The agile way of working within the manufacturing industry

An exploratory study investigating how to lead the adoption of the “Agile way of working” within the manufacturing industry
Master Thesis in General Management

Title: The agile way of working within the manufacturing industry
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Authors: Brinks H.H. and Johnson P.C.
Tutor: Minola T.
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Key terms: Agile way of working, Servant leadership, Empowerment, Adhocracy, Lean, Change management and Agile manufacturing.

Abstract

Background: Based upon two important phenomena within the manufacturing industry an upcoming agile era is being proposed within this thesis, those phenomena have shown a shift in the focus of attention for companies within the manufacturing industry in the past. The first phenomenon is being referred to as “physical product development saturation” and the second phenomenon is “lean saturation”, which are introduced in order to give importance to the aspiration for a new emphasis to remain competitiveness and create more value within the manufacturing industry. Where in the past the focus was on physical product development, this in order to enhance and or invent new products. This was followed by the need for a more efficient way of working by eliminating wastes (Lean), although both phenomena are about to reach their limits with respect to the extra value they (can) create. The forthcoming agile era allows for a new way of value creation, this by adaptivity. This introduces the potential of a new way to create value, this being done by the agile way of working.

Purpose: The research in this thesis aimed to find an answer to the question of how companies within the manufacturing industry could adopt an agile way of working in order to allow for a new way of value creation.

Method: This research was approached by conducting a qualitative study. Eleven semi-structured interviews were conducted, with companies from the manufacturing, IT and consultancy industries. The collected data was then sorted and analysed systematically to generate knowledge and draw upon conclusions to answer the proposed research questions.

Conclusion: In order to successfully adopt the agile way of working, within an organization in the manufacturing industry, the challenge is to create awareness and an understanding of the value and benefits an agile way of working could create, especially for the middle-management. This could be done by explaining an agile way of working as an extension to Lean. Furthermore, the tools & processes of the agile way of working could be experimented with in order to start “doing agile”, this finally resulting in creating an understanding of the potential power of an agile way of working. Whereas, an agile way of working is being characterized by an encouraging, transparent culture led by a servant leadership style by making use of empowerment to stimulate value creation. Ultimately, resulting in adopting an agile way of working and achieving “becoming agile”.

i
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Hanne Brinks & Prince Johnson
# Table of Contents

1. **Introduction** ................................................................................................. 1
   1.1 Background .................................................................................................................. 1
   1.2 Research problem & purpose ......................................................................................... 4
   1.3 Limitations ...................................................................................................................... 5
   1.4 Thesis walkthrough ....................................................................................................... 6

2. **Theoretical framework** ............................................................................ 7
   2.1 History introducing the agile era (for the manufacturing industry) .................... 7
   2.2 Organization cultures and Leadership styles ............................................................. 10
   2.2.1 Organizational cultures .......................................................................................... 11
   2.2.2 Leadership Styles ..................................................................................................... 12
   2.3 Relative mapping of various manufacturing industries .............................................. 14
   2.4 The Agile way of working ............................................................................................ 16
   2.4.1 Agile Management .................................................................................................... 17
   2.4.2 Agile Leadership ......................................................................................................... 20
   2.4.3 Scrum .......................................................................................................................... 21
   2.5 Lean Manufacturing ....................................................................................................... 23
   2.5.1 Continuous improvements ......................................................................................... 24
   2.5.2 Eliminating waste ....................................................................................................... 25
   2.5.3 Lean tools, instruments and methods ......................................................................... 26
   2.6 Handling change resistance ......................................................................................... 29

3. **Methodology** .............................................................................................. 31
   3.1 Research Philosophy ................................................................................................. 31
   3.1.1 Ontology .................................................................................................................... 31
   3.1.2 Epistemology ............................................................................................................. 32
   3.2 Research Approach ..................................................................................................... 33
   3.3 Research Method ......................................................................................................... 34
   3.4 Research Strategy ......................................................................................................... 34
   3.5 Research Design ......................................................................................................... 36
   3.6 Data collection procedure ............................................................................................ 37
   3.6.1 Secondary data ......................................................................................................... 37
   3.6.2 Primary data ............................................................................................................... 38
   3.7 Data analysis ................................................................................................................ 41
   3.8 Research Quality .......................................................................................................... 42
   3.9 Ethics .............................................................................................................................. 44

4. **Empirical Findings** ................................................................................... 45
   4.1 Overview interviewed associates .............................................................................. 45
   4.2 Interview results .......................................................................................................... 51

5. **Analysis** ....................................................................................................... 62
   5.1 Indication of recognition of agile importance by the manufacturing industry ........... 62
   5.2 Interpretation of the agile manifesto examination results ............................................. 65
   5.2.1 Evaluating Agile core values (Q3): ....................................................................... 65
   5.2.2 Evaluating Agile principles (Q4): .......................................................................... 69
   5.3 Perceived advantages and disadvantages with regards to an agile way of working ...(69)
<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.4</td>
<td>Lessons learned: barriers and challenges for adopting an agile way of working</td>
<td>73</td>
</tr>
<tr>
<td>5.5</td>
<td>Lean and Agile as siblings</td>
<td>75</td>
</tr>
<tr>
<td>6.</td>
<td>Conclusion</td>
<td>77</td>
</tr>
<tr>
<td>7.</td>
<td>Discussion</td>
<td>79</td>
</tr>
<tr>
<td>7.1</td>
<td>Limitations</td>
<td>79</td>
</tr>
<tr>
<td>7.2</td>
<td>Future research</td>
<td>80</td>
</tr>
<tr>
<td>8.</td>
<td>Reference List</td>
<td>81</td>
</tr>
<tr>
<td>Appendices</td>
<td></td>
<td>85</td>
</tr>
</tbody>
</table>
**Abbreviations and acronyms**

LM    Lean Management
LP    Lean Principles
LT    Lean Thinking
PPD  Physical Product Development
TPS  Toyota Production System
OEM  Original Equipment Manufacturer
IoT  Internet of Things
JIT  Just In Time
IT   Information Technology
SCP  Supply Chain Pyramid
CTQ  Critical to Quality
DMAIC Define, Measure, Analyse, Improve & Control
VSM  Value Stream Mapping
DFAA  Design For Automatic Assembly
1. Introduction

This chapter introduces the topic of the research in this thesis. First by describing the background based on some historical observations, narrowing down to the relevance of the subject of matter. Then it describes the research problem and purpose formulated into one main research question and the three sub-research questions. Followed by a description of the limitations attached to this research. Finally, a “thesis walkthrough” is presented which can be used as guide by the reader to understand the structure of this thesis.

1.1 Background

A trend regarding the manufacturing industry which has been prevalent over the last decades is the implementation of Lean Manufacturing (LM). Industries have moved from the industrial age, towards the information/knowledge era (Uhl-Bien et al., 2007) and are now moving towards an agile era, as depicted in Figure 1-1. In the information era the importance of Lean was recognized. The industrial age had put emphasis on productivity and efficiency, whereas the majority of products and improvements, to serve humans, were invented and developed by gaining a better understanding and applying knowledge of mechanical, electrical and chemical engineering (Schwab K., 2016). On a higher level this required rules, procedures and a hierarchy to align all those developments (bureaucracy), this has traditionally been done with a transactional leadership style culture connected to it (Uhl-Bien et al., 2007).

<table>
<thead>
<tr>
<th>Industrial Age</th>
<th>Information Era</th>
<th>Agile Era</th>
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</thead>
</table>

Figure 1-1: Visual time-line representation from Industrial age to Agile era.
Source: Own figure based on Schwab (2016) and Uhl-Bien et al. (2007).

During the time of this transition computers had been invented and greatly implemented as resources to manage information streams (Dalkir K., 2013). It might have been as a cause or as a result of this transition, whereby computer devices have had a catalyst effect on this transition. The data gathered had been greatly archived and documented but was
now also stored widely on a global scale, which introduced the information/knowledge era. Here the emphasis has tended more towards rational analysis and expertise by the usage of this data. In addition, a major impact had been the invention of the digital networks and the internet, which allowed humans to communicate, interact and share information on a global scale with the usage of a device that has access to the internet.

As a consequence of the capability of storing and sharing data, the limitations to the majority of inventions in the field of mechanical and electrical engineering have gained a major boost (Schwab K., 2016). Furthermore, as a result from that, engineering and design processes are getting automated by computers with the usage of algorithms. Ultimately, the only thing required for this is an input, calculating capacity and time.

Where there was a lack of information and data in the industrial age, the consequence was now an overflow of data and knowledge. Where in the past, gaining knowledge tended to create a better understanding now a paradox was acquired, where more knowledge does not necessarily always lead to a better understanding. The availability of knowledge became to some extent (close to) unlimited, more acquired knowledge could be a cause for less understanding, this by the overwhelming amount, exceptions found on previous knowledge and contradictions to previous knowledge (Birkinshaw & Ridderstråle, 2017). Achtenhagen et al. (2003) found that organizations, especially in the manufacturing industry, had initiated to give more importance to adaptability, knowledge and learning. This is in contrast to leading with the emphasis towards higher efficiency and control, which were more prevalent elements in the industrial age (Achtenhagen et al., 2003).

When comparing a variety of technical products (examples: lawn mower, phone, television, lathe, radio, toaster, computer, etc.) it can be noted that the current product improvements can be made by digitalization. Most varieties and limits of mechanical/physical enhancement by product development have already been reached. This phenomenon we refer to as “saturation point of physical product development (PPD)”, see also Figure 1-2. PPD saturation does not mean that products did not change in shape and physics anymore, but that the main added value by improvements were not achieved anymore via physical/mechanical enhancement in such a significant way as in the past. This did not apply only to product improvements, but also for newly invented
products. The next step of added value was mostly digital based, which has to do with (new) software implementations, software development or implementation of internet of things (IoT), inter connectivity, augmented reality and virtual reality applications for such devices. In Figure 1-2 the timelines of the development of the lawn mower and a phone are shown as examples (the pictures used are solely for representational purposes). Two completely different products, however what can be noticed, when looking at their development over the past, they take part as evidence for the proposed assumptions.

![Figure 1-2: Visual representation of the eras (note: timeline is not on scale).](image-url)

*Source: Own figure*

For manufacturing lines this development also applies, however the enhancement of production lines lags slightly behind on the development of products. Therefore, physical improvements are mostly still about to be made and to be achieved. To connect this with Lean manufacturing importance: the production lines whereupon those principles are aimed to be applied upon, are mostly established production lines originally established in the industrial age. The analysis of making improvements from the information era have mostly been done and nowadays the next step of improvements calls for agility. Such a production line is a complex cohesion of multiple machines and interfaces aligned together, which form the process of production. Changing one parameter, might disturb the other, however when both parameters would be changed and re-aligned the process might significantly improve.
Circumstances change and consequently the input might change (Kim & Wilemon, 2002). For this agility is required in order to be prepared to adapt, this in contrast to the usage of a waterfall, Ghant and/or stage-gate approach (Birkenshaw & Ridderstråle, 2017 p.77), experience and knowledge had become more important in order to provide this agility. The goals are less tangible and quantitative, but more driven based on a vision. Even when goals are set, they are due to be a matter of change over time. This introduces the agile era, where the emphasis is on agility, intuition and decisiveness. This different type of emphasis requires for an unique approach of leadership.

Original equipment manufacturing (OEM) companies, which are on top of the supply chain, have already initiated to adopt agile principles, observed from multiple outstanding vacancies. Mostly their development for the new model is already steps ahead of government policies, which can be regulations regarding safety, environment or others. An example could be regulations regarding emission: when the political decisions for regulations are there at the end, the design is likely to be topic of change. This will be influencing the entire supply-chain from top to bottom. What can be noted is that the lower level you get in the supply-chain pyramid, the lower you get the more traditional the manufacturer tends to be, containing more hierarchy, procedures and less agility, while being characterized by a more bureaucratic organizational culture with a transactional leadership style. However, the clients of those supplier (the company on the top level of the supply-chain: OEMs) require those “traditional” suppliers to change towards becoming more agile and for example delivering more according to Just-in-Time (JIT). This puts pressure on those suppliers to also change towards a more agile way of working.

1.2 Research problem & purpose

The research in this thesis aimed to find an answer to the question of how companies within the manufacturing industry could become more agile, this in order to be more prepared for the proposed agile era. The purpose of the research is to firstly identify if importance of the agile way of working is being recognized by companies within the manufacturing industry. Secondly, to identify the advantages and disadvantages of working in a more agile way within this industry. Thirdly, to recognize barriers and
challenges for the adoption of an agile way of working within manufacturing organizations had attempted to be addressed.

This was done by centralizing our research around the main research question (main RQ):

“How to lead the change towards a more agile way of working in the manufacturing industry?”

Sub-research questions which could be answered to find the solution for the main research questions are (RQ1, RQ2 and RQ3 respectively):

- “Has leadership been changed/adapted by the need for a more agile way of working (and how)?”
- “What are the advantages and disadvantages for a more agile way of working?”
- “What are the barriers and challenges involved for (adapting to) an agile way of working?”

1.3 Limitations

To find answers to these questions a qualitative study had been done. This study was limited to a targeted group doing qualitative interviews. It had been decided to take original equipment manufacturers (OEMs) in a variety of manufacturing industries as main focus of the qualitative data gathering, but also consider IT and consultancy companies had been taken as relevant sources to gather input and lessons learned about how to work in an agile way. The outcomes of this research will therefore be limited by the literature found about the agile way of working and the qualitative data gathered via the interviews. However, the outcome of the suggestions found by this research might be useful and applicable by others, the aim is to tailor the advice for global operating manufacturing companies, which are on top of the supply chain, also referred to as OEMs.
Thesis walkthrough

The thesis walkthrough provides an overview of the chapters in this thesis report, their content and how the chapters relate to each other, this overview is shown in Figure 1-3.

1.] Introduction
1.1 Background
1.2 Research problem & purpose

Main RQ: How to lead the change towards a more agile way of working in the manufacturing industry?
RQ1: Has leadership been changed by the need for a more agile way of working?
RQ2: What are the advantages and disadvantages for a more agile way of working?
RQ3: What are the barriers and challenges involved in making an agile way of working?
1.3 Limitations

2.] Theoretical framework
2.1 History introducing the agile era
2.2 Organization cultures and Leadership styles
2.2.1 Organizational cultures
2.2.2 Leadership styles
2.2.2.1 Transactional leadership
2.2.2.2 Transformational leadership
2.2.2.3 Servant leadership
2.3 Relative mapping of various manufacturing industries
2.4 The Agile Way of working
2.4.1 Agile Management
2.4.2 Agile Leadership
2.4.3 SCRUM
2.5 Lean Manufacturing
2.6 Handling change resistance

3.] Methodology
3.1 Research Philosophy
3.2 Research Approach
3.3 Research Method
3.4 Research Strategy
3.5 Research Design
3.6 Data collection procedure
3.6.1 Secondary data
3.6.2 Primary data
3.7 Data analysis
3.8 Research Quality
Credibility
transformability
Dependability
Confiability
Reliability
3.9 Ethics

4.] Empirical findings
4.1 Overview interviewed associates
4.2 Interview results

5.] Analysis
5.1 Indication of recognition of agile importance by the manufacturing industry
5.2 Interpretation of the agile manifesto examination results
5.2.1 Agile core values
5.2.2 Agile principles
5.3 Perceived advantages and disadvantages with regards to an agile way of working.
5.4 Lessons learned: barriers and challenges for adopting an agile way of working.
5.5 Lean and Agile as siblings

6.] Conclusion
RQ1: No direct recognition of the importance of agile way of working perceived by the manufacturing industry yet.
RQ2: Power of agile: enclosed by an agile mindset and culture including transparency, servant leadership, empowerment and being oriented around value creation.
RQ3: biggest barriers and challenges: changing the perceptions and attitude among middle-managers and attached to the required change: the perception of loss of control.

Main RQ: Overcome change resistance, this by focusing on creating an understanding and awareness about the value and benefits of an agile way of working. This by presenting agile as an extension to Lean practices and principles.

7.] Discussion
7.1 Limitations
7.2 Future research
2. Theoretical framework

The purpose of this chapter is to provide the theoretical background to the topic of this thesis. This is done by firstly introducing the agile era and relating this to historical events. Secondly, theory about organizational cultures and leadership styles in order to prepare for proposing an organizational adaptation. Thereafter a relative mapping of various sub-industries in the manufacturing industry is explained. Followed by theoretical background about what we call the agile way of working. Then lean manufacturing to get a better understanding of the way of thinking in the manufacturing industry is explained. Finally, change resistance theory is presented in order to prepare for the proposal on adopting an agile way of working.

