared goals, and if some members do not participate physically, then those will lose information. Since teams decide their tasks, creates solutions and prioritizes requirements, being located separately can result in the team not reaching the desired flexibility, creativity and productivity as Schwaber and Sutherland (2017) argue.

Organization 1 mainly work in functions of competence and do not work in project teams. The development project is mainly lead by one individual where each function interacts when needed and during project meetings. The projects are commonly short, and since there is a simple product compared to the other organizations a need for cross-functional teams with cross competence might be excessive. The low need for cross-functional teams might also depend on the close relationship between all the functions.

Some of the development teams within the studied organizations use retrospectives in order to improve their work. As principle number twelve states, which is translated by Nyman (2010) teams should reflect on how to become more efficient and adjust its behavior accordingly. There are mainly three organizations who have brought up this as an important aspect in their product development. Organization 2 have retrospectives each month, which the respondents explain facilitates willingness to change. Since new ways of working can be evaluated and changed regularly, the fear of implementing new ways of working has decreased. Organization 3 and Organization 6 also lift that retrospectives are a part of their development process and that it increases the knowledge.

Based on the theoretical and empirical findings, it is regardless of product or software development, important to work in cross-functional teams. There are no significant differences between software development and product development found in this area.

Table 7. Teamwork

Agile Framework	Org. 1	Org.2	Org. 3	Org. 4	Org. 5	Org. 6	Total
Teamwork	2	3	2	1	2	3	13

Main findings connected to teamwork
Cross-functional teams can increase the understanding of the product, process, and other functions' work. Furthermore, enhance the quality of the products. Focusing on teamwork with cross-functional teams is equally important regardless if developing software or products for the manufacturing industry.

5.2.2 Cross Competence

Within agile teams there should preferably be cross competence, it should however not be confused with cross-functionality. Sutherland & Sutherland (2014) even states that within a scrum team, there should be no titles or competency areas. This can, however, be debated, as the authors refer to the development of software, the tasks within a team might be similar. When developing products within the manufacturing industry, knowledge and competence areas might be necessary. The grading for cross competence is low within almost all, which can be assumed relates to the fact that all organizations are within the manufacturing industry. Cross competence could be assumed to be a method which organizations could implement if they have come far in their agile implementation. An assumption regarding this can be made according to Table 8. Organization 2 that has the highest total score is also the organization that succeeds in cross competence. It can, however, also depend on that Organization 2 had problems that could be partly solved by implementing cross competence.

Chin (2004) states that a team should have defined roles and responsibilities. Within the manufacturing industry, a combination might be best. The team should have as broad knowledge as possible, while still being relevant to the development area. As principle nine states, "Continuous attention to technical excellence and good design enhances agility." Ensuring that there are valuable skills within the team makes sure that the team can maintain their working pace, be able to improve the product, and handle change. Having cross competence will reduce the bottlenecks related to if only one individual could perform a task. It does, however, not require everyone in a team to know everything. Since the development team in agile should work to perform tasks as a team, with shared responsibility, there needs to be some understanding regarding all team members working areas. Organization 2 has implemented agile teams and are the organization with the most cross competence. The teams are self-organizing and can perform tasks without being dependent on other teams or their knowledge. This was one of the organization main issues before implementing agile, senior

employees had all the knowledge and there were issues delegating tasks to new employees. Therefore, the senior employees had a huge work overload. In comparison, the new employees had issues getting involved in the work. The flexibility in the teams has increased since more people can perform tasks. It has also made it easier for new employees to become involved in the development process. This method is one of the most important to have flexibility in for Organization 2 to solve their problems. Organization 3 works in cross competence but sometimes have difficulties finding generic tasks which can be solved by everyone in the development team.

The majority of the organizations state to be too small for cross competence. For example, Organization 1 who work in functions do not have the right organizational structure to include cross competence. The organizations mainly focus on cross-functional teams where cross competence occurs to some extent. For example, within Organization 6 the teams are partly built on cross competence. They help each other and perform tasks beyond their expertise. The organization does however, state that it would be inefficient if everyone worked cross competence. Nevertheless, all organizations could benefit from having some cross competence within the teams or organizations due to avoid bottlenecks (Chin, 2004).

As principle five states, “Build projects around motivated individuals. Give them the environment and support they need and trust them to get the job done.”. Motivated individuals are required to have self-organizing teams where the possibility to go beyond competence area might increase motivation.

Table 8. Cross competence

Agile Framework	Org. 1	Org.2	Org. 3	Org. 4	Org. 5	Org. 6	Total
Cross competence	1	3	2	1	1	2	10

Main findings connected to cross competence
Cross competence can be assumed to not be as relevant in product development within the manufacturing industry as when developing software products. It might be viewed as an implementation which is relevant if there already are agile methods in the organization.

5.2.3 Self-organizing team

The agile framework encourages organizations to support the employees to make decisions on their own, trust the employees to do a good job, and to have self-organizing teams. By doing that, individuals will be more motivated and perform better (Nyman, 2010). Principle number five and eleven from the manifesto addresses this area. Nyman (2010) translate principle number five as if teams can make their own decisions, they are more likely to do a better job.

This, since teams making their own decisions, creates ownership of the work and motivates employees. Marmgren and Ragnarsson (2001) describe that self-organized teams requires employees who are motivated since they are not driven and given tasks by a leader. Making decisions within the teams reduces lead times associated with waiting for someone else to make decisions.

Organization 2 is an excellent example of an organization that has succeeded in having self-organized teams and is therefore graded with a 3 as seen in Table 9. Within Organization 2 the employees make decisions within the teams where the team is mutually responsible for all work and that all work will be finalized in time. Before the agile implementation, some individuals had their responsibility for certain tasks, which both affected prioritization and collaboration. The prioritization of tasks was related to each individuals interest rather than the tasks most important to finalize first to simplify the development. There was a lack of teamwork and an understanding of how all tasks were related. Hence, self-organized teams can both strengthen the teamwork and benefit to finalize important tasks in time.