2.1 History introducing the agile era (for the manufacturing industry)

In the background, the industrial age, information era and the agile era and their cause and origin had briefly been touched upon. The purpose of this thesis is to bring out an advice on how to lead and manage the implementation of a more agile way of working in the manufacturing industry (in the new/upcoming era) to be prepared for the future. This since we are, at the start of a revolution, which is changing the way we live, work and relate to each other (Schwab K., 2016). This can be called the fourth industrial revolution in the manufacturing industry, whereby many is referred to as “industry 4.0” (Schwab, 2016 & Brettel et al., 2014 & Lee et al., 2014). In order to understand the importance of agile and how this importance was raised, it is good to have a look at the history and observations which could be made from the past. Two phenomena are interesting to look at in the developments within the manufacturing industry, furthermore it is interesting to evaluate the cultural and managerial consequences attached. The first phenomenon is what we call the development of physical product development (PPD), the need for (physical) product development and creation of new mechanical and/or electrical based inventions. The second phenomenon is the rise of Lean to increase efficiency and usage of Lean Principles by the analysis and convergence of gathered data (Womack et al., 2007).
Figure 2-1 visualizes that the PPD will come to a saturation point of development at some point in time. The profession of product development was prevalent at the start of the industrial era, but became over time less important to increase value of a product. Whereas this saturation point does not indicate that products were not (physically) developed anymore, from this point in time, but the emphasis of priority to improve started to shift. The industrial era itself can be divided into four revolutions (Schwab, 2016) and started in 1760s, whereas the transition was made from the agrarian revolution to the industrial revolution, replacing muscle power by mechanical power (Paige, 1978 and Toffler, 1980). The second industrial revolution was followed up in 1860s and made mass production possible, this introduced manufacturing in an industrial context, the manufacturing industry (Schwab, 2016). The third revolution, which we refer to as the information or knowledge era, was introduced by the rise of computer, which started in 1960s. Schwab (2016) also suggests that he believes that we are today in the beginning of the fourth industrial revolution, which builds on the digital revolution. We refer to this as the agile era, where in the manufacturing industry importance is given to atomization by machine learning, internet of things, machine to machine interactions, interconnectivity and augmented reality implementations of devices.

![Figure 2-1: visual representation of history of PPD saturation with respect to industrial, information and agile era.](source)

In Figure 2-2 the history of manufacturing companies had been sketched. The industrial era was a result of the first industries and manufacturing lines. However, the PPD saturation point of customer products has already been reached, this does not apply to the development of the production lines of those products. Machines can also be interpreted as “a product” and a set of machines (products) forms a production/manufacturing line, but since machines are always used to produce a certain product and the product development tends to lag behind on the products they make. Hence, the development of production lines lacks slightly behind on PPD, this also since changes in machines
manufacturing lines and processes often come with relative major investments for the manufacturing firms. Manufacturing lines were still to be improved by physical enhancement and the use of LP. Whereas lean does not put emphasize on the enhancement of the machines themselves, but on the (production) processes (Chiarini, 2013). Such a saturation point as suggested about PPD can also be expected to be achieved for Lean by the usage of LP. The saturation will be achieved when relatively a large amount of effort must be done to achieve only small enhancements, whereas when Lean was introduced simple and small changes could make great impact when LP were successfully adopted. Concluding, the longer Lean is applied and understood and Lean Thinking (LT) is adopted the less significant the impact to improvements are to be done by usage of LP, ultimately resulting in reaching a saturation point of improvements to be made by Lean. Depending on the manufacturer’s industry size, industry regulations, individual size of the production, profitability, uniqueness (niche or not), competitiveness and other factors affecting the manufacturing company, they are also developing towards a certain saturation point of production line improvement by the means of changes done by lean implementations and evaluations. Whereas a more traditional manufacturing company will be more likely to work in a more traditional way, with less emphasis (and need) to focus on the adoption of LP. The ambition and/or competitiveness in the (niche) market of such company will determine the need for more efficiency and cost reduction in manufacturing.

![Figure 2-2: Visual representation of history of manufacturing lines and lean saturation point with respect to industrial age, information era and agile era. Source: Own figure based on Schwab (2016) and Uhl-Bien et al (2007).](image)

As mentioned before the IT-industry can be referred to as the ‘pioneer in agile way of working’ (i.e. adhocracy). That the PPD saturation point has been reached, does not mean that products do not improve anymore at all. Products can be enhanced by upgrades to software, new usages of software integration, new applications of the internet (Eg. implementation of internet of things, machine learning and machine interactions and
cloud computing) in a novel way to create new functions and values. Rather than developing something completely physically new, it is about combining software with existing products to create some new property or feature for this device or tool. A lot can be achieved by software: compare the functionality of your first smartphone with the one you have today, the shape/screen is hardly the same right? IT did not exist at the start of the industrial era, but is nowadays greatly helping to develop products and machines invented and developed during that era. However, we did not aim to find an answer on how to work in an agile way in the IT-industry, (parts of) the outcomes could also be useful for this field. Also, by the greater implementation and accustomization of agile principles in this fields, samples and experienced from those companies would be useful to take into consideration (to gather “lessons learned”).

2.2 Organization cultures and Leadership styles

In order to find a way to lead change in an organization, in this research to lead towards a more agile way of working, it is necessary to create an understanding of organizational cultures. Organizational culture theory will create a better understanding about what organizations do, how they work and why they do so. Describing the “why, how and what” evaluation is a good measure to become conscious about the actions which are taken, as described by Sinek (2009) summarizing this in the Golden Circle (Figure 2-3). Balancing the three elements of the Golden Circle is essential to establish and maintain trust (Sinek, 2009). Thereby, leadership style theories have been studied in order to identify if particular leadership style traits could be used to leverage the adoption of an agile way of working. Theory of both subjects can be used to support the interpretations, of the empirical material, in the analysis paragraph.

Figure 2-3: The Golden Circle.
Source: image by Sinek (2009)
2.2.1 Organizational cultures

Throughout organizations different cultures can be involved. To give an indication of an internal organization one could look at how bureaucratic, meritocratic and adhocratic they are. Whereas in the industrial era bureaucracy was more important were positions were privileged, in the information era meritocracy had a greater importance, where knowledge was privileged and in the agile era more emphasis will be put on adhocracy where adaptivity is privileged.

**Bureaucracy**

Max Weber, one of the founders of sociology, has defined the bureaucracy extensively (Weber et al., 1958). He was the first one to formally study bureaucracy and his work led to the usage of this term (Sashkin & Sashkin, 2003).

The focus on hierarchy, structure and formalization is prevalently present in this description of bureaucracy. Weber argues bureaucracy as being the way of organizing human activity in the most efficient and rational way (Swedberg & Agevall, 2005).

In his essay he defined the bureaucracy by the following principles (Weber et al., 1958):

- a hierarchical organization.
- formal lines of authority (order and command).
- an anchored space of activity.
- an adamant division of labour.
- consistent delivery of assigned tasks.
- decision and power is defined by regulations.
- authorities assigned with expertise in their fields.
- career prosperousness based on qualifications.
- qualifications assessed by organizational rules (not individuals).

*We believe from our personal experiences and observations about the past that this not always being true, thereby over-dedication to those principles can have strong negative impact from a humane and ethical perspective. When fanaticism towards efficiency and rationalism is given more importance than social considerations, this can be dangerous. We believe that those principles can be of good use to be efficient and rational, however*
the best rational considerations and follow up of formal lines do not always have to be in
place for all (minor) decisions. According to us good intentions and a realistic view are
essential, thereafter still can be decided that the decision could be formed by following a
bureaucratic approach. Thereby, getting decisions through a greater hierarchy can also
be a lethargic process (which is in that case not efficient).

**Meritocracy**
Meritocracy is a culture with a social system in which the knowledge and rationale of
individuals form the basis for handing people positions and the distribution of rewards.
Meritocracy advocates for handing everyone an equal chance to advance and receive
awards, based on their individual effort and merits, this regardless of their background,
equality is an aspect of meritocracy (Castilla & Benard, 2010).

**Adhocracy**
Adhocracy can, on first sight, be perceived as the opposite of bureaucracy. This
characterized by an informal, adaptable and informal form of organization (Toffler,
1980). The emphasis in this culture should be put on agility, intuition and decisiveness.
Where coordination is done around opportunities, decisions are made through
experimentation and people get motivated by achievement.

### 2.2.2 Leadership Styles
A leadership style can be interpreted by the process that takes places amongst a group of
people where the leader of the group manages to influence their followers’ attitude or
behaviour in order to ensure that the targets of the organization are achieved (Oke et al.,
2009). Often a leader takes up roles which are adapted to the culture of the organization.
He or she could be an influencer within a range of behaviours: being motivational, a
determined visionary and inspirational. Kuhnert and Lewis (1987), suggests that there are
mainly two distinctions, transactional and transformational leaders and they are
qualitatively different types of people who construct reality in different ways, which
further can be understood as they lead their people in a contrasting way. Both,
transactional and transformational leaders can be seen to be each other’s opposites, but
they should be seen as complimenting each other. They are necessary for an organization
to perform, where the best leaders are capable of using elements of both ambidextrously.
Greenleaf in 1977, coined the term servant leadership. However, this was not a commonly used style of leadership. Descriptions are given of each leadership style below.

**Transactional Leadership**

Transactional leadership style emphasises on the exchange of value possessed or controlled by the leader that an employee would want in return for his or her services and at the same time employees are encouraged by a system of rewards and punishments (Oke et al., 2009). Transactional leaders also encourage a relationship of mutual dependence between the leaders and their employees where in the contribution from both parties are acknowledged and rewarded (Kuhnert and Lewis, 1987). Transactional leaders often tend to work and operate within the existing culture of an organization to maintain the status quo (Oke et al., 2009). At the same time Kuhnert and Lewis (1987), also states that a form on transactional leadership involves commitments and promises that are rooted in respect and trust.

**Transformational Leadership**

According to Kuhnert and Lewis (1987), transformational leadership starts from beliefs and personal values of the leaders, but not in a transaction of exchange among the leaders and their subordinates. It involves engaging people towards a common task or purpose through the reinforcing behaviours that followers, they could be termed as change drivers (Oke et al., 2009). These leaders operate out of in-depth personal value systems that hold justice and integrity as their most integral ones (Kuhnert and Lewis, 1987). It is considered as an ethical leadership style which involves the capability of a leader to promote intellectual simulation through inspiration (Choudhary, Akhtar, & Zaheer, 2013). The transformational style of leadership tends to show more impact than the servant leadership when it comes to organizational learning (Choudhary, Akhtar, & Zaheer, 2013).

**Servant Leadership**

The term servant leadership was initially defined as “the servant leader is a servant first; it begins with the natural feeling that one wants to serve and at the same time serve first. The aspiration of one to lead is guided by the choice they make” (Greenleaf, 2002). Servant leadership is considered as a style of leadership to encourage, motivate and guide
employees by establishing healthy relationships. (Greenleaf, 2002). These qualities together can be termed as empowerment. It is important that the leader understands that its essential for him or her to take up the role of a servant, the focus should be on others and not yourself (Greenleaf, 2002).

### 2.3 Relative mapping of various manufacturing industries

How far a company has come in reaching the saturation point by practicing lean is hard to quantitatively assess. This because of the relative measures, no production lines of varying (end-) products are the same, however some suggestions could be made and would be easy to accept when looking at observations from the industry. The reason why it is hard to quantify such is that the manufacturing industry as a whole contains many different (sub-)industries by itself, all with their own emphasis and importance towards efficiency, safety and quality.

Now if we map the IT-industry (which is not a sub-industry of the manufacturing industry) as a benchmark on top, as the reference industry for the adaptation and implementation of agile values and principles it is possible to start comparing. We can divide the manufacturing industry in multiple sub-industries, such as: automotive-, medical equipment-, mining equipment-, aerospace-, electronic devices-, food- and packaging-industry. All those industries require a different way of the usage of LP, which will also apply to the attitude towards (the adopting of) an agile way of working.

If we now zoom in to one of those industries, regardless of which, and map the supply chain in a Supply Chain Pyramid (SCP), such as in Figure 2-4, we can also predict a relative measure on the likelihood of importance towards the agile way of working. The higher an entity is located in the SCP hierarchy, ultimately being an OEM, the more tendency they show to be further ahead in the PPD saturation and Lean saturation. The lower you get in the pyramid, reaching the more tradition characterised suppliers, the less importance they will give towards the usage of such improvement principles.
When looking at the supply of a product it is relevant to mention that Turker (2018) already suggests and visualizes an adaptation towards more agile way of working from a supply chain perspective, as presented in Figure 2-5. This was made possible by automation and internet of things (IoT) for the supply chain of the manufacturing industry, whereas interconnectivity of several elements in the supply chain will be present in the future.
2.4 The Agile way of working

How to work according in an agile way of working is enclosed in the agile manifesto. However, in order to understand the real essence of an agile way of working, learning about the values and principles, where the agile manifesto is based upon, is not enough. This can be understood by looking at the presented “Agile Onion” (Figure 2-6) as found in a publication by Rowell (2019). There are multiple (wrong) descriptions about the Agile Onion to be found by assessing grey literature, but the “Agile Onion” originates from the description Powers S. (2016), who is the founder of the AWA (Adventures With Agile). The Agile Onion shows the less visible elements of agile as being the core philosophy of “being agile”, being agile enclosed by the more inner rings of the Agile Onion are the most powerful elements of agile. Whereas the more visible and tangible elements, which are the principles, practices, tools and processes form the outer ring of the Agile Onion. Those elements are important in order to “do agile”. In order to adopt the agile way of working Rowell (2019) suggest that starting with “doing agile” will help to train towards becoming agile (“being agile”). This because the “doing agile” elements will engrave automated behaviours as a habit and will ultimately create the understanding of value creation by “doing” and “being” agile: the agile way of working. This being used within the manufacturing industry could be termed as Agile manufacturing.

Figure 2-6: The Agile Onion
Source: Adopted from Rowell (2019)
The agile manifesto was established in 2001 which comprises of four values and twelve principles that comprise the core of agile methods. The four core values are (Agile Alliance, 2015a):

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

2.4.1 Agile Management

In teams with high performance individuals and interactions are necessary. It was found that when no problem of communication is present a particular team can perform about fifty times better than the industry average (Sutherland, 2013). In agile management interactions are done by practicing increased frequency of feedback and communication, transparency of data, respect for people, commitment, honesty and trust. However, processes and tools are also important.

The second value talks about the importance of working software, this is one of the major factors that come along with agile methodologies. Working software is generally decided and defined by the team. In agile, this is referred to as definition of done. This is when a team decide upon a set of predetermined requirements and determine when a task should be completed. (Sutherland, 2013).

Consistent and continuous customer collaboration and feedback is necessary during the development process in agile and crucial for success. The constant involvement of the customer allows for the changes of requirements during the development which makes them work on what is most important to the customer or client.

Lastly, the final one is responding to change. This is more important than going by a set plan. It is considered as a core value in agile because the teams should respond to change to be able to fulfil the customers’ desires. Agile teams plan for change and are prepared for it. Certain tools are used and specifically designed to change priorities, to ensure that they are aligned to what a customer wants (Sutherland, 2013).
The twelve principles in agile are meant to support and facilitate teams while working with agility and are the extension of the four values that are presented (Agile Alliance, 2015b). They are as follows:

1. **Customer satisfaction**: It is of utmost priority to provide regular and in time deliveries to customers and their satisfaction is highly important.

2. **Embracing changes**: Being open to change even later in the process of development. The agile process facilitates the process of change.

3. **Speed delivery**: This means to deliver at regular intervals and consistently. It would be a couple of weeks or months. Short time limitations are generally preferred.

4. **Collaboration**: Different departments work together throughout the project.

5. **Empowerment**: Motivating individuals. Make sure you create an environment to support them.

6. **Effective communication**: Initiating face to face conversations. That is the most effective way to communicate.

7. **Good metrics**: Working software is used to measure success and how far they've reached.

8. **Steadiness**: Building and promoting a sustainable relationship. A steady pace should be maintained throughout the development.

9. **Operational Excellence**: Constant check for tech resources is a key to the agile way of working.

10. **Simplicity**: Keeping the workflow very simple and not complex.

11. **Self-organization**: Teams those tend to organize themselves and take their own decisions.

12. **Continuous improvement**: A constant improvement plan is in place and promoted.

There are various articles and books written about the concepts and tools of an agile way of working, the most relevant ones that corresponds with the agile philosophy are addressed below.
Self-Organization

Self-organization is a process, which appears spontaneously, resulting in teams forming a pattern within an organization. This can be obtained without any form of authority overlooking it within agile teams (Appelo, 2011). The people working in agile teams are employed within agile environments to handle various complex issues and they are able to manage themselves while being responsible for following deadlines (Appelo, 2011). A self-organized team can also be understood as a team that organizes their activities independently, the maintain themselves and there is generally no external management required to manage them.

Sprints

Sprints can be defined as the time taken for a particular assignment to be completed within a stipulated period of time. Generally, a sprint two of four weeks long for a project (Rouse, 2015). A minimum viable product is produced after each sprint. Corrections and advancements could be made at regular intervals. The firsts tasks that are executed are the ones that are the most important ones and later its broken down to smaller tasks. The modules are further evaluated on the basis of the time taken to implement them and a clear “definition of done” is developed for each of the modules. This evaluation gives the entire team a clear idea about how many modules would be further implemented in the upcoming sprint (Rigby et al., 2016). A group of sprints that can be combined together for the same outcome is considered as an increment. Each increment could be two to four sprints together.

Empowerment

Empowerment is suggested to be a process of granting employees authority but also reminding them of how strong and powerful they are which includes the support for risk taking, personal growth and cultural change (Appelo, 2011). There is a common understanding that empowerment is used to motivate people. However, Appelo (2011), suggests that by empowering employees one would improve manageability while with this would help them make their own decisions and take responsibility.
2.4.2 Agile Leadership

Organization and companies these days face tremendous concerns when it comes to changes within technology, ability to customize, globalization and many more factors (Narasimhan & Das, 1999).

Organizational processes and people with top-notch technology to meet customer demands for high end products and services with a short time frame comprises of an agile organization. This can possibly happen when agility is viewed as a fundamental to organizational esteem and a technique supported by leadership (Crocitto & Youssef, 2003).

Agile leadership could be termed as a mindset. Nowadays, businesses face new challenges of complexity and uncertainty. Here agile leadership comes to play. One major way to tackle uncertainty is with continuous inspection and adaptation while at the same time supporting creativity and innovation. There is no quintessential formula for developing an agile firm; a firm can become increasingly agile, but never concretely agile (Alzoubi, 2011). In order to meet the demands of the emerging market, various management principles have emerged within the scope of “Operational Rigidity” (Friedman, 2008). The manager tends to become an adaptive leader by setting up clear direction for his employees, following simple processes and giving high importance to continuous feedback, collaboration as well as adaptation (Parker, Pathak & Holesgrove, 2013).

Gardner et al. (2005), proposed an authentic framework which provided a clear direction to teams that intend on practising agile methodologies as shown below. The principles are as follows:

- The power to deal with changes.
- To understand organizations as adaptive systems that consist of people who are excellent at what they do.
- An understanding of ones authority in order to establish order, and at the same time the importance of intelligent control that promotes self-organization.
- A problem solver approach.
• It depends on the ability of self-organized teams to solve problems.
• It forces you to be adaptable to the changing conditions.
• Removes obstacles to further manage the outcomes.

Parker, Pathak and Holesgrove (2013) states that these principles or attributes would have worked in the past for various companies. These steps on the other hand provide a false idea of being secure by extensively planning and controlling but at the same time making the entire system complex.

2.4.3 Scrum

Scrum is an agile method of project management, which was developed by and for the IT industry. The approach focuses on the development of products and needs of the services while also fulfilling the business needs (Pries & Quigley, 2010). It is a practice which is incremental and at the same time iterations are practiced while acting upon an appearing issue and adapting to then change in time and circumstances.

From the start of a project to the finish line (A ‘start’ → B ‘finished’) a project can be seen as a travel journey, there is a starting point (A) and a destination point to reach (B), a certain goal to achieve. In order to go from A to B it is important to start moving and in order to not get stuck on the way, a plan should be made to be well prepared when taking off from the starting point. However, even the best planning will lack of details, which will come across during the journey, Figure 2-7 visualizes this, Figure 2-7 shows that most planned elements are still in the journey, some elements look similar but slightly differ and that there are other unexpected obstacles on the way.

![Figure 2-7: Visualization of the expected path in a planning (top) and the actual path of the journey (bottom). Source: Own figure](image-url)
A representation of scrum within a project is shown in Figure 2-8. The inner bold circle depicts the iterations of the development activities that follows one after the other and the outer circle represents the daily inspection that occurs during the inspection (Schwaber, 2004). The iterations are the most important part of scrum. The team together addresses the requirements, considers the resources of available technology and evaluates their own capabilities and skills with respect to the requirement which further collectively determines how to build the functionality, making necessary changes when new complexities and difficulties arise (Schwaber, 2004). This process is the most integral part of SCRUM.

![Diagram of SCRUM iterations and inspections](image)

Figure 2-8: SCRUM contains routine sprints, to reach the project goal.
Source: Own figure based on Schwaber (2004)

To make scrum sessions successful, there is a meeting routine of when the sprints take place. After each sprint all the individuals, involved in the project team, are supposed to give an update of the status that the team is working on. In order to keep track of those activities a scrum board is usually used. A scrum board contains a three sections and tasks should “flow” from the left to the right. This with on the left the “Backlog”, which contains tasks which came in during previous sprint, but have not been allocated yet. Then flow into the “To Do” section, where in that case will be worked upon during that sprint, also assigning by who. Then the final section is the “Done” section where the finished tasked are kept, the growth of the tasks in this section visualizes the pace of work. A division of roles in scrum is essential and tasks should be allocated which generally consists of a product owner, scrum master and the team (Schwaber, 2004).

- **Product Owner**
  The product owner is representing the interests of all the stake holders involved in the project. It could be termed as the voice of the customer. He or She fills in
the backlog and prioritises and updates the backlog items, the backlog acts like a queue of tasks (Pries & Quigley, 2010).

- **Scrum master**
  The Scrum master manages the scrum meetings and the time, he or she is responsible for facilitating the session. He or she would have to answer the following questions:
  - What is the status with respect to the last scrum session?
  - What comes next?
  - Are there any difficulties in going forward?
  The scrum master ensures that the process is used as intended (Pries & Quigley, 2010).

- **Team Members**
  The team members are assigned with tasks: the report to the scrum master during the scrum meetings. The team works together and helps each other to get things done. They should be aware and respect the four core values of Agile. The team generally contains three to nine members (Pries & Quigley, 2010).

The scrum master is responsible for the entire scrum process and for coaching/promoting scrum to all the parties involved within the project. This to implement scrum and adapting it to an organization’s culture (Schwaber, 2004).

### 2.5 Lean Manufacturing

In order to create an understanding of the proposed future way of working and changing leadership it is important to gather an understanding about the respected principles and culture the manufacturing have their roots. Hereby, Lean was perceived as an innovative new way of thinking and working: Aiming to only do things which add value for the clients and eliminate all wastes. The definition of Lean in short: ‘do more with less’. To get prepared for the adoption of the agile way of working, firstly it should be understood what lean is all about. Lean originates from the Toyota Production System (TPS) and the lean philosophy is a different way of thinking: “Hooray, we have a problem!” (Lohman et al., 2010 p.1), a problem is usually a taboo, this because it is associated with a negative attitude. TPS lean welcomes and embraces problems, since a problem have been
identified now the search for a solution could be initiated. When the desire to achieve is improvement, then problems should be addressed accordingly. The TPS aims for gaining profit from those improvement as the philosophy is shown in Figure 2-9 (Lohman et al., 2010 p.9).

<table>
<thead>
<tr>
<th>Traditional: price</th>
<th>= costs + profit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toyota: profit</td>
<td>= price - costs</td>
</tr>
</tbody>
</table>

*Figure 2-9: Toyota’s different way of thinking.*
*Source: Lohman et al. (2010)*

2.5.1 Continuous improvements

Lean is developed by Toyota to improve the value stream of their production; the principles are developed with the aim to (continuously) improve a manufacturing line (in the case of Toyota a line for producing cars).

Lean *Six Sigma* is an improvement program with the aim to enhance only the necessary (Chiarini, 2013 p.6). Six Sigma strives to reduce the variability of the “Critical To Quality” elements (CTQs), whereas CTQs are the critical characteristics of the quality of a product or service. Six Sigma strictly follows five steps, known as DMAIC: Define, Measure, Analyse, Improve and Control.

- **Define:** determine the need of improvement, this by making use of CTQs.
- **Measure:** determine the current deviation (status) of the CTQs.
- **Analyse:** Identify reasons why target is not met, identify waste (“Muda” in Lean).
- **Improve:** execute improvements to eliminate (the causes of) waste (“Muda”).
- **Control:** measure the improvements and verify the improvements made, develop a method to maintain or even iterate with the improvements made.

Also recognized as the *continuous improvement* cycle used for getting the right design (Jackson, 2009 p.298) as shown in Figure 2-10. In lean those cycles also apply and should constantly take place, for continuous improvement (Kaizen). The key principal of Lean is to continuously experiment about how things can be done quicker, more efficient, better (without mistakes) and with less resources. This does not directly mean that Lean aims to
lay off resources but doing the same work with less resources. The resources made available by this could then be used for other purposes, things which add more value for the customer (Lohman et al., 2010).

Figure 2-10: the continuous improvement cycle and getting design right cycle suggested by Jackson (2009).

Source: by Jackson (2009)

2.5.2 Eliminating waste

As shown DMAIC builds around identifying and improving upon waste this within a value stream. In Japanese there are three words for waste with all their own meaning: “Muda”, “Mura”, “Muri”. “Muda” is described as when there is more capacity available then workload. “Mura” means that the capacity swings around the goal, the waste is not steady. And “Muri” indicates that the waste comes from more workload then actual capacity, elements in the value stream are overloaded.

According to the TPS a value stream (could) contain in total seven relevant types of waste (Chiarini, 2013 p.19): overproduction, inventory, motion, defectiveness, transportation, over processing and waiting capacity. It should be noted that not all elements could be fully eliminated, but in order to improve the constantly added value over time and elimination of wastes iterations in order to reduce such should take place. Furthermore, the wastes can be distinguished in three categories: directly avoidable, not directly avoidable and unavoidable.
The main purpose of eliminating those wastes is to create a constant flow of added value in the value stream towards the client (Lohman et al., 2010 p.14). Ideally a value stream is driven by the pull (bottom-up approach) principle, whereas the demand of the client “pulls” the product or service through the value stream. This in contrast to a more traditional push (top-down approach) system Figure 2-11, where a beforehand planned amount will be produced and then later to be sold. By doing so the main focus will now be centralized around the people and place where the actual value is being added (in Japanese “Gemba”, translated ‘workplace’, ‘site’ or ‘actual spot’), in other words around the production (Chiarini 2013 and Lohman et al. 2010). According to Chiarini (2013) the average percentage of actual value-adding activities inside a product/service flow is 10% of the total activities (75% is non-value-adding activities and 15% mandatory non-value-adding activities.)

![Figure 2-11: How improvements should not be approached (left) and should be approached (right).](source)

Source: by Chiarini (2013)

2.5.3 Lean tools, instruments and methods

A tool in order to identify the most relevant wastes to eliminate is Value Stream Mapping (VSM). A VSM contains a description of the value adding processes (for example stations in a production line) and visualizes the added value by the process. The principle of VSM is that it should be aimed to be used to analyse processes striving to achieve goals and not the goals itself.

Within lean there are several lean-instruments, which could be applied separately, but by combining them in the right matter will establish a lean-system which could realize targets reducing the costs, with highest quality and shortest lead times. This specific combination
could be summarized in the TPS Lean-House (Figure 2-10, Figure 2-12). The Lean-house has a foundation of standardized work, is based on continuous improvement (“Kaizen”) and by a consistent flow (“Heijunka”), therefore the production should be levelled for both volume and variety. The roof is supported by the Just-in-Time (JIT) principle and autonomination (“Jidoka”), “Jidoka” is about stopping the line when mistakes happens so that the mistake will not remain (unnoticed).

![The Lean-house](image)

*Figure 2-12: The Lean-house.*  
*Source: by Lohman et al. (2010)*

The 5S-method is a habit about standardizing the work, it is about eliminating disturbances by maintaining order and tidiness in the workplace. 5S challenges to create the following routine of sequential steps:

- **“Seiri”** (Sort): choose/sort within the process what is useful and what is not and then separate them, only remaining useful tools.
- **“Seiton”** (Set in order): tidying the area, locate everything needed for the process on the most suitable and logical location, this so the employee can work as efficient as possible. Then make use of labels, grids, lines and other visible signs to indicate what should be placed where.
- **“Seiso”** (Shine): cleaning up the area and maintaining it.
- “Seiketsu” (Standardize): standardization is the outcome of the previous steps, those should be repeated in a certain suitable interval. This interval can be daily or with every set-up switch in case of (a part of) a production line.
- “Shitsuke” (Sustain): this introduces the discipline to carefully comply with the standards of the previous steps. This by keep on reflecting and critically assessing if this routine could be done even better every time. Measurements and results could be useful to quantify the outcomes.

Besides lean is about several techniques based around focusing on doing only what adds value, Lean Management is also a new cultural way of thinking. The new lean culture is characterized by asking the employees to (only) focus on (Lohman et al. 2010) and: what adds value for the customer, awareness of customer desires, prevent waste, prevent mistakes, deliver in time, team spirit (respect towards all staff), open communication, aim performance oriented, control costs, celebrate achievements, cleanliness, focused on renewal and improvement. Chiarini (2013) referred to those demands to behave as Value Guides, when implementing lean or any major change, an organization should aim to gain support by its employees to achieve ‘embracement’.
2.6 Handling change resistance

As pointed out by Chiarini (2013) the ultimate goal to make the adoption of a change successful is to achieve embracement by the persons involved. This could be achieved by making them understand the change, make employees feel being capable of showing the right behaviour that is part of the change and manage that the employees take their responsibility of their position (Mars, 2012). This can be challenging since a request of change causes resistance, according to Moran and Brightman (2001) resistance should be expected with any great change, this since it shakes the foundation of privilege. Resistance whenever an improvement is initiated is never desired. However, Lohman et al. (2010) suggests that resistance must be present, in case it is not there is a real problem, this because it indicates that the major change, of for example implementing lean, is not being taken seriously and will by that reason never be accepted and come to its potential. By this means it is important to find a right way to lead and manage the implementation of such a change. Mars (2012) suggests the phenomena of resistance to change and suggest natural resistance curve as shown in Figure 2-13.

![Natural resistance reaction towards change](image)

*Figure 2-13: Natural resistance reaction towards change.*

*Source: translated from figure by Mars (2012)*
Mars (2012) also addresses eight causes of resistance:

1. Doubt to the need for change.
2. Teething problems (problems in the initial part of a process).
3. Extra energy required for the change.
4. Insecurity about own position with respect to the changes of environment.
5. When the change is observed as moving more backwards instead of forward.
6. Miscommunications and wrong interaction between change initiator and the one who must do the actual change.
7. Unfamiliarity with new situation.
8. Previous experiences with less fortunate change processes.
3. Methodology

This chapter contains the description of the methodology used to find the answer to the research questions. This is done by describing and discussing the research: philosophy, strategy, approach and design. Followed by an explanation of the data collection procedure. After which the data analysis procedure is described. Subsequently, a description is given on how the assurance of the quality of the study had been anchored. Finally, ethical consideration attached to the research strategy had been discussed.

3.1 Research Philosophy

Philosophy, in Greek “φιλοσοφία” which means “love of wisdom” according to the Greek to English Oxford dictionary by Pring (2000), reflects on the conditions of the possibility of acquiring knowledge. In order to gain knowledge different ontological and epistemological assumptions could be made in order to develop the methodology of a research (Easterby-Smith et al., 2015). The ontological and epistemological assumptions in this study will be discussed in this paragraph.