Organization 1 describes that individuals can make decisions by themselves that involve the daily work while more important decisions are made by a manager, the project leader, or the upper management. Organization 1 does, however, work in short projects that run for about six months, and the projects are relatively small. The respondents from Organization 1 describe that everyone works close to each other, even though some decisions have to be taken through a manager, decisions can be taken rapidly. For larger organizations with more complex products, not having self-organized teams could harm the organization more, could make the process slower and inflexible. Having a development team who makes their own decisions creates motivation among the employees (Nyman, 2010). At Organization 1, there are no teams that make decisions together. Due to Organization 1 being a relatively small organization, assumptions can be made regarding there being a lower risk of employees not feeling involved in the process or decision making if not having self-organized teams. Everyone at the organization knows who makes the decisions and information regarding a decision is easily spread to everyone involved. Large organizations where employees might not know who the decision makers or management are could benefit more of having self-organized teams. Hence, to avoid lead times related to decisions but also to not lose motivation among the employees (Nyman, 2010; Marmgren & Ragnarsson, 2001).

The development teams in Organization 3 and 4 can as individuals within Organization 1 make some decisions by themselves. Organization 3 describe that there are levels of when individuals and the team can make their own decisions. In some cases, the upper management is the decision makers. The respondent from Organization 3 also describes that everyone can make their own decision on how to perform the work. Organization 4 describes that they strive towards having self-organized teams. This since today, they find having teams that do not make their own decisions slows down the development process. The respondent also talked about tools and that the right circumstances create abilities to achieve self-organized teams. Before implementing the tools, it is important to ensure that the organization has an agile mindset

(Measey, 2015). Implementing an agile mindset is important if Organization 4 want to have teams that can make their own decisions. It is important for both the development teams and management. If the organization lacks in an agile mindset, there are possibilities to fall back to old patterns or misuse the agile tools.

One of the respondents from Organization 5 explains an issue related to self-organized teams. Organization 5 have seen hinders of having teams located in other countries than the management or individuals working in teams while not being located together. Some teams are located abroad where there are cultural differences which contradict with the agile framework. The teams abroad are used to a more hierarchical structure with a leader who delegates the work. Therefore, there are difficulties in making the team make their own decisions. Since almost all organizations in this thesis are located in Sweden, Swedish organizations can be interpreted as not that hierarchical with a rather flat organization. Swedish employees are according to Organization 5's found challenges and use to making their own decisions compared to an organization within other countries. This can be a reason why most of the organizations succeed pretty well in this area. Organizations which are located in different countries need to consider the cultural differences and that challenges might occur regarding self-organized teams when implementing agile according to Organization 5's experience.

Table 9. Self-organizing team

Agile Framework	Org. 1	Org.2	Org. 3	Org. 4	Org. 5	Org. 6	Total
Self-organizing team	2	3	2	1	2	3	13

Main findings connected to self-organizing team
Self-organized teams can strengthen the teamwork, increase the motivation, and benefit important tasks to be finalized in time. Self-organizing teams require other agile methods to be implemented first.

5.2.4 Roles

Agile roles are often referred to as the roles within a scrum team. A scrum team includes the employees working with the development, the scrum master, and product owner. A scrum team should be, which implies the team to make decisions about their tasks, without a leader who controls them (Schwaber & Sutherland 2017). The scrum master has the role of coaching the team to follow the agile framework and remove obstacles (Maximini, 2015). When working according to a framework, Expert 2 discusses the importance of continually reminding employees on how to work according to the set framework and goals. It should not be possible to forget the decided framework, methods, or tools. Hence, having a scrum master covers the

importance of maintenance and constantly support employees to work according to the set working method as Expert 2 claims are very important.

The product owner is the one ordering the products being developed by the development team, and the product owner can be either internal or external within the organization (Gustavsson, 2016). The studied organizations which have a product owner have their product owner internally, within the organization. The product owner should have a decision maker role and should be the one who makes decisions regarding the project's boundaries, requirements, and demands. The product owner should be the one with customer contact and should base decisions on customer input (Gustavsson, 2016). Thereby, it can be assumed crucial that the product owner or someone with the same authorities is present during the development if not there can be issues regarding the direction of the development.

All of the experts are in agreement on the importance of a decision maker within the development process. Even Gustavsson (2016) states that the product owner role is critical and needs to be present during the whole project. The experts expressed that there needs to be someone with decision maker authorities despite being named product owner or not. Expert 1 claims that there needs to be someone present during product development who can understand if new suggestions are related to the organization's desired direction. The product owner should preferably be someone outside of the team since decision then can be taken without bias. According to Gustavsson, (2016), the product owner should ideally not be located with the team since it can result in the product owner being too involved in the daily activities. If the product owner is too present faster decisions and changes can occur than needed. The product owner should be a part of the team, but not sit within the team.

Expert 2 described a common project management mistake was that irrelevant things are prioritized, and projects run for too long heading the wrong direction. The mistake is commonly due to lack of a decision maker, someone with knowledge of goals and direction to go to reach the goal. The expert claims that the weaker connection a project has to a decision maker, such as the project owner, the harder it is to develop something that the customer wants. Expert 3 claims that the product owner role has been present even before the agile framework was invented. Then the role was divided within each function rather than within a development team. Both Expert 2 and 3 states that there commonly is confusion between the project leader and the project owner. The project leader can have project owner responsibilities, but it has to be clearly defined.

Expert 3 states that roles within an organization need to be clearly defined. There needs to be the same language and definition of each role otherwise the way of working will not function as desired. This can be related to Chin (2004), who states that it is crucial to define clear roles and responsibilities within every project team. It is even more critical when working agile since the agile roles and responsibilities create limits that guide the team. The organizations being studied all have different roles within their teams, and it is difficult to grasp their exact definition of a role. In many cases, roles have different names but with different responsibilities

and the other way around. However, it is vital for the organization to know the roles and responsibilities themselves.

Organization 1 have not implemented scrum or the agile framework. Hence there are no agile roles, and the organization is therefore given a low grade. The organization does, however, have a project manager with authorities related to the product owner. The project manager is the decision maker and is the one arguing for the project and product. Organization 2 has chosen to implement agile scrum roles where the product owner sets the scope, prioritizes tasks, and acts as an interface. The team leader is now known as a scrum master, with main responsibilities of leading the team. The developers in the team are self-organized and decide the tasks on their own. The way Organization 2 has implemented agile in their team is the most similar to how the theory describes agile teams to function, they have therefore been graded with a 3 as seen in Table 10. Organization 3 does not work according to the roles in a scrum team. They do, however, have a project manager with authorities similar to a scrum master and project owner, where the project manager sets requirements and communicates with internal and external stakeholders. Organization 4 works according to the SAFe framework where the teams should consist of a scrum master, a product owner, and a line manager. The roles within the development are related to the agile framework, and responsibility areas seem to be defined. The organization is in an implementation phase, and it is difficulties in analyzing whether the roles are settled.