3.1.1 Ontology

Ontology describes the topic of being, becoming and existence, which are views about the nature of reality (Easterby-Smith et al., 2015). Easterby-Smith (2015) suggests that four ontological positions could be situated on a continuum: Realism, Internal realism, Relativism and Nominalism. Where realism is based upon one reality with direct access, internal realism provides one reality with indirect access, relativism describes reality as being dependent on from which perspective the “reality” is being observed and nominalism represents a social reality, which is created through language and discourse and based upon the interpretations of humans. The nature of our research tends to be towards the relativism and nominalism side, whereas the terms “Agile”, but also “Lean” are very likely to have multiple social realities (created through language and discourse). It was aimed to create a proper foundation for the understanding of both terms and supportive subjects in order to compensate for the different perceptions by the interview associates, this was done by an extensive literature review.
3.1.2 Epistemology

Epistemology describes the topic of knowledge, which reviews the set of assumptions used to evaluate how knowledge has been acquired (Easterby-Smith et al., 2015). Within epistemology there are two contrasting scientific views: positivism and social constructionism. Positivism describes the reality as it is, observation are measured by objective methods to measure the reality. Whereas social constructionism describes that the ‘reality’ is determined by people’s interpretation and imagination as a result of shared assumptions about reality by multiple individuals. This study is based on a social constructionism epistemology, this since the main data acquired to analyse and build up to conclusions was done by (qualitative) interviews. Hereby, the answers highly rely on the perceptions, knowledge and understanding of the interviewees. The researchers aimed to approach the interviews detached and approached the observations from a positivistic perspective, however mostly a part of the interview time was allocated to get a common understanding about the topic of matter between the researchers and the interviewees. Therefore, the outcomes must be implied as being based upon constructionism.
3.2 Research Approach

The three general approaches while researching on a specific topic are abductive, deductive and inductive. The abductive approach generally starts with some incomplete observations and tries to find the best predictions for those observations by the use of theory. It is majorly used when there are uncertainties in the field of research.

The deductive approach (Figure 3-1) on the other hand, begins with an opinion of a general rule (a theory) and continues from there to reach a specific guaranteed solution. This is generally used when there is less room for uncertainties and alongside a quantitative research.

![Image: Deductive (top-down) approach](source: Own figure based on Walliman (2006) and Brinks & Bruins (2016))

The inductive approach (Figure 3-2) begins with observations one makes and then combines this with theory to draw generalized conclusions. Since, the inductive reasoning does not result in a certain conclusion, it would make predictions about the future (Bryman & Bell, 2003). The approach used in this research was first a deductive approach, followed by an inductive approach.

![Image: Inductive (bottom-up) approach](source: Own figure based on Walliman (2006) and Brinks & Bruins (2016))

The main emphasis of study was towards the inductive side, whereas the most important part for this research was to create an understanding based upon observations and use this knowledge to construct a general conclusion, containing an advise on how to adopt an agile way of working in the manufacturing industry. We considered this as the most appropriate because theory coupled with real life experiences and observations would help us obtain an in-depth understanding of agile management. Thereby, we could add value to the world by forming a theory preparing for adopting an agile way of working.
3.3 Research Method

Research can be done both by doing a quantitative or a qualitative study. Whereas a quantitative method is characterised by a process of quantification, which means measurement by a number of units. Qualitative research depends on definitions interpretation and the meaning of words (Walliman, 2011). Walliman (2006) states: “Quantitative research tends to measure, qualitative research tends to describe”. For this research a qualitative study had been done. The research work is majorly based upon convergence from knowledge this done by the usage of both multiple secondary and primary sources. Thereby, the researchers were required to also gain more knowledge and a better understanding about the topic of this research (what is agile?), whereas a qualitative approach could help to advance creating this understanding.

3.4 Research Strategy

To gather data for a qualitative research, multiple strategies could be used. Within a qualitative research this could be done by: observational research, interactive participatory research, action research, archival research, ethnographical research, narrative research, grounded theory and/or a case study (Easterby-Smith et al., 2015).

Within our research we aimed to do an extensive case study, aiming to acquire a project at a manufacturing company (an OEM) who recognized the importance of an “agile way of working”. This in order to cooperate and write a proposal for their organization in order to adapt. Furthermore, with the ambition to firstly investigate one company as a whole (interviewing different stakeholders throughout their organizational hierarchy) in order to get an in depth understanding of the agile way of working within this firm. Ultimately, also interviewing their suppliers (tier 1 to 4), in order to get insights of the agile way of working this within a whole supply chain in order to compare the different perspectives. Thereby, the findings of this research could then be used to generalize amongst the industry.

However, such company had not been managed to be acquired in time. Thereafter, it had been decided to take a wider approach, based upon grounded theory, interviewing multiple companies and gather a perspective from the industry rather than one individual company. Hereby not only manufacturing companies turned out to be relevant to consider, but also companies of other industries, which were more used to an agile way
of working, have been used to gather data which turned out to be valuable sources. Later in the process of the research interest was acquired from two manufacturing companies to propose a case study, however due time constraints it was not possible anymore to accommodate this within the timeframe of this research. Instead multiple interviews had been performed within the context of one of those two organizations.
3.5 Research Design

During the process of our research we followed the model proposed by Myers (2013). The research was initiated with a social constructionism approach and a qualitative method of research was adopted. Data was collected through the multiple interviews that was conducted throughout different industries and organizations. Once the process of data collection was completed it was followed by analysis. For this we decided to conduct a systematic analysis of the empirical findings and analyse it with the knowledge acquired over the process of reviewing existing or published literature. An in-depth analysis was conducted to make sure that maximum value was generated throughout the process. Following which, the thesis was written and further published.

As mentioned before, the research design in Figure 3-3 depicts the progress of our study according to the model presented by Myers (2013).

![Figure 3-3: Visualization of research design. Source: Model based on Myers (2013)]
3.6 Data collection procedure

In this paragraph the data collection procedure of this research is described. Figure 3-4 shows an overview of secondary and primary data both being used as input for the analysis, which was used to draw conclusions upon.

![Data collection procedure and purpose.](Source: Own figure)

3.6.1 Secondary data

Literature reviews is described as a good way of learning from previously conducted researches (Bryman & Bell, 2015). In this research, a systematic literature review was carried out since the majority of the research area was new to the researchers. However, the literature review was carried out in three major phases. This by gathering in total about 40 class “A” articles connected to the research area in the first phase. Thereafter, a selection was made of twelve highly relevant articles and finally narrowed down to four major articles where the theoretical framework was based upon. From this gathering of articles snowball sampling had been used to gather knowledge into most corners of the research field. Keywords were used on web search platforms and highly rated journals were selected. Initially a list of articles was made to figure out a general overview of the entire topic. As we got deeper, we classified articles based on various factors such as: relevance, citations, publisher and novelty. With this the list of articles were further streamlined. The literature review also helped us find a suitable area of our interest and at the same time answered some of our questions that came up during the entire process. The literature review was helpful to analyse the answers obtained from the interview. The
source of the literature review was data collected from various search engines such as google scholar, web of science and primo, the majority of the article have finally been accessed by the usage of Jönköping University digital library also printed copies and books were borrowed from this library.

3.6.2 Primary data
A qualitative study was conducted collecting data which comprised of conducting interviews. Interviews are generally considered as the most promising way of obtaining maximum information from interviewees. A semi-structured interview process was followed in this research as this allowed the interviewee to share maximum information, which he or she considered interesting and important towards our area of research. This often facilitates greater understanding into the area of research (Easterby-Smith et al., 2015). An interview plan was prepared for the interviews which acted as a guideline for us while performing the interviews. It was made sure that most of our questions were open ended which allowed the interviewee to share more information. Though allowing a flexibility in regards to the questions it was made sure the entire interview plan was structured in a way with utmost focus around the topic concerned as suggest by Bryman & Bell (2015).

Sampling
In order to select the companies for the research, it was decided to approach IT companies, consultancy companies that have been coaching various companies as well as practicing the agile way of working and several manufacturing companies which included OEMs and suppliers. A list with a total of 46 companies was initially prepared, whereof to the majority was reached out to. It consisted of companies from various industries. Whereof 29 companies belonged to the manufacturing industry, 11 to the IT industry and about 9 were consultancy companies. The summation of those adds up to over 49, this can be explained as there were three companies who could be considered as “hybrids” of working both with IT and consultancy.

A separation of the three industry categories could be made with respect to the purpose of the interviews, this separation could divide two types of emphasis during the interviews, visualized in Figure 3-5. Whereas the emphasis of discussion during the
interview with IT and consultancy companies would be put on gathering “lessons learned”, this by identifying barriers and challenges for (adopting) the agile way of working and discussing the advantages and drawbacks. The emphasis of discussion with the manufacturing firms was tend towards the perceived importance of the agile way of working and evaluating their performance on the agile way of working by examining the agile manifesto. On top of that their concerns and perspectives about the barriers, challenges and advantages/disadvantages were discussed.

The study focuses on companies that practice agile ways of working and manufacturing companies. Therefore, only such companies were contacted for interviews. Web searches on LinkedIn, personal contacts, professors and the alumni network of Jönköping International Business School were approached to obtain contact information to various companies. Once contacts were obtained, connections were established either by telephone or emails through which the purpose and background of our study was discussed.

After this, appointments were made and further interviews were conducted either face-to-face or by video calls according to the convenience of the interviewee, however a preference to do the interview face-to-face was expressed by us. All the interviews started with a brief description about the purpose of our study. The interviewees were given an interview plan for reference purposes once the interview was completed. A wrap up summary of the interview was also emailed to all the interviewees involved and approval was taken before using them as empirical data in this thesis.
Table 3-1 gives an overview of the interviews that were done. This table shows the type of interview that was conducted, the duration of the interview as well as the position in the company of the person that was interviewed.

Table 3-1: Overview of interviews done.

<table>
<thead>
<tr>
<th>Nr.</th>
<th>Position</th>
<th>Duration</th>
<th>Type of Interview</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Agile Coach/Management Consultant</td>
<td>90 Minutes</td>
<td>Face-to-Face</td>
</tr>
<tr>
<td>2</td>
<td>Manager Production Engineering Assembly</td>
<td>60 Minutes</td>
<td>Face-to-Face</td>
</tr>
<tr>
<td>3</td>
<td>Agile Coach</td>
<td>60 Minutes</td>
<td>Video-call</td>
</tr>
<tr>
<td>4</td>
<td>Production Engineer</td>
<td>55 Minutes</td>
<td>Video-call</td>
</tr>
<tr>
<td>5</td>
<td>SCRUM Master</td>
<td>70 Minutes</td>
<td>Video-call</td>
</tr>
<tr>
<td>6</td>
<td>Global Commodity Manager</td>
<td>60 Minutes</td>
<td>Video-call</td>
</tr>
<tr>
<td>7</td>
<td>Planning Manager</td>
<td>60 Minutes</td>
<td>Face-to-Face</td>
</tr>
<tr>
<td>8</td>
<td>The way we produce Facilitator (lean)</td>
<td>60 Minutes</td>
<td>Face-to-Face</td>
</tr>
<tr>
<td>9</td>
<td>Manager Production Engineering</td>
<td>75 Minutes</td>
<td>Face-to-Face</td>
</tr>
<tr>
<td>10</td>
<td>Supply Chain Manager</td>
<td>45 Minutes</td>
<td>Face-to-Face</td>
</tr>
<tr>
<td>11</td>
<td>Senior Test Engineer</td>
<td>90 Minutes</td>
<td>Face-to-Face</td>
</tr>
</tbody>
</table>

Source: Own table

Interviews

For conducting the interviews, it had been decided to adopt the approach suggested by Bryman & Bell (2015). They explained that it was beneficial to have two researchers performing an interview. One with the focus on conducting the interview while the other was focused on taking notes and analysing the answers. The passive interviewer was responsible for interrupting and intervene when the discussion is not staying on the topic. Recording the interviews were another aspect that we followed. Permission for recordings were asked to the interviewee, when the interviewee gives allowance it is not likely that the recording will influence his responses (Easterby-Smith et al., 2015 p.192). A recording device was used to transcribe the interview. This was done to make sure that we did not miss out any information that was relevant for our research.

This research aims to study about agile management within IT companies, consultancy companies as well as manufacturing firms. The questions that were prepared for the semi-structured interviews were with regards to leadership styles, management process and implementation of agile principles. The questions were formulated based on the purpose of our research coupled along with the frame of reference to get an answer for the main research question. This was done by multiple questions. Initially, a set of questions were asked to identify the need for a more agile way of working. Then, to identify the current
status to agile value and principles. Lastly, a set of questions were asked to gather perceptions about advantages and disadvantages of the agile way of working and to gather the lessons learned about the different barriers and challenges involved while trying to work in an agile way. The established interview plan is attached as Appendix 1.

3.7 Data analysis

The aim of the research is to obtain a deeper understanding of various agile methods used in management and leadership within the IT companies, consultancy firms and manufacturing companies. In order to explore the subject in detail and improve the understanding in regards to the subject it was decided to gather empirical data, that could be obtained from multiple interviews with leaders and managers within both OEMs and IT companies. The information was sorted and further evaluated in a systematic manner to gain a better insight of the challenges and concerns these managers had to face. The lessons learnt from the IT companies and consultancy firms with respect to practicing agile methods of working were analysed and further, the results were used to understand the way of working within manufacturing companies.

We considered grounded theory to be the most suitable one to analyse the empirical data that was collected through interviews. This is also the most commonly used methods for analysing qualitative data. Grounded theory is defined as the theory that was derived from data, which has been systematically collected and analysed throughout the research process (Bryman & Bell, 2015). The organization of data, compilation, labelling and separation is together considered as coding. Coding is one of the most integral processes of the grounded theory. We initiated this process by first transcribing all the interviews that were recorded. All interviews recorded, were listened to once or twice while transcribing it and summarized individually to ensure that key points from the interview were not missed out. During this phase, recordings and transcripts were re-listened and re-read respectively. Once the transcription was done, a summary of the response was made attached to the code of the interview associate. Those were in turn used to gain a clearer understanding of the area of research.
3.8 Research Quality

Research quality is a major aspect that was looked into throughout the process of the research. The most important factors to consider in a qualitative research while assessing and establishing the quality of data is validity and reliability (Bryman & Bell, 2015). The trustworthiness of our research is presented in a clear and definite way in order to make sure that our research can be taken into consideration. Bryman & Bell (2015) suggests that trustworthiness should be focused on when it comes to qualitative research. It constitutes of four major factors: credibility, transferability, dependability and confirmability.

- **Credibility**
  Bryman & Bell (2015) suggests that credibility can achieved by respondent validation, serious and continuous observations, peer debriefings and triangulation can be used. During the course of this research, the answers given during the course of the interviews were repeated to make sure that the right essence was captured and noted. An email wrap up containing a summary of the entire interview was also sent out to all the participants.
  Triangulation is when multiple perspectives are considered and compared or various sources of data are used during a research (Bryman & Bell, 2015). Throughout the timeline of the research, multiple interviews, literature study from different sources and various other documents and reports were used to ensure the credibility through triangulation.

- **Transferability**
  It is necessary that the person who reads the research can decide for themselves if the results can be applied to any other possible companies and not a specific organization that was investigated or no. It ensures that a research conducted would also contribute to surroundings and not just the specific organization which had been researched upon (Bryman & Bell, 2015).
The transferability of this study and its findings were ensured while interviewing the different companies from three conscious selected industries. The thorough background study and the literature review helped in crafting questions and the results were compared. The selection of interviews was done in order to acquire maximum information from IT, (agile) consultancy and manufacturing companies.

- **Dependability**
  In order to ensure dependability, researchers should choose to adopt an auditing approach, which generally refers that a record is kept over every phase of the research (Bryman & Bell, 2015). Dependability in this research has been ensured by keeping a track and record of all the steps involved in the complete research process. This includes interview transcripts, recordings of interviews, data analysis decisions, field notes and selections of interviews. Our group was split into and the gathered empirical data was interpreted individually. The interpretations of the interviews were then discussed to reach an unanimous understanding thus making the findings more dependable.

- **Confirmability**
  This is the next quality principle, it is to make sure that the researchers are acting in good faith and making sure that the results are not influenced on their own beliefs or who the investigators are (Bryman & Bell, 2015). In this research, it has been ensured that the research findings from the research are not influenced by personal values or backgrounds of the researchers. This has been resolved by analysing our thoughts and ideas as researchers along with the empirical data collected.
3.9 Ethics

Physical harm was not very likely to happen throughout the research to participants while conducting a research in a specific area. However, the process of interviews and the way questions are asked could lead to personal or societal harm: this in the form of psychological, social or economic harm (Easterby-Smith et al., 2015 p.192). To avoid this Easterby-Smith et al. (2015) suggests ten principles of ethics that was adapted from Bell and Bryman (2017) as presented in Table 3-2.

Table 3-2: Principles for ethical considerations.

<table>
<thead>
<tr>
<th>S. No</th>
<th>Principle:</th>
<th>Concerns:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ensuring that no harm was caused to the interviewees</td>
<td>Protection of research participants</td>
</tr>
<tr>
<td>2</td>
<td>Respecting the dignity of the interviewees</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Ensuring a fully informed consent of the interviewees</td>
<td>Protection of integrity of research community</td>
</tr>
<tr>
<td>4</td>
<td>Respecting the privacy of the interviewees</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Ensuring the confidentiality of collected data</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Protecting the anonymity of individual organizations (if requested)</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Avoiding deception about the nature or aims of the research</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Declaration of affiliations, funding sources and conflicts of interest</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Honesty and transparency in communication about the research</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Avoidance of any misleading or false reporting of research finding</td>
<td></td>
</tr>
</tbody>
</table>

Source: Adapted from Bell and Bryman (2015)

In order to tackle the ethical concerns those are mentioned here, actions were taken. Every interview started by the interviewee being informed about the purpose of the interview. They were also informed about how the data collected during the interview would be used. The interviewees were given a choice to remain anonymous or not during the publication of the research. Before the interviews were initiated, the interviewees were provided with a brief description about the interview and the time that it would take. This was done in order to ensure that all the participants involved were aware about the nature of the study and provide clarity about how the interview process would be carried out. As mentioned above, once the interview was complete, a copy of the interview plan, our contact details as well as a wrap up summary email about how we would be using the data and in case they wanted anything information to be removed from the research they could also let us know about it.
4. Empirical Findings

This chapter of the report presents the results of the gathered empirical data. First, the different interviewed companies are listed and presented in a table and briefly described related to their context within this research. Furthermore, the aim and purpose of the asked questions are given and repeated followed by the presentation of the interview results.

4.1 Overview interviewed associates

To gather primary data, interviews were done as proposed and explained in the methodology chapter. The outcomes of those interviews are presented in this chapter. The overview of the interview plan, which formed the basis for those outcomes, is attached in Appendix 1. The outcomes from all interviewees are grouped per question. The answers given are summaries of the original transcript of responses, only the relevant information connecting to the purpose of the question and our research has been retained.

In order to present the outcomes in a well-arranged and compact way the interviewees had been coded, shown in Table 4-1, those codes will furthermore be used throughout the thesis to refer to the interviewed associates. Depending on the question the relevance of the answers differed based on the industry classification. For some questions the relevance of the response is higher from the manufacturing companies and for others the perspectives from the IT and/or consultancy firms had a greater importance. This will be further discussed in the analysis chapter.
Table 4-1: Coding of the interviewed associates.

<table>
<thead>
<tr>
<th>Code</th>
<th>Company</th>
<th>Position</th>
<th>Industry</th>
<th>Industry classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>CC</td>
<td>Cybercom</td>
<td>Agile Coach / Management Consultant</td>
<td>IT &amp; product development</td>
<td>IT / Consultancy (hybrid)</td>
</tr>
<tr>
<td>HQ</td>
<td>Husqvarna</td>
<td>Manager Production Engineering Assembly</td>
<td>Outdoor power products</td>
<td>Manufacturing</td>
</tr>
<tr>
<td>LB</td>
<td>Lindberg Consulting &amp; Coaching AB</td>
<td>Agile Coach</td>
<td>Freelance Consultancy</td>
<td>Consultancy</td>
</tr>
<tr>
<td>SS</td>
<td>Sensata</td>
<td>Process Engineer</td>
<td>Sensors supplier for automotive and aerospace industry</td>
<td>Manufacturing</td>
</tr>
<tr>
<td>FD</td>
<td>Fudura</td>
<td>Scrum Master</td>
<td>Utility service industry</td>
<td>Consultancy</td>
</tr>
<tr>
<td>AN</td>
<td>Anonymous</td>
<td>Global Commodity Manager</td>
<td>Medical devices industry</td>
<td>Manufacturing</td>
</tr>
<tr>
<td>ER₁</td>
<td>Epiroc</td>
<td>Planning Manager</td>
<td>Mining and infrastructure</td>
<td>Manufacturing</td>
</tr>
<tr>
<td>ER₂</td>
<td>Epiroc</td>
<td>The way we produce Manager (lean)</td>
<td>Mining and infrastructure</td>
<td>Manufacturing</td>
</tr>
<tr>
<td>ER₃</td>
<td>Epiroc</td>
<td>Manager Production Engineering</td>
<td>Mining and infrastructure</td>
<td>Manufacturing</td>
</tr>
<tr>
<td>ER₄</td>
<td>Epiroc</td>
<td>Supply Chain Manager</td>
<td>Mining and infrastructure</td>
<td>Manufacturing</td>
</tr>
<tr>
<td>CN</td>
<td>Consid</td>
<td>Senior Test Engineer</td>
<td>IT in industry &amp; trade</td>
<td>IT</td>
</tr>
</tbody>
</table>

Source: Own table

An overview of all interviewed associates and their industry classification, industry, company name and roles are also shown in Figure 4-1.
Figure 4-1: Overview of interviewed associates.
Source: Own figure
A brief description of the companies and interview associates is given here below. Thereby their purposefulness in relation to the research is given to put the interview response material in perspective towards the research.

_Cybercom_ (CC) defines themselves as an IT and product development company. They consist of about 1,300 employees (Cybercom, 2019). Cybercom is based in Sweden and has thereby offices in three different regions outside Sweden within Europe and a partnership with an IT company in India. We had the opportunity to meet the agile coach and management consultant who works at the Jönköping office. He has been a pioneer when it comes to working in an agile way. He has a background of working in various projects that were operated in a conventional way but now considers himself as a lean and agile coach now who has a passion for developing people, product and organization.

_Husqvarna_ (HQ) is a manufacturing firm that deals with producing outdoor power products. They have a history with more than 300 years of experience as a manufacturing company, Husqvarna Group had approximately 13,000 employees (in 2018) in 40 countries, divided over three businesses: Husqvarna, Gardena and construction (Husqvarna, 2019). Their products include chainsaws, robotic lawn mowers, trimmers and a lot more. We interviewed the manager of production engineering assembly, within the outdoor power products industry. He has work experience of about twelve years, previously working within an automotive company in Jönköping (Sweden) and for the past seven years with Husqvarna as a manager of production engineering assembly.

_Lindberg Consulting and Coaching AB_ (LB) is a management consultancy firm. They have been consultants for various companies around the globe. The agile coach that we spoke has worked with most major companies in Sweden such as IKEA, Volvo cars, TetraPak, Beijer Electronics and more. She brought in a wide range of experience by working with diverse organizational cultures and leaders who practiced different leadership styles.

_Sensata_ (SS) is a company that has been designing and making sensors for various industries. They claim to have approximately 47,000 unique products which are provided to a range of companies with consists of various automotive companies to different
aircraft flight control units (Sensata Technologies, 2019). Being from the manufacturing industry, at the same time being a supplier to various other manufacturing firms, made Sensata a distinct sample for the purpose of research. We spoke to a process engineer who holds a degree in both mechanical and industrial engineering. His insights about how Sensata worked as a supplier to various automotive companies and also within the company helped us create a deeper understanding about the way of working within manufacturing firms as being a supplier to various OEMs.

**Fudura** (FD) is a company within the utility services industry in the Netherlands. They deal with around 25,000 companies to improve their energy consumption and infrastructure (Fudura, 2019). We spoke to the scrum master at Fudura and hence we have considered it under the industry classification as a consultancy. This since his job consist of acting as a coach to various teams in order to increase their efficiency of value creating, this being done with an keen eye for the agile manifesto.

**Anonymous** (AN) this company is a global producer, supplier and OEM within the medical devices industry. We spoke to their global commodity manager. He was responsible for the supply chain management at the firm. His experiences and expertise helped us understand and evaluate the current status of medical device industries and their working principles.

**Epiroc** (ER) identifies itself as a manufacturing firm within the mining and infrastructure industry, whereas it is an OEM. Epiroc has its roots since 1873 as part of the Atlas Copco Group, but had been separated formally as an independent legal entity in June 2018. Epiroc has globally 14,000 employees and operates from Sweden, the United States, Canada, Germany, China and India (Epiroc, 2019). We had an opportunity to conduct multiple interviews within this company. This helped us to gain a clear understanding and idea about how the company worked within the various operations they performed. We spoke to the planning manager, the way we produce facilitator, manager production engineering and supply chain manager. All four of these participants were highly skilled with enormous years of experience within their respective areas of work. Their inputs have been tremendously valuable throughout the research.
**Consid** (CN) is an IT company based in Jönköping with an estimated amount of over 300 employees (Allabolag, 2019), with thirteen offices throughout Sweden (Consid, 2019). We had the opportunity to interview a senior test engineer. He worked within the IT specifically for “industry and trade”. The interviewee had worked previously with manufacturing companies and now worked as a consultant for the IT industry. He has been an experienced professional within embedded systems and systems engineering.
4.2 Interview results

This paragraph contains the outcomes of all interviews, this is presented question by question with the summary of relevant responses of the interviewees attached.

The first two questions (Q1 and Q2) were related to identify if the need for the agile way of working was recognized. This by validating the suggested transition in time from the industrial era, via the information era towards the agile era. The two proposed important phenomena connected to this transition in time had been evaluated with those questions.

The second set of questions (Q3 and Q4) had been composed to identify whether the agile way of working was present. This by an evaluation of the values and principles from the Agile Manifesto. The results of this are presented in a table (Table 4-2), quantifying the results. The detailed inputs to get to those results are attached in Appendix 2.

The third set of questions (Q5 and Q6) were formed to investigate the perceived usefulness of the agile way of working and to learn more about the advantages and disadvantages of the agile way of working.

The fourth set of questions (Q7 up to and including Q10) were asked to identify barriers and challenges for adapting to a more agile way of working, but also lessons learned were tried to gather from interview samples who have been (involved in) adopting the agile way of working.

Finally, the interviewees were asked to bring up anything interesting and purposeful related to our research (Q11), as if they would have gained more knowledge about the purpose of study during the interview. Thereby, had been asked for suggestions of suitable persons which could be contacted for further research (Q12), the results of this question have been left out of thesis.

Here below all questions and the answers from the interviewees are presented. Sometimes a question had not been asked, was not answered by the interviewee. Then the answer is marked with "-". When a question had been passed by the researchers this had been done consciously, whereas the researcher already figured out during the open speech part of the semi-structured interview that the question would not be relevant to ask.
Identifying the need for a more agile way of working: recognition of PPD and lean saturation status.

Q1) How far have you reached with the physical product development saturation? *

CC: -

HQ: Husqvarna has always been busy inventing new things, a lot of products which were produced by Husqvarna in the past we don’t produce anymore nowadays. So Husqvarna is on a constant discovery tour through new products and industries. Currently we have our main emphasis on the forest and garden industry, concrete industry as well. What is seen now as change in approaching industry is the rise of electrical driven products as a substitute to combustion driven models (lawn mowers, chain saws etc.). This since we are in an environmental change. The last 7/8 years we have started to make battery products as alternatives, the market is rising with +/-70% per year. There is a change in demand of renting over buying from the younger generation as change in purchasing behaviour. When implementing IoT in devices, a product could be owned by several people and the status & location could be monitored and requested by one person who needs it (for example in a group of friends).

LB: -

SS: Can not really identify this trend within the products they produce as reference. Also explained that his job is more oriented about the production rather than about the product, so hard to judge.

FD: -

AN: With new technology, there is a lot of improvements that are coming. E.g. CNC machines. There are improvements that are happening in other sectors if not for automotive.

ER1: It seems, what I see in our industry is that we start to move from Diesel usage to battery power, at the same time implementing automation. Thereby it is a safety trend and provides new opportunities in the future. On the short-term this trend might be harder for my work, but in the long-term makes it easier.

ER2: Agreed, change approach is needed into an agile way of working. Workers tend to desire following a plan and get work done, instead of inventing. A change approach towards a more agile way of working could possible change this.

ER3: Yes, I also believe that the majority of mechanical inventions are nowadays rather old. I think this has been achieved around the late 70s’. Nowadays inventions can be made by new system integrations. Thereby, the trend of shift in the way of “ownership” is perceived differently.

ER4: -

CN: Yes! The mechanical side is saturating but there is always a lot of scope in adding value by collecting a lot of data.
Q2) How far have you reached with lean saturation? *

CC: -

HQ: What he said is that Husqvarna sees the TPS basically as a toolbox of improvements. However, not all tools are (equally) useful for Husqvarna. For that they have made “Husqvarna operating system” which is an abstraction of the TPS. Lean is defined and described in the USA, but the source comes from Japan (TPS). We recognize we have made many improvements by this. Our next step is industry 4.0, which has to do with the implementation of automation in our production line. Currently we are busy transforming manual assembly labour steps into automated production processes. Lean is often about (continuous) small improvement steps, but in lean there is also a tool where you take a big leap. Moving from manual assembly to automatic assembly can be an example of such a big step, since a lot of problems will arise when you want to let a robot assemble certain components instead of manual assembly.

LB: -

SS: I more the less work on demand of on projects and process and production optimization within our firm. Lean optimization is mainly done at our production location in China for example itself. When there is a new machine to which is going to be installed process engineers with more knowledge from the business side get involved, which can be me, to look at the most efficient and effective way of using this machine.

FD: -

AN: The medical industry is about 10 to 15 years behind. The medical industry still has a lot more to be explored. Lean is being looked into but at the same time agility is also needed.

ER1: No, within our firm there is still a lot to be improved by the usage of lean. I recognize the trend you sketch, but would not consider that we have reached this saturation closely yet. Attached to this is a big data problem, which can contain faulty manual inputs, which makes it harder to trust the data. The data are then intoxicated by human flaws

ER2: Absolutely not, we can do more. There is still a lot to improve for us by the implementation of lean principles. The master data isn’t good enough to implement more digital tools, that can help us to improve our way of work. I think agile is a sibling of Lean, lean is also about testing new things, learning from mistakes, agile is maybe the same. The difference is not too big, lean has developed into agile, agile is more on IT and software sides, lean is doing a little better each day. The way of working is similar, and both is about adding value.

ER3: We are aware of the lean principles, however we have not been able to use them in the best matter, it’s hard to abide by it. We understand the lean principles, however we still struggle to adopt and trust on all of them.

ER4: Yes, we have daily steering meetings, where we highlight deviations, self-evaluation, continuous improvement. Hereby we aim to minimize waste, as one of the spirits of lean.

CN: I can definitely recognize your point but then I don’t see it reaching a saturation point.
Current status of agile way of working: Are the values and principles from the agile manifesto used?

The questions under Q3 evaluated the core values of the agile manifesto. A measurement of the perceived importance and/or recognition of those core values was done by questioning those. The answers to those are to be found in Appendix 2, visualizing the outcomes had been an analytical process and is therefore to be found in chapter 5.

The next questions under Q4 contained open ended questions, based on the answers of the interviewees and the knowledge about the philosophy behind the agile principles it had been selected whether the principle was met “Yes” or “No”. These outcome can also be found in Appendix 2. This resulting in a quantitative measure of how many principles were met.

The outcomes of the agile manifesto principles evaluation are summarized in Table 4-2.

<table>
<thead>
<tr>
<th>Codes</th>
<th>Agile principles (Q4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CC:</td>
<td>10 out of 12</td>
</tr>
<tr>
<td>HQ:</td>
<td>10 out of 11</td>
</tr>
<tr>
<td>LB:</td>
<td>9 out of 10</td>
</tr>
<tr>
<td>SS:</td>
<td>7 out of 12</td>
</tr>
<tr>
<td>FD:</td>
<td>11 out of 12</td>
</tr>
<tr>
<td>AN:</td>
<td>10.5 out of 11</td>
</tr>
<tr>
<td>ER1:</td>
<td>9 out of 12</td>
</tr>
<tr>
<td>ER2:</td>
<td>9 out of 12</td>
</tr>
<tr>
<td>ER3:</td>
<td>8 out of 11</td>
</tr>
<tr>
<td>ER4:</td>
<td>8 out of 12</td>
</tr>
<tr>
<td>CN:</td>
<td>9 out of 12</td>
</tr>
</tbody>
</table>

*Source: Own table*
Perceived advantages and disadvantages with regards to a more agile way of working.