Within Organization 5 there is one division who have roles which are included in the agile framework. The agile role is mainly the product owner, who is the one with a close relationship with the sales department. The product owner does, however, not have direct contact with customers, but the product owner receives input from the sales department, which then are translated to the development teams. The product owner role and responsibility areas are somewhat redefined compared to the agile framework. It is hard to analyze how well the organization succeeds in its agile roles.

Nevertheless, having a product owner that provides customer requirements and make decisions is crucial according to all the experts. This could confirm that the organization has somewhat understood the meaning of having agile roles. However, having roles with titles according to the agile framework does not mean that the roles have been implemented in the right way. Hence, how well the organization succeeds in its agile roles would need the organization to be studied further. As previously discussed, there are difficulties in analyzing whether an organization has interpreted the agile roles in the right way. It would require more and increased number of in-depth interviews with all organizations.

Organization 6 has recently implemented SAFe roles. One of the respondents explains that sometimes, it can be hard to differentiate the roles from each other. The respondents explain there to be similarities in the scrum master, project manager, and line manager role where the organization lack a common understanding of the roles. Each role can be interpreted as lacking a definition, which can create confusion. The organization has also expanded rapidly, which

can be one of the reasons why roles are somewhat undefined. Unclarity in roles is related to what Expert 2 claimed, an organization implementing a new framework such as SAFe needs have defined roles and responsibility areas which new roles can be related to. If an organization lack defined role prior to starting a new implementation, there would be difficulties for the employees in the organization to relate and adapt the new roles.

Table 10. Roles

Agile Framework	Org. 1	Org.2	Org. 3	Org. 4	Org. 5	Org. 6	Total
Roles	1	3	2	2	2	2	12

Main findings connected to roles

The role of a decision maker, such as the product owner role, is of great importance. There needs to be clarity in who makes decisions and that the decisions are based on customer requirements. Moreover, the scrum master role is important to support and make sure that the team and the employees work according to the set framework. All roles need to be clearly defined with their responsibility areas. There also needs to be a common understanding within the organization regarding which decision or authorities that are included in a role.

5.3 Communication

This chapter includes analysis about open and spontaneous communication, understanding of the development process among suppliers and documentation.

5.3.1 Open and Spontaneous Communication

The agile framework highlights the importance of interactions over processes and tools through the first agile value. The value does, according to Cobb (2015), increase problem solving and enables the development to be more responsive to changes. Being too process and tools driven can, according to Layton (2012) hinder the communication only to take place when the process states it. The communication is encouraged to be held face-to-face. Hence, it is the most efficient way of communication according to principle six in the agile manifesto.

The organizations within this study are overall performing well regarding communicating within their product development as seen in Table 11, which depends on different factors. Both Organization 1 and Organization 6 has the whole organization with production located in the same building, which can increase the possibility of good communication. Organization 1 has stated the communication to be one of their main success factors. The communication is spontaneous and mostly held face to face where some communication is documented to avoid misunderstandings. Previously, the organization had issues with communication since the organization was split up in different cities. At that point, communication was one of the organization's main issues. When the organization was located together, the communication improved tremendously. Now, the communication has enabled the organization to be quick in their development hence testing, and results quickly can be communicated and changed. The communication within Organization 1 creates the most flexibility in their development process despite them not working in cross-functional teams. Cooper (2016) strengthen the empirical finding by claiming that communication and quick feedback enables a more rapid development. Since the development within Organization 1 only run for six months, it is of great importance to have a rapid and flexible communication and for the process to be flexible and fast.

Within Organization 6, each team is placed together. According to the respondents, this increases the feeling of teamwork and collaboration. There is face-to-face communication, as the agile manifesto encourages (Agilemanifesto, 2001). Each team also has daily meetings and PI planning events which are easily performed since they are located together which enhances communication within the whole organization. One of the respondent's state that only enabling communication and creating ways to communicate easier, are not enough. Good communication also requires individuals who are willing to share and communicate. As Expert 2 and Stanleigh (2013) claims, there needs to be an understanding of why communication is important and why it enhances development. The purpose of doing something needs to be communicated and understood by those performing it. This can also be related to what Expert 1 discussed, and an organization needs to have the right employees and competences. As the agile principle five states, a project should be built around motivated individuals. If there are

motivated individuals, they will perform well, but it also requires the organization to trust them and create an environment for them to get the job done.

Expert 3 claims that gaining value of agile teams requires the team to be physically present. It can, for example, be during daily meetings where everyone physically meets. Lack of physical meetings could result in a loss of team dynamic and information. This aspect needs to be considered by mainly three of the studied organizations due to there are some shortcomings in this area. The product development within Organization 5 is mainly located in the same building. As previously described, only one division within the organization has worked on implementing agile methods and tools for the past years. This division does, however, have parts of teams located abroad while the other none agile division have development working closely together. The same is for Organization 3, where there is one development team located in Turkey. If there is a desire to use agile methods, not being closely located can hinder the development rather than improve hence agile team requires close communication to succeed. If teams are required to work in a setting where changes quickly can be applied, there should be clear communication regarding goals and direction as well as communication about daily work. Furthermore, if there is a lack of communication regarding these areas, the result will probably be lacking as well.

Communication is an advantage in agile, according to Expert 1, but it is equally important regardless of the development framework. The expert explained there to be value in having frequent communication with stakeholders and decision makers during development. It will result in them having a better understanding of the development process, and better decisions can be made. Through frequent communication, there will be an understanding of why certain activities have been performed, which results in understanding the result. Since communication is an important aspect in many frameworks, communication can be assumed to be equally important regardless of development within the manufacturing industry or software development.