Q5) What are the main advantages of working agile from a leadership point of view?

CC: **Advantages**: I don’t put myself in a central rule. I would be a servant leader to support the team but then should not be dependent on me. It’s important to help your employees to grow!

HQ: -

LB: **Advantages**: It’s the mindset shift. You are able to build autonomy and empower people.

SS: -

FD: **Advantages**: being able to deliver value by accepting that there are things you cannot control and by working with the things we do know.

AN: **Advantages**: First the product needs to be defined if it is critical to cost, critical to quality and critical to delivery. Based on that the technique of approach can be selected as to if the project needs to be lean or agile. You would be a market leader.

ER1: -

ER2: **Advantages**: more flexible adaptive and quicker.

ER3: **Advantages**: clear picture on expectations, efficient as co-worker when being a team, in contrast to having “island”.

ER4: **Advantages**: adaptive towards reality, changes happen often and they are solved faster.

CN: -
Q6) What are the disadvantages of working agile from a leadership point of view?

CC: Disadvantages: This leadership style doesn’t suit everyone. Some people think it is very passive approach as they would prefer to be in command.

It’s important to help your employees to grow!

HQ: -

LB: Disadvantages: There is a friction within the management and hence it hard to overcome and take decisions.

SS: -

FD: Disadvantages: vulnerability maybe, but this will be more on the short-term.

AN: Disadvantages: Agility means to get things done faster. There could be multiple approaches and a loss of control can be noticed.

ER1: -

ER2: Potential drawbacks: change management resistance is tricky. Especially to change the employees on the shopfloor (operators) and first- and middle-management.

ER3: Disadvantages: we can’t spend 100% of our time in working on sprint achievements, we have to be available for the surrounding world. We have to do support or attend meetings during this time.

ER4: Disadvantages: sometimes hard to measure when finished.

CN: Disadvantages: People tend to forget essential documentation and lack of planning while practicing the agile way of working.
Lessons learned: barriers and challenges implementing an agile way of working.

Q7) What are the biggest organizational barriers according to you that needs to be changed to move into an agile way of management/leadership?

CC: The biggest organizational barrier is always the middle managers.

HQ: DFAA: Design for Automatic Assembly.

LB: Many! The preparation for change management. Many times, when you’re ready with the planning to implement, the mindset of the people involved are different. The middle management especially have a huge concern.

SS: -

FD: The feeling of the loss of control, which is perceived, but is actually not true by the middle-management who require to adopt this change. A way of control they never really had, but which they thought they had. Transparency is required to do this, which is not always easy because of hidden insecurities. Also making teams self-organize themselves and handing the authority to themselves instead of taking authority as a manager is not always an easy thing to change as a habit when this is perceived as the way to work. Being transparent and open up about your vulnerabilities is sensitive and not always easy to achieve but can create a lot of value when achieved.

AN: No, I haven’t come across people who don’t agree to agility or agile practices.

ER1: -

ER2: Resistance from different stakeholders in the organization.

ER3: Alignment among different teams is important. Within Epiroc we are very dedicated to commit for our end-customer, this is our biggest strength, but can also sometimes be a pitfall.

ER4: The operational side will have a hard time to see the benefits of the agile way of working.

CN: The management expects to deliver MVPs every sprint which is not possible. In reality, this is very difficult. It is hard to change from a traditional waterfall approach to a lean and agile way. It often seems as chaos in the beginning.
Q8) What are the biggest concerns as a leader that you have faced while implementing agile way of working?
Q8.1) How did you manage them?

CC: Q8) Company culture, knowledge and educational level about agile principles and methods.
Q8.1) Drive change, experiment new things, discuss and evaluate progress.

HQ: Q8) Prioritizing this to be an actual thing to do, it is really likely in my job to look and be busy with the actual problems each week. For such an adaptation you need to allocate time and step out of the work which is being done now.
Q8.1) -

LB: Q8) The preparation for change management. Many times, when you’re ready with the planning to implement, the mindset of the people involved are different. The middle management especially have a huge concern.
Q8.1) Changing the mindset first is the primary step that needs to be taken.

SS: -

FD: -

AN: Q8) Most people in the organization wouldn’t even understand what agile is. The middle management especially doesn’t want to change and hence they stay away from ‘agile’.
Q8.1) -

ER1: Q8) To back each other is hard when processes are not followed and/or in place. This especially for new people, the guidelines are of great usage for them to know what should be done.
Q8.1) -

ER2: -

ER3: -

ER4: Q8) Find the “what is in it for me?” answer for all people involved.
Q8.1) Run a pilot to trigger those questions and see how you can tackle them.

CN: Q8) -
Q8.1) It’s easier to start up a new project and implement agile rather than pushing an existing project into agile.
Q9) Are you currently working in an agile way?
Q9.1) (continue) if yes: Have you also worked in a non-agile way before (i.e. conventional way?)
Q9.2) (continue) if yes: what steps did you take while moving from the conventional way of working to the agile way?

CC: Q9) Yes
Q9.1) Yes! While working with various waterfall projects in the past.
Q9.2) Most changes were unscripted. We started by creating teams and setting up a backlog for all teams. Share and Learn from best practices. He made sure there was some flexibility built in.

HQ: -

LB: -

SS: -

FD: -

AN: -

ER1: -

ER2: Q9) We work with SCRUM cycles of 2-4 weeks, project managers meet on this frequency.
Q9.1) -
Q8.2) -

ER3: -

ER4: -

CN: -
Q10) How did you manage the people who did not believe in the agile way of working and how did you manage the transition?

CC: There would be both early adopters of new techniques and some other who would not want to change. You need to identify the early adopters first and work along with them and evaluate the results and show them to the others and this would further encourage them to adopt agile ways of working.

HQ: -

LB: I never tell people what to do or what is best for them. Study their competences and tell them what is in it for them and evaluate their benefits and stick to best practices.

SS: -

FD: Focus on explaining the value and why it is important rather than just educating about the agile principles and such. The understanding of why this could help to improve is key.

AN: -

ER1: -

ER2: Create awareness, take a step back when resistance is found. When resistance occurs then this is a signal that I as a leader have not done my homework good enough. For the hardest ones to change (line-managers & assemblers) it is required to take more time and put more effort in raising awareness of why the change is good.

ER3: Not initiated yet, but it is planned for the future. From my experience the main challenge will be the change journey.

ER4: -

CN: Would create and an understanding and point out benefits.
Q11) Do you have any questions or final thoughts for us?

CC: -

HQ: -

LB: -

SS: Related to the agile way of working you refer to; I was recently at Hannover Messe in Germany where they had something called industry 4.0. This was showing machines all being connected to a database, which could be useful to optimize the production line. We have already lots of data coming out of our machines, however we do not have an industry 4.0 system yet.

FD: The power of agile comes from beyond the core values and principles and that it is about creating awareness of what creates value and why. The goal of a company should not become to be agile, but agile should be used by the company to be more focussed on where they create value.

Agile is about being adaptive towards the reality and the world in contrast to a traditional waterfall planning method approach. It is about accepting that not everything is predictable, to learn from the past and gather data from there and move forward, but also being slightly flexible towards the future when sudden unexpected changes arise.

Agile and SCRUM mindset is about being in touch and binding with your customers. It can be the next step in customer service, which then creates value in a new dimension instead of just delivering a product and that being the end goal.

Most important metric in agile delivery is “time to learn”.

Furthermore, interesting keywords related to your research:

- STACEY MATRIX (simple/complex matrix, about what and how (know/unknown)).
- Servant leadership

Final take-away:

“Agile is not only about being able to deliver more value, it also about being transparent and being open about vulnerabilities, which can be a big challenge.”

AN: -

ER1: I see potential in a more agile way of working in the manufacturing industry, especially with regards to the upcoming trends. So therefore, it is an interesting topic. I think it is an addition towards principles, I don’t see agile as an opposite or conflicting practice towards lean.

ER2: -

ER3: -

ER4: -

CN: -
5. Analysis

This chapter contains the analysis of the gathered data and interpretations. This aims to connect the empirical finding with the knowledge gained in the theoretical framework. This done by first identifying the importance of the agile way of working as perceived by the manufacturing industry. Thereafter, a discussion of the interpretations based on the examination about the values and principles of the agile manifesto is done. Followed by discussing the perceived advantages of the agile way of working. Finally, the barriers and challenging involved when adopting the agile way of working are discussed.

5.1 Indication of recognition of agile importance by the manufacturing industry

In order to evaluate the recognition of the importance of agile, within the manufacturing industry, we started by asking the associates two major questions which are further analysed below. The saturation of product development and the saturation of lean. These are the two major questions asked and their responses were analysed.

Q1) How far have you reached with the physical product development saturation? *

As stated, this question was mainly asked to the manufacturing company associates that were interviewed (" * " indicated the question to be only applicable for asking towards manufacturing related interview samples). Associates HQ, SS, AN, ER1, ER2 & ER3 had various answers with regards to this. Associate HQ emphasised about how they have been inventing different products over the years based on the changes in the industry. He stated how a shift into electric driven products, as alternative to combustion driven models, are to be noticed. He mentioned social groups (such as friends) starting to give importance to shared ownership among devices, where digital applications could help to share information about devices owned by a social group. He also mentioned a shift in the customer behaviour to start preferring to rent things rather than buying devices. Thereby, it was mentioned that digital application within devices could be used to gathered and send user (performance) data to the factory, which could be further used to provide services and for product development. Another topic of interest which was addressed to enhance the efficiency of production was Design for Automatic Assembly (DFAA),
which is seen as the future challenge. Here within the inter-connectivity of production machines is very important.

Associate AN said that there was still scope for physical product development within his industry. He stated how physical product development could have possibly become saturated for the automotive industry but there was still scope for physical product development within the other industries. Associate ER\textsubscript{1} seemed to agree with the statement by HQ of shift of usage by customers to battery powered machines. To extend on this the mechanics of battery-based power products, with an electrical engine, consist of a lesser components and complexity as a combustion engine.

On the other hand, ER\textsubscript{2}, ER\textsubscript{3} and CN agreed that the majority of mechanical inventions are saturating. ER\textsubscript{3} stated that the major inventions have been around since the late 70’s and thereby a shift in change was desperately needed. ER\textsubscript{2} stated that a change in plan was absolutely needed as workers tend to follow a conventional plan now and hence are not engaged to invent anything new.

To summarize, the shift towards the battery powered machines is noticed within the different manufacturing firms. The shift would probably seem hard in the short term but would be easier and beneficial in different ways in the long run. Some of the manufacturers believe that there is still scope for new product development as innovations are being fostered too. While some of them notice and accept the saturation point of physical product development that has been noticed over the years. A change in approach is needed. The statements made by most of the associates when analysed along with literature shows that fostering innovation and development should be encouraged.

Q2) How far have you reached with lean saturation? *

Associate HQ stated lean is described and defined in the USA and they do recognize certain principles as use them as a toolbox to adopt best practices from. He considers that there is a lot more one could do. Associate AN clearly stated that the medical devices industry is about ten to fifteen years behind with respect to more progressive industries, this caused by the limitation of the requirement to stick to strict legal compliances. He stated that there is still a lot more to do with lean, while agile principles and values should
also be considered. All the participants from ER stated that they didn’t notice a point of
lean saturation and that there was a lot more for them to still adopt, consider and practice.

Thus, all the manufacturing companies said that there was still a lot more of lean
principles that could be adopted. Agile and lean are like siblings and hence a clear
saturation point cannot be considered. We would say that lean and agile go hand in hand.

Summarizing

The importance of digital applications of traditional physical products is being recognized
by the industry, hence putting less emphasis on the physical product development and
more on digitalization and orientation based on digital application. Thereby the shift
towards more sustainable, battery driven products is identified, which will simplify the
mechanical composition of most products.

The industry does not show to be done with improving based upon Lean principles. Most
interviewed associates seem to identify being busy trying to get the best out of what they
do by the usage of Lean principles. Thereby agile was not always directly understood as
next step. The interviewed associates seem currently to give more importance towards
Lean, suggesting that they do not have the impression the saturation point, by
improvements based on Lean, is about to be reached.
5.2 Interpretation of the agile manifesto examination results

The core values and principles of the agile manifesto were analysed and evaluated based on the responses collected from various interviews.

5.2.1 Evaluating Agile core values (Q3):

In order to evaluate the core values, icons had been assigned to the codes as shown in Table 5-1. They had been utilized to map for each interviewee up to what extent they are familiar with the core values of agile. Icon had been used in order to enhance visibility while analysing. Thereby four different colours have been used to distinguish the industries the samples represent. Each colour is connected to one specific industry classification. Manufacturing was given the colour grey, consultancy the colour green and IT the colour red. Thereby, there was one company which classified for both IT and consultancy, which had therefore been referred to as “hybrid” and was given the orange colour.

Table 5-1: Icons given to the codes

<table>
<thead>
<tr>
<th>Codes</th>
<th>Icons</th>
<th>Industry classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>CC:</td>
<td>●</td>
<td>IT / Consultancy (hybrid)</td>
</tr>
<tr>
<td>HQ:</td>
<td>●</td>
<td>Manufacturing</td>
</tr>
<tr>
<td>LB:</td>
<td>●</td>
<td>Consultancy</td>
</tr>
<tr>
<td>SS:</td>
<td>▲</td>
<td>Manufacturing</td>
</tr>
<tr>
<td>FD:</td>
<td>▲</td>
<td>Consultancy</td>
</tr>
<tr>
<td>AN:</td>
<td>■</td>
<td>Manufacturing</td>
</tr>
<tr>
<td>ER1:</td>
<td>+</td>
<td>Manufacturing</td>
</tr>
<tr>
<td>ER2:</td>
<td>★</td>
<td>Manufacturing</td>
</tr>
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<td>⭐</td>
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</tr>
<tr>
<td>ER4:</td>
<td>⭐</td>
<td>Manufacturing</td>
</tr>
<tr>
<td>CN:</td>
<td>●</td>
<td>IT</td>
</tr>
</tbody>
</table>

Source: Own table

Once the icons were assigned, the analysis could start. For each core value a scalebar, from left to right, had been made to map the results of the core value examination for all interviewees into one chart. The distinction of colours had been used to compare the manufacturing industry with the IT and consultancy (and hybrid), whereas the IT and consultancy should have more experience with the agile core values and therefore it was used as a benchmark. The results of all the four core values mapping on a chart are presented in Figure 5-1.
Figure 5-1: Analysis of the four core values of the Agile Manifesto
Source: Own figure
**Agile (values) consciousness**

The questions asked regarding the agile core values helped to gain a perspective of how those values were perceived by the different interview associates. By keeping the industry classification in mind while doing the analysis of the responses it turned out that the element of consciousness regarding the values differed depending on the industry classification. Whereas the (agile) consultancy samples showed full awareness of the core values of agile were being examined, where the IT companies turned out to be strict in using them, but not always showing awareness of those being connected to the agile philosophy. Furthermore, the manufacturing samples showed a more pragmatic way of thinking, but unconsciously sometimes still giving importance to the right tendency regarding the values.

**Overall comparison of the manufacturing industry with the benchmarks**

When comparing the different industries, the benchmark companies scored relatively high as expected them of being the reference/benchmark. From the results of the mapping of Q3.1, Q3.3 and Q3.4 could be seen that the manufacturing samples appeared to give less emphasis to the values to the right side (which is direction wise on the left side in the charts). Remarkable is how the manufacturing industry samples distinguish themselves by the second core value in comparison to the benchmarks.

**(Q3.1) Importance of individual interactions**

As mentioned before the manufacturing industry has the tendency to be connected to a pragmatic way of thinking and working. The manufacturing industry samples show to give less importance to individual interactions than to processes and tools. The benchmark companies appeared perfectly to be aligned with what they are supposed to give importance to. What the manufacturing industry could learn from this is that the reality is not always so close to theory as expected, requiring communication and interaction to compensate. This not always everything be opted and covered by processes and tools, creating awareness of such could enhance the efficiency of work. Thereby the medical devices industry (AN) associate pointed out the (proposed) potential delay by the presence of (an overuse of) processes and tools. Processes and tools are perceived as providing (the perception of) control (associates SS, AN, ER₁, ER₂, ER₃ and CN).
(Q3.2) Manufacturing industry giving relative high importance to working software
What is remarkable that the benchmark samples did not show to score relatively high on Q3.2 in comparison to the manufacturing companies. It could be concluded from this is that the manufacturing companies already tend to give great importance to working software, eliminating comprehensive documentation, even up to such an extent that they give more importance to this than the IT (software developing companies) firms themselves. Software was commonly perceived as being the preferred side. Associate AN pointed out the risk of over-usage of software, furthermore ER2 stated how the usage of working software should be oriented about their original purpose and add value to the work. Concluding that the overall the perception was that working software is preferred, but often easier said than done (FD) and the IT associates could share more insights about the complexity of this implementation. The manufacturing associates shared awareness of potential drawbacks of (over) usage of software.