Organization 4 is located in many countries, cities and develop a highly complex product which makes communication more challenging. According to the agile manifesto (2001), communication should preferably be held face-to-face, which is more difficult when the organization is located as it is. Nevertheless, the respondents from Organization 4 describe that the SAFe framework is built on communication. Working with a framework that prioritizes communication can be assumed important for Organization 4 since challenges related to communication is obvious. The respondents from Organization 4 also explain that the organization uses software tools to communicate with employees located abroad or in another city. Expert 3 does, however, argue that so far, no software tool that can replace face-to-face communication has yet been invented. Based on Expert 3’s statement, and the communication challenges found within that Organization 4, it can be assumed that the organization requires to put a greater effort into making the communication easier.

Table 11. Open and spontaneous communication

Agile Framework	Org. 1	Org.2	Org. 3	Org. 4	Org. 5	Org. 6	Total
Open and spontaneous communication	3	3	2	1	2	3	14

Main findings connected to open and spontaneous communication
Having face-to-face communication enhances the flexibility, decisions can more rapidly be taken, and the process can more rapidly move forward. Having the product development and related parts working closely increases the possibility to communicate, and physical presence increases understanding of the development. Communication is important regardless if an organization develop software or products for the manufacturing industry. Communication can be increased through using the agile framework, but it also requires the individual to understand the purpose of communicating.

5.3.2 Understanding of the Development Process Among Suppliers

In product development, there is often a need for external suppliers or competences. Therefore, it can be assumed that an organization's way of working should be understood by the closest external parts in order for the organization to succeed with their work. As Gustavsson (2016) states, the organization should base the choice of a supplier on their possibility to adapt to the agile framework. This since when developing the agile way, there is a higher demand on the supplier, and there need to be continuous reconciliations.

The organizations being studied are lacking in having understanding suppliers regarding their product development process. The low gradings can depend on how the interviewees interpreted the question regarding an understanding of the development process among suppliers. As Organization 1 do not use agile methods or tools at all, the interpretation was rather if their suppliers have understood their development process. The other organizations interpreted weather their suppliers understand their work towards being agile, which most of them claimed not. Hence, it could be misleading to compare the answers from Organization 1 with the other organizations. Regardless of outspokenly working agile or not, the organizations can benefit from having suppliers understand the development process. This statement can be assumed based on how Organization 1 benefit from succeeding in this area.

Organization 1 is the organization which have the best relationship with their suppliers, as seen in Table 12. There is regular communication where the suppliers, for example, can send new ingredient tests within a day. This enables the development to reduce lead times. Organization 1 mainly work with the same suppliers, which creates a good collaboration and understanding of each other's processes. Organization 2 and 6 are the organizations who have the lowest understanding among their suppliers. Organization 2 claims that there is low understanding of

the organization's development process but that there are no problems related to it. The product development adapts to the customers and suppliers, not the other way around. Organization 6 states that their suppliers most certainly do not have an understanding of their product development, they do not change regardless of working agile or not.

Organization 4 and 5 are according to the interviews most dependent on their supplier relationships. Both organizations also claim to have adapted agile methods and tools. Organization 4 works with many suppliers hence, it is a product with many components. The organization is according to one of the respondents facing issues. Hence, they claim to need a partnership with suppliers if the agile framework should work as desired. Today, the organization uses the suppliers against each other in order to reduce component costs. If instead suppliers were based on a partnership, there would be difficulties in lowering costs, and costs would probably increase due to increased contact and more frequents deliveries as stated by Gustavsson (2016). Organization 5 are dependent on their suppliers. Hence, they do not have their own production but rather only assembly different components. The organization have a lot of value in the material from suppliers and need to have a predictable supplier base since a new supplier equals high risks. Both organizations would benefit from having suppliers who understand the product development process. Expert 1 claims that developing products within the manufacturing industry often includes more lead times compared to software development. An assumption can, therefore, be made, having an understanding of the development process among suppliers can be even more important when developing for the manufacturing industry.

Table 12. Understanding of the development process among suppliers

Agile Framework	Org. 1	Org.2	Org. 3	Org. 4	Org. 5	Org. 6	Total
Understanding of the development process among suppliers	3	1	1	2	2	1	10

Main findings connected to understanding of the development process among suppliers
A close relationship with suppliers can create flexibility since it can enhance the possibility to changed demands during the development process. A closer relationship with suppliers can reduce lead times and an understanding among suppliers can be assumed to be more important when developing products within the manufacturing industry than software.

5.3.3 Documentation

Documentation is the second area where the organizations lack in working according to the agile framework. The agile value number two states that working products should be valued higher than comprehensive documentation (Agilemanifesto, 2001). This does, however, not imply removing all documentation from the development process. The majority of

organizations are having issues regarding finding a balance between what to document in the process. Some of the organizations document too much, and some almost not at all. As Organization 5 explained, there was a culture of documenting where, when agile methods and tools were implemented, the documentation was reduced. They are trying to find a balance in only documenting what is essential. There needs to be an understanding of what to document for it to add value to the development process (Nyman, 2010). Documenting should not be seen as a hassle, it should be made to gather tacit knowledge and share the knowledge for future projects (Highsmith, 2003). Organization 5 first documented too much, when they started to work using agile methods and tools, dude to that there was a misunderstanding about how much they should cut down the documentation. One of the respondents from Organization 5 describes that they lack documentation standards and that they currently do not document enough. They are aware of their lack of clear structures of what should be documented, and they are working to solve this issue. As stated, the documentation needs to add value. Otherwise, documentation might end up on a shelf and not be used as Expert 2 claims. Then the work will be considered waste and none value adding.

Expert 1 stated that within product development of manufacturing products, there are more lead times and external dependencies than in software development. Therefore, it could be assumed to be even more important to document when developing products within the manufacturing industry. The documents could thereby increase clarity in decisions being made, increase communication and collaboration. The documentation could ensure that there is a mutual understanding. The benefits being gained from documenting can be related to the benefits of communicating.

The agile value “working products over comprehensive documentation” could, based on the empirical data, be seen as one of the most misunderstood values. This could be assumed to be an answer to why the total grading, as seen in Table 13 is one of the methods. Finding a balance of what is important to document can be hard. When implementing the agile framework, the framework can be an excuse to stop documenting since the value can be misinterpreted. Organization 1 have not implemented the agile framework, but the organization has found a good balance where their documentation adds value to their development. They mainly describe to document and inform through email when decisions are taken in order for everyone to remember and also to ensure that everyone has understood the decision in the same way.