(Q3.3) Applicability error of third core value towards the manufacturing industry
The core value of Q3.3 turned out to be hard to examine for the manufacturing industry samples, this since most associates were disconnected from the end customer. This is a difference in comparison to the IT industry, where the agile manifesto is established, but also for the consultancy industry associates. Whereas, the IT companies deliver software solutions directly to their end customer and where the consultancy (advisory/agile coaches) reported directly to their customers. Therefore, the applicability for the third core value of the agile manifesto is hard to examine. As there is hardly interaction between the associate working in a manufacturing firm and the (end-)customer. This could be explained by the presence bureaucratic hierarchical structure within the organization of a manufacturing firm. This had also been the reason why this question could not be answered by the interviewed associate of Sensata (SS).

Therefore, it is advisable in order to become more agile for the manufacturing firms to find a way to create a closer connection to the (end-)customers throughout the whole organization. This will enhance the awareness of the value creation by each individual within the organization, which could enhance performance and efficiency.
(Q3.4) High spread on tendency to emphasize on responding to change by manufacturers

When examining the likelihood to be responsive to change the manufacturing companies clearly appeared to be behind in respective to the benchmarks. As the Fudura (FD) associate referred to the capability of being responsive to change is showing awareness around the values you create and why, showing similarities by what Sinek (2009) proposes with the Golden Circle (Figure 2-3). This possibly can be explained by the perceived distance between the (end-) customer and the manufacturing associates as observed by Q3.3. Being more connected to the value created by the organization could possibly enhance the judgement on decisions required to adapt to changes.

5.2.2 Evaluating Agile principles (Q4):

The score on how many agile principles were into play in the work of the interviewed associates could be seen as a quantitative measure on how well the samples performed on “doing” agile.

*(Table 5-2): "scores” on usage of agile principles*

<table>
<thead>
<tr>
<th>Codes</th>
<th>Agile principles (Q4)</th>
<th>Industry classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>CC:</td>
<td>10/12</td>
<td>IT / Consultancy (hybrid)</td>
</tr>
<tr>
<td>HQ:</td>
<td>10/11</td>
<td>Manufacturing</td>
</tr>
<tr>
<td>LB:</td>
<td>9/10</td>
<td>Consultancy</td>
</tr>
<tr>
<td>SS:</td>
<td>7/12</td>
<td>Manufacturing</td>
</tr>
<tr>
<td>FD:</td>
<td>11/12</td>
<td>Consultancy</td>
</tr>
<tr>
<td>AN:</td>
<td>10.5/11</td>
<td>Manufacturing</td>
</tr>
<tr>
<td>ER₁:</td>
<td>9/12</td>
<td>Manufacturing</td>
</tr>
<tr>
<td>ER₂:</td>
<td>9/12</td>
<td>Manufacturing</td>
</tr>
<tr>
<td>ER₃:</td>
<td>8/11</td>
<td>Manufacturing</td>
</tr>
<tr>
<td>ER₄:</td>
<td>8/12</td>
<td>Manufacturing</td>
</tr>
<tr>
<td>CN:</td>
<td>9/12</td>
<td>IT</td>
</tr>
</tbody>
</table>

*Source: Own table*

Average percentage of score on principles by manufacturing references: 75%
Average percentage of score on principles by IT references: 83%
Average percentage of score on principles by consultancy references: 91%

The conclusion of this is that the manufacturing industry does already make use of principles incorporated in the agile manifesto. Might this be consciousness or unconsciousness, the overall perception from us as experts was that most principles were met unconsciously. However, what can also be seen is that they lag behind on the IT
reference industry, as could be expected. In order to generalize this the samples within this study are quite limited, therefore another research should be proposed in order to disprove or confirm those outcomes.

5.3 Perceived advantages and disadvantages with regards to an agile way of working.

The interview results show the (summaries of) transcripts of the answers to the questions related to the advantages and disadvantages of the agile way of working from a leadership point of view. Here below the relevant outcomes are summarized and discussed in connection to the theory.

Q5) What are the main advantages of working agile from a leadership point of view?

The advantages of agile way of working are mainly:

1.) A progressive mindset (associate CC, FD and LB)
   a. Servant leadership: a team which can function independently from their leader. Individuals are also empowered to self-organize, this with respect to approaching their tasks, but also for team formation (associates CC and FD).
   b. Empowerment: handing people the opportunity to take their own decisions, which allow them for potential growth (associate CC, LB, ER₁ and AN). Mistakes could happen, but they should be taken as opportunity to learn and improve (associates CC, LB and ER₃).
      i. Autonomy
      ii. Responsibility
2.) It encloses a positive attitude towards acceptance and adaptiveness towards things you cannot control. (associate FD and ER₂)
3.) Being oriented and more transparent common ground on where the values is being created, which gives more clarity about expectations (associates ER₃, FD and CC).

Those three elements had been the main advantages taken away from the interview associates. Empowerment could be used to centralize the value creation around the individuals which are the experts in their field of work. The first core value encloses
communication, which stimulates transparency and a cross-functional learning experience promoting the team’s synergy, which are also important elements in an adhocratic organizational culture. Whereas empowerment is also connected to a transformational leadership style. Within a transformational style of leadership, importance is given to a value system on being just and working with integrity. On the other hand, being a servant leader is when one acts like a gardener for the team. Associate (CC) stated that, you need to support your team being a servant leader just as a gardener. He further mentioned about a servant leader being ready to nurture his people in the best way possible. Associates (FD & ER2) mentioned how being agile would help you adapt to the things that you cannot control. By being flexible and quicker one would be able to deliver high value. Creating value for the end customer is essential within an agile way of working as suggested. The associates ER3, FD and CC suggested a transparency factor which is crucial and important within an agile team to create a certain dynamic and open culture with efficient communication and cooperating, ultimately being synergized to the best matter. The manufacturing interview associates appeared to be more constrained to functioning within their “own island” (department/section/division) in contrast to acting as a team. The consultancy firms shared that changing this constrained way of thinking as being one pillar of their work and why they get hired to coach. Constrained thinking in a scope provides simplicity. However, it should be aimed for to find simplicity in a wider scope, this not by thinking in a constrained area but simplicity achieved by a disciplined way of organizing information, handling priorities and transparency throughout the organization attached. The IT associates seems to be good at working in this way, with a team philosophy and having team formation based upon self-organization and their work stimulated by empowerment throughout their organization.
Q6) What are the disadvantages of working agile from a leadership point of view?

Potential drawbacks, or disadvantages, of agile way of working are:

1.) It does not suit everyone:
   it will possibly be hard to adapt by the ones who are used to a bureaucratic organizational culture and for leaders which are used to lead by a transactional leadership style (CC and LB).

2.) (short-term) Transparency:
   Transparency is a key pillar in the agile way of working. This means also being transparent about vulnerabilities, which is not always appreciated by everyone. Generally, within a bureaucratic organizational culture with leaders that follow transactional styles are not likely to have incorporated transparency as an important element to make things work. Associate (FD) stated that becoming transparent make transactional leaders vulnerable to their feeling of perception of losing control and might force them to drop their pride and ego aside.

3.) The feeling of loss of control was an expected disadvantage to be perceived by the (middle-) management according to multiple associates (CC, LB, FD, ER2, ER4 and CN).

4.) Associate FD critically discussed this by mentioning that “loss of control” was more as a perception of “loss of control” than an actual loss of control. He addressed the perceived “control” as not being actual control but an imagination of control, this by ignoring the reality, which would often give one a feeling of being in control, in contrast this attitude shows a huge lack of power to adapt.
   a. Harder to measure progress (ER4).

   The perceived loss of control was attributed to the complexity of measuring progress when being more adaptive.

To conclude this the main disadvantages are the perception of loss of control and becoming transparent. We believe that the lack of transparency could catalyse the perception of lack of control. In most cases projects and the world are not predictable, therefore it should be accepted that the uncontrollable cannot be controlled. When transparency is achieved a team could approach a certain problem more efficient by a
mutual common understanding about the value creation this in contrast to less aligned/synergized team.

5.4 Lessons learned: barriers and challenges for adopting an agile way of working.

The interview results show the (summaries of) transcripts of the answers to the questions related to experience of the interviewed associates, discussing the barriers and challenges of the agile way of working. Here below the relevant outcomes are summarized and discussed in connection with the knowledge gained enclosed in the theoretical framework.

Q7) What are the biggest organizational barriers according to you that needs to be changed to move into an agile way of management/leadership?

In order to adopt an agile way of working the main organizational barrier perceived had been change management (LB and ER₂). This had been found to be challenging for multiple stakeholders (ER₂, ER₃ and ER₄) throughout an organization, but especially finding a way to change the middle management had been addressed to as the most challenging part (CC, LB, FD, ER₂, ER and CN). As the problems why those stakeholders face difficulties have been discussed and addressed by Q6.

Thereby, the HQ associate addressed the preparation towards the future of Design for Automatic Assembly (DFAA) to be a challenging subject of matter, which could possibly be driven by working in an agile way.

Q8) What are the biggest concerns as a leader that you have faced while implementing agile way of working?

Q8.1) How did you manage them?

The biggest concern had been pointed out to be the middle management (see also Q7). First, actions to eventually adopt an agile way of working should be decided upon to be prioritized (HQ). Then time should be allocated to train, educate and experiment with the agile way of working (CC), this in order to achieve mindset alignment (LB).
Q9) Are you currently working in an agile way?

Q9.1) (continue) if yes: Have you also worked in a non-agile way before (i.e. conventional way)?

Q9.2) (continue) if yes: what steps did you take while moving from the conventional way of working to the agile way?

The outcomes of Q9 turned out to be not relevant, most to be expected outcomes had already been covered while asking previous questions and will not give new ideas or perspectives, hence we do not discuss the outcomes of Q9 furthermore.

Q10) How did you manage the people who did not believe in the agile way of working and how did you manage the transition?

Try to get an understanding of the ones who embrace the change and the ones who would not want to change. Then focus on the ones who want to change (early adopters) (CC, ER2). Discuss and evaluate the outcomes of initiating this change with them to create and understanding of its value (CC, LB, FD and CN). When resistance is acquired this indicates that the leader of the change has not prepared well enough for implementation (ER2). Then a step back should be taken and their competences should be analysed into more depth in order to create an understanding of the benefits for them (ER2, LB, FD and CN). This can then be used to create an understanding of how this creates value and what benefits it provides.

Q11) Do you have any questions or final thoughts for us?

We listed the responses from the interviewees to this question from which the relevant ones are discussed here. Most of them said that it was an interesting topic of research as it was relatively new. Companies found it difficult to imply all the values and principles of agile, however showed to be aware about the advantages and positive outcomes it could bring.

Associate (SS) spoke about how industry 4.0 was coming up with a boom and that it could have a positive effect towards having organizations to adopt an agile way of working. Associate (FD) had various thoughts to share with us. He mentioned that a company should first create an awareness about what creates value and the reasons of why one needs to create value. Once an awareness is transpired it is easier for the change to take place. He further stated that being agile is about being adaptive to reality. Being in
constant touch with your customers and binding with them is an initial step towards an agile mindset. Associate (ER1) said that he sees a potential for an agile way of working within the manufacturing industries and truly believes that both lean and agile are not conflicting terms rather they complement each other.

To conclude, we strongly believe that educating employees about the benefits of agile and at the same time making them understand about the value it would create would be the best way to initiate the change that is required. Heralitus, a Greek philosopher once quoted “Change is the only constant” (Goodreads, 2019). Change would happen very often, it is up to us to have ourselves prepared for it. Creating an environment that supports an agile mindset to create value would facilitate this process of change.

5.5 Lean and Agile as siblings

During the interviews with the several manufacturing interview associates (HQ, AN, ER1 and ER2) the discussion arose about the agile way of working being a substitute for Lean. Already pointed out by ER2 and AN: Lean and the agile way of working should not be perceived as such. Lean and an agile way of working can go hand in hand, they can act and serve as siblings simultaneously.

When analysing and comparing the theory of Agile way of working and Lean it can be noticed that the twelve principles of the agile manifesto shows similarities with the Lean principles as shown in Table 5-3.

Table 5-3: The agile principles focus points.

<table>
<thead>
<tr>
<th>Principle Nr.</th>
<th>Agile principles focus:</th>
<th>Attention paid to within lean?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.)</td>
<td>Customer satisfaction?</td>
<td>Yes; value creation centralized around client</td>
</tr>
<tr>
<td>2.)</td>
<td>Embracing changes?</td>
<td>-</td>
</tr>
<tr>
<td>3.)</td>
<td>Speed delivery?</td>
<td>-</td>
</tr>
<tr>
<td>4.)</td>
<td>Collaboration?</td>
<td>-</td>
</tr>
<tr>
<td>5.)</td>
<td>Empowerment?</td>
<td>-</td>
</tr>
<tr>
<td>6.)</td>
<td>Effective communication?</td>
<td>-</td>
</tr>
<tr>
<td>7.)</td>
<td>Good metrics?</td>
<td>Yes; 5S to standardize work</td>
</tr>
<tr>
<td>8.)</td>
<td>Steadiness?</td>
<td>Yes; purpose to create constant flow</td>
</tr>
<tr>
<td>9.)</td>
<td>Operational Excellence?</td>
<td>-</td>
</tr>
<tr>
<td>10.)</td>
<td>Simplicity?</td>
<td>-</td>
</tr>
<tr>
<td>11.)</td>
<td>Self-organization?</td>
<td>-</td>
</tr>
<tr>
<td>12.)</td>
<td>Continuous improvement?</td>
<td>Yes; key principle of Lean DMAIC</td>
</tr>
</tbody>
</table>

Source: own table
When we now reorganize the principles, which are left over Table 5-4 can be made.

**Table 5-4: the eight Agile principles not incorporated in Lean**

<table>
<thead>
<tr>
<th>Principle Nr.</th>
<th>Agile principles leftover:</th>
<th>Subjects</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.)</td>
<td>Embracing changes?</td>
<td>Attitude</td>
</tr>
<tr>
<td>3.)</td>
<td>Speed delivery?</td>
<td></td>
</tr>
<tr>
<td>9.)</td>
<td>Operational Excellence?</td>
<td>Organizational</td>
</tr>
<tr>
<td>10.)</td>
<td>Simplicity?</td>
<td></td>
</tr>
<tr>
<td>4.)</td>
<td>Collaboration?</td>
<td></td>
</tr>
<tr>
<td>5.)</td>
<td>Empowerment?</td>
<td>Social</td>
</tr>
<tr>
<td>6.)</td>
<td>Effective communication?</td>
<td></td>
</tr>
<tr>
<td>11.)</td>
<td>Self-organization?</td>
<td></td>
</tr>
</tbody>
</table>

*Source: Own table*

Subsequently, the leftover principles can be connected to a certain subject, where no attention is being paid to within Lean. Embracing changes has to do with *Attitude*, which is a key element for adaptiveness in an agile mindset. Furthermore, speed delivery, operational excellence and simplicity have to do with how a manufacturing process is organized and are *Organizational*. The most remarkable leftover principles are enclosed in the *Social* ones, which have to with expected values related to interaction and communication within a team.

Except for the agile principles within the *Organizational* subject the principles within the other subjects; *Social* and *Attitude*, have not been paid attention to within the theory of Lean. Therefore, it can be said that the adaptation of an agile way of working could be a great extension to Lean.
6. Conclusion

This chapter contains the conclusion of this research. This is done by first answering the three sub-research questions resulting in an answer to the main research question.

The purpose of this research was to identify how manufacturing companies adopt the agile way of working, this in order be prepared for the agile era. Formulated in the main research question (main RQ): “How to lead the change towards a more agile way of working in the manufacturing industry?” This has been approached by aiming to find answers towards the sub-research questions RQ1, RQ2 and RQ3. First, a conclusive description of the answers to those questions will be given in order to finally answer the main RQ.