Highsmith (2003) argues that documentation is vital in order to share and collect gained knowledge for future projects. Within the agile framework, learnings are made through the sprints, and as Organization 3 explained, retrospectives and learnings are gathered throughout the development process instead of documenting lessons learned at the end of a project. Organization 6 explain that the organization is lacking in documenting learnings from projects. The organization has, however, improved their knowledge sharing since implementing agile, and the teams started to work cross-functionally.

Table 13. Documentation

Agile Framework	Org. 1	Org.2	Org. 3	Org. 4	Org. 5	Org. 6	Total
Documentation	2	2	1	2	1	1	9

Main finding connected to documentations

The agile framework should not be misinterpreted as not documenting at all, which often is an issue. Organizations should document what is considered value adding information. There should be clear structures of what should be documented and how it can be communicated for everyone involved. Documenting can be assumed to be even more important when developing products within the manufacturing industry, especially for more complex products. This due to lead times and dependencies to other components.

5.4 How Agile are the Organizations?

The analysis tool shows a comparison between the organizations and the agile framework. It is, however, important to differentiate that the number of agile methods in the organization's development process does not equal their product development success. The gradings seen in Table 14 are rather to investigate where agile can be applied in the manufacturing industry and where it can be difficulties to implement. There are reasons why some methods are not implemented, and to why some might be difficult. It is evident that Organization 2 has most of the agile methods and tools in their development process compared to the other organizations. It is the organization who outspokenly has adapted the agile framework, has worked with the methods the longest period of time and also based the implementation on found issues. Both Organization 4 and Organization 6 work according to SAFe, they differ in size but implemented the framework almost at the same time, about one and a half year ago. The main difference is that Organization 6 had implemented agile methods and tools once before implementing the SAFe framework on an existing organizational structure. They realized that it did not work and thereafter changed their implementation plan and organizational structure when implementing the SAFe framework. Organization 6 is smaller than Organization 4, with fewer employees, which can be a reason for why they have come further than Organization 4. Organization 1 does, according to themselves, not have agile methods and tools in their development process. Throughout this thesis, it was found that their development process and way of working however have many similarities with agile. As Denning (2018) describes, an organization can be agile without using the term. It does, however, needs to be a low hierarchy, short development cycles, small team where customer feedback is valued. Organization 3 and 5 have implemented some of the agile methods, but there are some aspects missing in order to fully working according to the agile framework.

Table 14. Grading of methods and tools within each organization

Agile Framework	Org. 1	Org.2	Org. 3	Org. 4	Org. 5	Org. 6
Total	23	27	20	18	20	25

5.6 Stability

The agile framework is, according to Gustavsson (2016) said to increase flexibility while traditional frameworks are said to enhance stability according to Boehm and Turner (2004). As many organizations today move towards the agile framework, there is an interpretation that flexibility and stability are paradoxical. Therefore, organizations tend to make trade-offs between flexibility and stability. Flexibility is referred to as the ability to make and adapt to changes according to Dönmez et al. (2016), while stability is referred to the intention of eliminating variation. Dönmez et al. (2016) state that organizations do not need to make trade-offs between stability and flexibility, an organization can be both flexible in their process and outcome (Dönmex et al. 2016). The end product can be stable while product development is flexible.

The stability within agile can be referred to the clearly defined work structure with, for example teams, team sizes, sprints, meeting. The SAFe framework is considered to provide stability according to Organization 4 and 6. It is a clearly defined framework with a set structure while still keeping flexibility in changing goals, plans, and direction. The agile value number four, responding to change over following a plan can be referred to the paradox between flexibility and stability. The value does, however, not exclude stability but rather values a flexible process higher. The majority of the studied organizations have addressed that working in sprints and stage-gate simultaneously increases stability in the process and increase the quality of the product. The sprints increase flexibility. Since there is no set plan from start to finish, and the development can change direction within each sprint. The sprint is performed in between gates where the gates are a way to ensure that certain activities have been performed, which are activities that can increase the quality of the product. Compared to software development, the product development of manufacturing product is more regulated by rules, standards, and laws. For example, Organization 3, who develops MedTech products, have high regulations to consider. If these are not followed, there would be consequences such as the product not being allowed to be sold. The hybrid of stage-gate combined with sprints can be assumed as a good way for manufacturing organizations to be flexible while still keeping stability within the development process.

5.7 Implementation

Some of the organizations within this study are in an implementation phase, which means that they are undergoing a change. Throughout the thesis, there has been a discussion regarding if all agile methods within the framework need to be implemented or if the framework should be customized. If relating to lean, an organization should customize the framework to their needs which can be related to the Expert 3 saying "why fix something that is not broken?". If there, for example already are teams working well together, or the organization already has a clearly defined role of a decision maker, then it might not be necessary to change the role or its name.

Organization 2 is an example of how an organization can adapt the agile framework to solve issues in a customized way. The organization mainly had issues within their development teams. Adapting a change to existing problems has resulted in the team understanding why the change was needed and understood why the new methods were implemented. As Rubenowitz (2004) describes, there is a risk of creating conflicts while undergoing a change due to organizational members feeling as though changes are being forced on them. This was the case at first for Organization 2. The upper management required to implement agile with lacking explanations for why, which made the team lack in understanding the benefits of the change. As Expert 1 and 2 states, together with Kotter (1995), it is crucial to have upper management support when performing a change. It does however also need to include an understanding of the change among the organization which Organization 2 later succeeded with. As Expert 2 also stated, in order to implement a new way of working, there has to be a purpose, and the purpose needs to be communicated. As the management of Organization 2 lacked in communicating the purpose of the change problems occurred later and had to re-implement the framework. The second implementation was adapted together with the team. There was a change leader involved, an agile coach which Stanleight (2013) state is important. Expert 1 also states that there needs to be someone with a good understanding of the implementation. There needs to be a leader who has understood the values and principles and not just the tools.

During the first implementation, the team implemented agile tools such as a new visualization board which visualized the tasks. The teams were skeptical towards visualization board. The board visualized the tasks which made the team feeling as its purpose was to control the team. After the re-implementation, the team experienced a new perspective on the visualization board, and now it helps them in their daily work. During the first implementation, the organization used agile tools and processes without the agile mindset. As Measey (2015) states, an organization which is implementing agile first need to implement an agile mindset. Thereafter, the values, principles, and practices prior to implementing the tools and processes. Working agile requires a new way of thinking, and by only implementing tools, the mindset will not automatically come with it. If there is no agile mindset, the agile tools will not be interpreted correctly.

The same was for Organization 6, and the organization changed towards being agile but did not change the organizational structure. They tried to use agile methods and tools while still keeping the functional structure. They quickly realized that it did not work and changed the

structure to cross-functional teams. Both of Organization 2 and 6 have been graded highly in Table 15. Both organizations have been aware of their implementation and been flexible in changing if something did not work. They have customized the framework to its organization and made sure that it suits the organization. The implementations have also not happened overnight and are constantly improved through retrospectives. The success might be linked to the organization's way of implementing the framework, through basing it on current problems and changing it if something does not work. It might also be due to that the organizations have implemented the framework continuously over time and not through a dramatic change. As Expert 1 claims, a radical change is only necessary if there is a crisis.

When implementing a new way of working Expert 2 states that there should be reminders everywhere. It is common that a new way of working is introduced and thereafter forgotten with instructions being placed in a folder. To ensure that a new way of working is settled it needs to be part of the culture, which also is the last step of implementation, according to Kotter (1995). It takes many years, but the organization needs to make sure that employees constantly are reminded.

Two out of the six organizations have implemented agile through the SAFe framework, while one of them have gathered inspiration from the framework. The framework combines both agile and lean and is available in four different variants depending on the size of the organization (Scaled Agile Framework, n.d.). Organization 4 has implemented full SAFe and is the one developing the most complex products out of the six organizations. Organization 6 has implemented a less complex version of SAFe than Organization 6, while Organization 5 mentions SAFe as a source of inspiration. SAFe provides a clear framework on how to work, but it has to be somewhat customized to the organization's needs and circumstances (Scaled Agile Framework, n.d.). Since the agile framework might be difficult to interpret with its values and principles, it can be assumed that the SAFe framework provides an already defined way of implementing. As Organization 4 describes, the SAFe framework was chosen based on that is it a complete package with educations. It makes the implementation quicker and communication easier hence, the framework has set roles and descriptions of them. The framework creates a shared language where roles, responsibilities, how to communicate, and so on are pre-determined.

Despite SAFe having set roles and responsibility areas, Expert 2 describes that if the organization does not have clearly defined roles prior to the implementation, it is difficult to relate to new roles. The framework will be difficult to implement if there is a lack of organizational structure and shared language since no one can relate new roles to already existing roles. Implementing a framework such as SAFe might be preferable since it creates a base which everyone can follow. The SAFe framework creates clarity and is a comprehensive framework (Scaled Agile Framework, n.d.). To implement a framework with the stated characteristics might be crucial for a large organization that develops complex products. If a large organization as Organization 4 only implemented agile tools and methods linked to their problems, it could be difficult to create a common understanding.

When implementing a new way of working, it might be of interest to analyze whether the change has improved the way of working or not. An analysis of the current state should preferably, therefore, be performed, which also can ensure that perceived problems actually exist (Holmdahl, 2016). If a current state analysis is not performed, it might be difficult to know problem areas and if agile methods are applicable to start with. If there is no current state to start with, it will be impossible to know whether the changes have improved the way of working or not. Organization 5 has implemented agile methods and tools within one of their development divisions six years ago. The respondent did, however, say that there were no evident signs of improvement, it was too short of a time in order to see such signs. If a current state analysis was made, it could be assumed that improvements could be found throughout the six years.

5.7.1 Software Development vs. Product Development

The agile framework is according to the theory developed for software development. Hence, all methods within the agile framework are suitable for software development. Based on the empirical data and the theory, all methods could also be suitable, bring value and be adaptable for product development within the manufacturing industry. Since all methods are suitable for both software- and product development, a "yes" is provided for all methods in Table 15. However, some methods might need more attention than others when developing products. Some methods might also need to be implemented differently with different considerations compare to software development, majorly due to lead times. The analysis in Table 15 is based on the main findings from the analysis section.

Table 15. Main findings

Agile Framework	Software	Product	Analysis
Flexible and dynamic development process	Yes	Yes	Develop product which satisfies the customer needs while finalizing the product in time and with the desired quality. Develop with greater flexibility at the start of the project and set a plan closer to launch. The flexible and dynamic development process can depend on how complex the product is and how long lead times the product has.
Short planning periods with frequent deliveries	Yes	Yes	Combining stage-gate with sprints can be a good way to increase quality and stability while still having possibilities to change direction within each sprint. Sprints can assist the stage-gate process to be more flexible and to create motivation. The stage-gate not should hinder flexibility within the sprints and only work as a support if the organization strive to be agile.

Time limitation	Yes	Yes	All of the organizations have time limitations for when the product development needs to be finalized. This is due to lead times, which cannot be neglected within the manufacturing industry. The more complex a product or organization can be the measure of how well agile can fit an organization rather than if there is the development of software or manufacturing products.
Not develop more than necessary	Yes	Yes	Using a backlog can benefit the product development process to prioritize the work. There has to be a decision maker which can ensure that the prioritization is related to customer requirements. Prioritization does not equal shorter projects but rather benefits in understanding what to develop.
Customer focus	Yes	Yes	In order to create flexibility, there must be a collaboration with the customer throughout the development process. Close collaboration increases the possibilities of the developed product to be made according to customer needs. Developing product to be manufactured differs from software development since there is a limitation in how far in the process new inputs can be considered.
Teamwork	Yes	Yes	Cross-functional teams can increase the understanding of the product, process, and other functions' work. Furthermore, enhance the quality of the products. Focusing on teamwork with cross-functional teams is equally important regardless if developing software or products for the manufacturing industry.
Cross competence	Yes	Yes	Cross competence can be assumed to not be as relevant in product development within the manufacturing industry as when developing software products. It might be viewed as an implementation which is relevant if there already are agile methods in the organization.
Self-organizing team	Yes	Yes	Self-organized teams can strengthen the teamwork, increase the motivation, and benefit important tasks to be finalized in time. Self-organizing teams require other agile methods to be implemented first.
Roles	Yes	Yes	The role of a decision maker, such as the product owner role, is of great importance. There needs to be clarity in who makes decisions and that the decisions are based on customer requirements. All roles need to be clearly defined with its responsibility areas, and there also needs to be a common understanding within the organization regarding which decision or authorities that are included in a role.
Open and spontaneous communication	Yes	Yes	Face-to-face communication enhances the flexibility, decisions can more rapidly be taken, and the process can more rapidly move forward. Communication is important regardless if an organization develop software or products for the manufacturing industry. Communication can be increased by using the agile framework, but it also requires the individual to understand the purpose of communicating.

Understanding of the development process among suppliers	Yes	Yes	A close relationship with suppliers can create flexibility since it can enhance the possibility to change demands during the development process. A closer relationship with suppliers can reduce lead times and can be assumed to be more important when developing products within the manufacturing industry than software.
Documentation	Yes	Yes	The agile framework should not be misinterpreted as not documenting at all, which often is an issue. Organizations should document what is considered value adding information. Documenting can be assumed to be even more important when developing products within the manufacturing industry, especially for more complex products. This due to lead times and dependencies to other components.

6. Conclusion

In this section, the three research questions will be answered based on the theoretical framework, empirical findings, and analysis.

RQ1. How can the agile framework, with its methods and tools, create value for product development within the manufacturing industry?

All methods and tools included in the agile framework presented in the theory can, based on the empirical findings, suit and create value for product development within the manufacturing industry. However, the agile mindset needs to be implemented before the methods and tools in order to succeed, as the mindset is the foundation of agile. Hence, the mindset with the agile principles and values needs to be understood to adjust and customize the agile framework to the organization. Organizations can benefit from customizing the framework to its need's, ambitions and challenges. When customizing the framework to the organization, the new way of working receives a purpose.

All methods and tools within the agile framework create value for organizations within the manufacturing industry, but some methods and tools might be more value adding than others, depending on the organization's ambitions and challenges. Furthermore, some methods and tools can be harder to implement fully depending on the organization's size and complexity of product or organization. The more complex a product or organization is can be the measure of how well agile can fit an organization rather than if there is the development of software or manufacturing products.

Lead times is the main difference between the development of software and products which cannot be neglected. Since lead times can hinder the ability to make changes late in the process, some agile methods and tools need to be adjusted, depending on organization. Sprints are one of the methods which need to be considered. Within product development, there need to be set dates for when the development needs to be finalized due to, for example, tools to be ordered, or planned production. Since no changes should be made after the set date, it might be more suitable to enhance flexibility in the start of a project and work according to a set plan closer to launch. Adjustments can be made where the sprints are combined with a traditional stage-gate model in order to handle lead times. When developing products, it is also important that the product has a certain quality Using gates, where important activities can be confirmed as finalized, can increase quality while still being flexible and work in sprints between each gate.

The agile framework can create strong teams, enhance communication, motivation and enable a more customer-focused development process. This since the development process is built on iterative cycles. The iterative cycles not only enhance communication and customer focus but also creates motivation within the development teams. Continuously delivering results is one of the reasons for increased motivation within the team members. It can also ensure the development to head in the desired direction since the result is reviewed during each delivery.

The reviewing of results should be based on if customer requirements are being met where new requirements or changes can be made at each review. The motivation and ownership within teams also increases since the teams have more responsibilities and can make their own decisions. Agile product development furthermore creates transparency in organizations since there is more involvements and understanding of each other's work and the development process. Moreover, agile product development focuses on having a decision maker, the product owner. The role makes decisions regarding the product being developed and should base decisions on customer requirements and fact, without any bias. This is one of the most essential roles within agile product development that organizations within the manufacturing industry can benefit from including.

RQ2. How can the agile framework be connected to success factors in product development within the manufacturing industry?

While conducting this thesis, an understanding of agile and its foundation has been gained. Through this, the agile framework has been revealed to be less complex than first interpreted and is not perceived as revolutionary. The values and principles can be found in organizations regardless of them outspokenly working according to the agile framework or not.

Previous challenges within some of the studied organizations have turned into their main success factors. The challenges were related to the market or organizational challenges. As the organizations realized their challenges, time was spent on improvement, which resulted in those areas turning out to be success factors in their product development process.

This was evident for the three organizations with the highest scores in total. Organization 1 had previous challenges related to communication. Now a rapidly, face-to-face communication is one of their success factors. Communication enables them to be flexible and to move forward in their development process rapidly. Organization 2 had challenges regarding how to even the workload and how to include everyone within the team. Now, the organization has a strong team with an evener workload and cross competence. Organization 6 had challenges related to implementing the agile framework. They tried to implement it without changing the teams into cross-functional teams. Today, they have cross-functional teams, which is one of their main success factors. These three organizations have solved their challenges with agile methods and tools. Organization 1 have never worked according to the agile framework. Despite this, there is a lot of agility found in their development process. Hence, agile methods and tools can be related to success factors and found in organizations who never heard about the agile framework.

Working according to the agile framework does not have to imply using all or none of the agile methods and tools. The framework can be implemented to solve the organization's challenges and benefit for the organization to reach its ambitions.

RQ3. How can agile product development projects gain value from having stable processes and routines?

The agile framework is commonly interpreted as lacking stability. Agile product development does not have to imply a trade-off between stability and flexibility. Having stable processes within an organization can increase the possibility of changing directions, goals, and plans. The framework itself should be clarified and be based on organizations' challenges and ambitions. Therefore, the framework itself can create stability while the methods and tools can increase flexibility. It can for example, enable the development process to change direction. How to handle changes is set trough working in iterative sprints while the work performed within the sprint is not set. The methods and tools can thereby be considered as stable while the work performed can be considered as flexible.

By understanding the foundation of agile, there is less of a risk to interpret the values and principles incorrectly. If there is a lack of understanding, an organization might implement the framework in an extreme way where the stability is removed. The agile framework includes stability, but it should not hinder flexibility.

7. Recommendations

Our recommendation is for organizations developing products within the manufacturing industry to implement the agile framework. However, methods and tools are recommended to be adjusted to each organization. When implementing the agile framework within an organization, the allocation of time and resources is crucial. If the recommendations are considered, then the agile framework is more likely to be successfully adapted and fit the organization. The steps on how to implement the agile framework is presented in Figure 10.

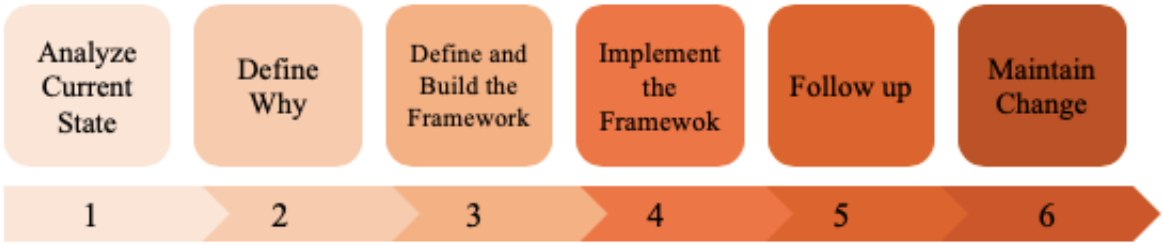

Figure 10. Steps on how to implement the agile framework (Created by the authors, 2019).

1. Analyze Current State

An organization needs to have an understanding of the market, organizational demands, and prerequisites. These findings can be gathered through a current state analysis where an organization's challenges will be revealed and confirmed.

2. Define Why

The change needs to have a purpose associated with an organization's ambitions and challenges. Having a purpose of why a change is necessary and why the specific framework is chosen is essential to understand before continuing to the next step.

3. Define and Build the Framework

The agile framework is built on principles and values. In order to implement the framework successfully, the whole framework with is values and principle needs to be understood. When the background of the framework is understood, decisions regarding which methods and tools that suits the organization best should be made.

It is important that the decisions regarding methods and tools are based on the purpose of the implementation, which relates to the organization's ambitions and challenges. Moreover, it is important that the created framework with the organization’s decided methods and tools are not to complex nor too time consuming. Creating a framework with complex methods and tools will be time consuming to create, difficult to understand and demanding to implement.

There are mainly five critical aspects which need to be considered when building and defining the framework:

Roles
The framework should include set roles with clear role descriptions and authorities.

Decision makers that base decisions on customer requirements without bias
The role and authorities of decision makers need to be set. Decisions being made within product development need to be based on facts that are valuable and benefits the projects desired direction. The decision maker needs to have the authority to shut down projects and base the decision on facts.

Customer focus
Customer focus should be built in the framework, there needs to be a clear description of who the customers are and how the organization can satisfy their customers. The framework should be based on a strategy for how to have close customer collaboration and how to fulfill the requirements.

Set limitations
Everyone within a development project needs to work according to the same budget, time plan, limitations, and goals. The organization needs to have an understanding of the market and adjust limitations according to the market and competitors.

Set way of working
Everyone needs to work according to the decided framework and the decided best way of working, for example there needs to be a set way of communicating.

4. Implement the Framework
Our recommendation is to have a described plan and strategy for how the organization should maintain the implemented framework. A plan and strategy for the maintenance of the framework need to be set before the implementation. Otherwise, there is a risk of not prioritizing it. Implementation of a new framework is commonly more time consuming than planned, which needs to be taken into consideration. A recommendation is for organizations to focus and prioritize how the implementation should be performed and create a strategy for how to maintain the framework. Time should be spent on understanding the agile principles and values in order to create a simplified framework which is easy to grasp.

5. Follow up
When the new framework has been implemented, there needs to be follow-ups in order to understand the results which the new framework has provided. As a current state analysis has been performed, the organization can compare the new way of working with the previous current state. The previous steps should be evaluated and there should be an evaluation regarding if the purpose has been fulfilled, and if it reflects the built and defined framework. Moreover, there needs to be an evaluation regarding if the framework has been implemented successfully and if is there a plan for how to maintain the change. If the change does not provide successful results, it is important for the organization to understand what went wrong in order

to fail fast. Failing fast enables the organization to not continue working using methods and tools in an unsuccessful way.

6. Maintain Change

Our recommendations are to have a strategy for how to maintain the change. There need to be constant reminders regarding how to work according to the framework. There should also be change leaders or coaches available who can guide the organization in how to use the new framework.

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Appendix 1.

Template for the interviews with the organizations

Introduction

1. Who are you and what is your professional role?
2. Can you describe the organization, what do you do and how many employees are there?
3. What kind of products do you develop?

Development process

1. Describe your development process?
2. Do you work according to a specific framework?
3. How do you plan the development?
4. Do you have set goals? Can they be changed?
5. Can requirements on the product change during the development process?

Organizational structure

1. How is the product development structured?
2. Are there any defined roles? Can they be flexible?
3. Do you have a product owner?
4. How do you work within the development, are you in teams?
5. Who has authorities to make decisions and is it clearly defined?

Communication

1. How do you communicate internally?
2. How do you communicate externally?
3. Do your ways of communicating facilitate your product development?

Routines

1. Do you have shared routines or standards within the product development?
2. If yes, are they well known?
3. If yes, do they facilitate the product development?
4. If yes, does it hinder or encourage you to be creative or flexible?
5. How and what do you document during the product development?

Agile

1. What's your take on agile product development?
2. What do you interpret as the best with the framework?
3. Have you encountered any difficulties or failures?
4. What's your take on an agile implementation?

Other

1. What are your main success factors in the product development?
2. What are your main hinders and challenges?

Appendix 2.

Template for the expert interviews

Introduction

1. What is your current work position?
2. How long have you been in the business?
3. What is your work experience and in what industries have you worked?

Main questions

1. What are your main learnings from working with different companies' product development processes? Are there any differences and similarities?
2. Who do you think are the main success factors in product development? Those who have succeeded, what do you think they have done?
3. What are the biggest obstacles and difficulties in a product development process? Are there any classic pitfalls?
4. How do you view agile product development?
5. Have you worked with both software and hardware development? What are the main differences and similarities in the product development?
6. Do you think an organization have to implement all agile philosophies for them to improve?
7. How strong purpose must there be in order to make a change in an organization? How important is the implementation?