RQ1: “Has leadership been changed/adapted by the need for a more agile way of working (and how)?”
Currently, the manufacturing industry does not seem to recognize the importance of an agile way of working yet. However, they seem to share values and have already adopted multiple principles from the agile manifesto, this is a result of their focus on Lean Manufacturing. Leaders within the manufacturing industry, especially the middle-management have not yet recognized or understood the importance of an agile way of working. On the other hand, companies from the manufacturing industry seem to recognize and verify the trends introducing the agile era, whereas they indirectly suggest to recognize the importance to become more adaptive. Thereby, the manufacturing companies tend to fall behind following agile practices in comparison with the IT and (agile) consultancy industries as benchmark references.

RQ2) “What are the advantages and disadvantages for a more agile way of working?”
The power of an agile way of working is enclosed within the mindset and culture of an agile way of working. An agile way of working is oriented towards being adaptive and reactive towards the unknown, by accepting that certain uncertainties will always be present. In order to be able to provide this attitude of acceptance, a progressive mindset and transparency are highly essential. A progressive mindset would include empowerment and should be led by a servant leadership style, this in order to promote
self-organization, autonomy and at the same time responsibility. The combination of a progressive mindset and transparency throughout an organization, could ensure the people within this organization to be more oriented towards where the value is being created.

Potential drawbacks of an agile way of working could be the perception of loss of control, which is especially perceived by the middle-management. Thereby, it might give difficulties for individuals to get used to the required transparency, this mainly because this might reveal their vulnerabilities.

**RQ3) "What are the barriers and challenges involved for (adapting to) an agile way of working?"**

A big challenge is change management as there are multiple stakeholders involved throughout an organization. The middle-management seem to be the major bottleneck towards the adaptation towards a more agile way of working. This can be explained by their feeling of loss of control. The biggest challenge is to create awareness and convince the middle-managers about the value which could potentially be created by an agile way of working. Furthermore, individuals who are used to interact with or by a transactional leadership style might face more difficulties adapting an agile way of working.

**Main RQ) “How to lead the change towards a more agile way of working in the manufacturing industry?”**

In order to successfully adopt an agile way of working within the manufacturing industry, it is essential to overcome the resistance of change, this especially for the middle-management. This could be achieved by creating awareness about the value the practices of an agile way of working could create. This could be done by explaining the tools and values of agile as an extension to Lean principles and practices, which will help to point out the benefits. Furthermore, when this has been achieved, experimenting could be started by using the tools and processes enclosed within an agile way of working (“doing agile”). When resistance is encountered, a step back should be taken and attention should be paid to the ones who recognize the value of an agile way of working. By “doing agile”, “being agile” could be achieved, reaching the most powerful element of an agile way of working; having an agile mindset and culture (Figure 2-6).
7. Discussion

In this chapter the outcomes of this research are being discussed. Firstly, by addressing the limitations of the research that was carried out. Thereafter, possibilities for future research are being discussed.

7.1 Limitations

Our research had many constraints when it came to conducting interviews and contacting the right participants. However, we were able to accumulate valuable and maximum information from our participants, evidently a higher sample size from the manufacturing side and their varying responses will result in more data where upon a more precise conclusions could be drawn. As all the interviewees were only from Sweden and Netherlands, the diversity of the data collected was limited from a demographic and cultural perception.

The perception of the outcome of the middle-management being the hardest to convince about an agile way of working is interesting to discuss. Hereby, it is good to realize that most of the interview associates, sharing this outcome work under such a middle manager. Therefore, it could be their perception of their middle-manager being resistant towards accepting an agile way of working. This does not necessarily have to be true, however we have not been able to confirm or disprove this by talking to the (middle) managers, of the interviewed associates, in regards to this. It is also reasonably imaginable that those middle-managers will give the impression to be in (and maintaining) control, as this is being part of their job, hence it is not likely that they will be transparent about embracing ideas which might suggest or imply a perception of loss of control.

The outcomes of this research are based on and tailored for bringing out an advice towards organizations within the manufacturing industry. The outcome of this research could be used in a wider spectrum of industries. The only limitations towards this is the suggestion of explaining the values of agile by connecting them to lean as an extension, which might not always be understandable for other industries. This since they might not be used to work with, or be familiar to the Lean practices and principles.
7.2 Future research

For future research we would suggest a wider study about usage of the values and principles form the agile manifesto within the manufacturing industry, which could be done with a (more) quantitative approach. Hereby, it would be suggested to perform a survey, which could help to craft larger amount of data within a relatively short time span. This could provide a more accurate and precise measure about the “agile status” of the companies within the manufacturing industry.

Also, it could be suggested to conduct a case study, as this had been originally the ambition for this research. This could help to create an even deeper understanding of the problems attached when aiming to adopt the agile way of working. Ultimately, it would be beneficial to perform multiple case studies with all the actors within a certain supply chain, branching down from OEM to the lowest actor within the chain.

A more evident in-depth research to provide more evidence for the suggested incoming agile era, could confirm the relevance of this study. This could be done by a historical and archival studies of researching about the product development of a variety of products.

Since this study was limited to sample companies based in Sweden and the Netherlands, a copy of this research within other demographical areas could possibly provide new insights and findings. This especially taking into consideration that the Swedish and Dutch cultures contain a lot of similarities, whereas there are more contrasting cultures within other demographical areas.

Finally, the usage of Agile as an extension of Lean could be interesting and study more focussed comparing both principles could possibly provide new insights and thereby be used to create awareness to catalyse the acceptance of an agile way of working within the manufacturing industry.
8. Reference List


## Appendices

<table>
<thead>
<tr>
<th>Appendix 1 – Interview Plan</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appendix 2 - Interview results of evaluating the Agile Manifesto</td>
<td>17</td>
</tr>
</tbody>
</table>
APPENDIX 1

Interview Plan
# Interview plan

[CENTER] [FILL IN DATE HERE]

## Opening Questions

**General questions**

- Company name (if anonymity is not required):
- Industry:
- What is current position in the company?
- What is your background?

## 1 Identify the need for agile way of working

1.1) How far have you reached with the physical product development saturation? *
1.2) How far have you reached with lean saturation? *

## 2 Identify agile way of working, evaluating the agile manifesto

### 2.1 Identifying Agile core values

2.1.1) Would you recommend/prefer emphasis on individual interactions OR processes & tools to ensure work gets done?

*select one:  Individuals and interactions  processes and tools*

2.1.2) Would you recommend/prefer emphasis on comprehensive documentation or working software to ensure a process to be done/followed accordingly?

*Select one:  Working software  comprehensive documentation*

2.1.3) Would you like to prefer putting emphasis on collaborating with your customer or on negotiating contracts?

*select one:  Customer collaboration  contract negotiation*

2.1.4) Would you prefer to work according to following a plan or put emphasis on responding to changes? Done!

*select one:  Responding to change  following a plan*

* questions only applicable for manufacturing companies.
2.2 Identifying Agile principles

2.2.1) What does customer satisfaction mean for you (in your work)?
Customer satisfaction?  Y / N

2.2.2) How do you handle changes in projects?
Embracing changes?  Y / N

2.2.3) How is your delivery process?
Speed delivery?  Y / N

2.2.4) (How) do you collaborate with different departments?
Collaboration?  Y / N

2.2.5) What does empowerment mean to you (in your work)?
Empowerment?  Y / N

2.2.6) How do you generally communicate with your team?
Effective communication?  Y / N

2.2.7) What is your core measure of progress?
Good metrics?  Y / N  (if answer is “working software”, then Y)

2.2.8) (How) do you manage your development pace in a project? (“lagom” or varying?)
Steadiness?  Y / N

2.2.9) How often do you check your technical resources? (Continuous/ Once in a while?)
Operational Excellence?  Y / N

2.2.10) How would you classify your current workflow to be? (Simple/ Complex?)
Simplicity?  Y / N

2.2.11) Do you promote self-organized teams?
Self-Organization?  Y / N

2.2.12) Do you have ongoing feedback sessions?
Continuous Improvement?  Y / N
3 Pros & Cons

3.1) What are the main advantages of working agile from a leadership point of view?
3.2) What are the main disadvantages of working agile from a leadership point of view?

4 Barriers and challenges (for agile way of working)?

4.1) What are the biggest organizational barriers according to you that needs to be changed to move into an agile way of management/leadership?
4.2) What are the biggest concerns as a leader that you have faced while implementing agile way of working?
  3.2.1) How did you manage them?
4.3) Are you currently working in an agile way?
  3.3.1) (continue) if yes: Have you also worked in a non-agile way before (i.e. conventional way?
  3.3.2) (continue) if yes: what steps did you take while moving from the conventional way of working to the agile way?
4.4) How did you manage the people who did not believe in the agile way of working and how did you manage the transition?

Closing questions
- Do you have any questions or final thoughts for us?
- Do you have any suggestions or other suitable people that we might contact in regards to this?

Δ Thank you! Δ

After the interview our contact details would be given to the interviewee. This in order to ensure that they can personally reach out to us to ask questions, make suggestions or contact us if there is any content which they would like to exclude from the interview. The interviews (questions) will not have the intention to contain sensitive questions/answers. However, this can be perceived differently by the interviewees, therefore we ensure this opportunity is there.

The interviewee should realize (parts of) the interview results might be published in the public domain, i.e. as academic Master thesis as common in Sweden. The opportunity to remain anonymous, for any (non or given) reason, is given. The interviewee can let us know during or alternatively after the interview, via the contact details provided. This request must be received before 10th of May 2019 to be sure this could be processed within the final draft of the thesis.

Intention declaration: All interview content will be treated confidentially and only the elements relevant to our research purpose will/might be included in the summary of the transcripts.

Hanne Brinks E: brha18lo@student.ju.se
Prince Johnson E: jopr18ke@student.ju.se
APPENDIX 2

*Interview results of evaluating the Agile Manifesto*
Current status of agile way of working: Are the values and principles from the agile manifesto used?

Identifying Agile core values (Q3):

Q3.1) Would you recommend/prefer emphasis on individual interactions OR processes & tools to ensure work gets done?

CC: Select one side: **Individuals and interactions**  processes and tools
  Interactions are important. On the other hand planning, structure and discipline are extremely necessary in agile.

HQ: Select one side: **Individuals and interactions**  processes and tools
  He said he expects his engineers to be independent and structured. He would support and discuss with the people working under him as he believes that it would help both parties to reach a higher point. He wants them to question if there is always a better way of working. The guidelines should be respected, but when someone has a different opinion or improvement idea this discussed in a team discussion.

LB: Select one side: **Individuals and interactions**  processes and tools

SS: Select one side: **Individuals and interactions**  processes and tools
  To optimize we set a meeting a make an A3 overview, whereas there is not a specific process then yet which we follow to start from. Then we dig into the core reason to identify the problem.

FD: Select one side: **Individuals and interactions**  processes and tools
  The agile manifesto is clear about this, the attention should be paid on individual interactions. It is very easy to say this, but hard to live by those values in practice. It is part of my job to bring up those values and make the team stick to them. Agile manifesto is about valuing processes and tools but bringing more attention and giving more importance to individuals and interactions.

AN: Select one side: **Individuals and interactions**  processes and tools
  Processes and tools can delay things, individual interactions are given high importance.

ER1: Select one side: **Individuals and interactions**  processes and tools
  Start with ensuring processes and standards, to make it better for everyone. Tends to lean towards the “processes & tools” side.

ER2: Select one side: **Individuals and interactions**  processes and tools
  In between, this is about leadership. The best of both is needed to ensure that work is done well (Management). You need to have a manager to make sure you use the processes and tools (accordingly). He connects the individual and interactions side with what management is, which is referred to as being important.

ER3: Select one side: **Individuals and interactions**  processes and tools
  In the middle, gives preference to training with face to face contact. Processes & tools should form the basis, but you should never skip over the personal interactions.

ER4: Select one side: **Individuals and interactions**  processes and tools
  Both equally important.

CN: Select one side: **Individuals and interactions**  processes and tools
Would definitely prefer individual interactions, but then processes give you a guideline. Talking to people and having discussions are really important.

Q3.2) Would you recommend/prefer emphasis on comprehensive documentation or working software to ensure a process to be done/followed accordingly?

CC: Select one side: Working software, comprehensive documentation
It depends! One should question every action. Reason (Why/How/What) the things you do and make sure it creates more value.

HQ: Select one side: Working software, comprehensive documentation
Both, but working software is preferred. It is also recommended to not over-document, this distracts and makes it at the end harder to develop the right software.

LB: Select one side: Working software, comprehensive documentation
Hard question, because I can't say there will be an “or” for this question. You can have old documentation, but new software. When looking at this from the “agile way” then you should reduce the amount of documentation, because that is commonly waste: no one reads them and most importantly, no one updates them. Software can help for this. The ultimate is finding the right balance, depending on what is required by the market.

SS: Select one side: Working software, comprehensive documentation
Working software is preferred.

FD: Select one side: Working software, comprehensive documentation
Obviously working software over comprehensive documentation, however this is also easier said than being done.

AN: Select one side: Working software, comprehensive documentation
Of course, software would be preferred over documentation. Sometimes software is overused and only time-consuming processes should be substituted by the use of software.

ER1: Select one side: Working software, comprehensive documentation
Fully dependant on IT. However, documentation is the main input/foundation for this software.

ER2: Select one side: Working software, comprehensive documentation
Working software is useful to reduce the time of the leader, but the digitalization should have a purpose, it should add value to (efficiency of) the work. Still a journey to make, digital boards will reduce time involved.

ER3: Select one side: Working software, comprehensive documentation
Every project has a certain process, with documentation attached which should be filled out and followed up during the project. Sometimes we might be lacking on this follow up, when a project falls behind, it is most likely that the documentation gets lower priority and therefore lags behind. Prioritizing work requires documentation.

ER4: Select one side: Working software, comprehensive documentation
Software is preferred, easier to keep it updated and such.

CN: Select one side: Working software, comprehensive documentation
Depends, need some support system but at the same time it needs documentation at times.
Q3.3) Would you like to prefer putting emphasis on collaborating with your customer or on negotiating contracts?

CC: Select one side: Customer collaboration contract negotiation
Our vision is to be our customers most closest partner.

HQ: Select one side: Customer collaboration contract negotiation
Prefers close customer collaboration, however as production manager he is quite some steps apart from the end customer. He and the development department will hear via other departments what the end customer wants. With all steps of communication in between he recognizes the risk of interpretations of everyone in the communication chain

LB: Select one side: Customer collaboration contract negotiation

SS: -
Refers to this as not being in his scope of work.

FD: Select one side: Customer collaboration contract negotiation
Customer collaboration, because then you can touch upon and discuss the why about what you do.

AN: Select one side: Customer collaboration (middle) contract negotiation
He believes in relationship Management.

ER1: Select one side: Customer collaboration contract negotiation
We want interaction and discuss consequences, so customer collaboration.

ER2: Select one side: Customer collaboration contract negotiation
He said that the respective teams should identify their customers. They believe in discussions among the various parties involved and hence definitely customer collaboration.

ER3: Select one side: Customer collaboration contract negotiation
Now, contracts but more of customer collaboration. Collaboration by nature, but a contract behind (the scenes) to facilitate agreements.

ER4: Select one side: Customer collaboration contract negotiation
Collaboration is preferred, the marketing department handles the contracts, export services sometimes have to do with this.

CN: Select one side: Customer collaboration contract negotiation
We discuss with customer based on priorities.
Q3.4) Would you prefer to work according to following a plan or put emphasis on responding to changes?

CC: Select one side:  
We learn throughout the process of the project and in my personal opinion it is really important to respond to change.

HQ: Select one side:  

LB: Select one side:  Setting up short term goals are really important. I would prefer following a plan but at the same time respond effectively to changes.

SS: Select one side:  

FD: Select one side:  Responding to change is where it is all about. When you are aware of the “why” about what you do and where you create value, then you will be good at understanding the impact of a change and how to prioritize the changes.

AN: Select one side:  Depends on what and how the project/product it is. It is somewhere in between.

ER1: Select one side:  Too responsive to change and hence sometime creates problems (for others).

ER2: Select one side:  We struggle with change. We need to do something else to be prepared for the future. Currently we tend to have the emphasis in between (bit following a plan bit responsive), but with the ambition to become more responsive to change.

ER3: Select one side:  Adaptive and agile is what we prefer, but we also aim to stick to the game plan, this in order to prevent losing time because of unnecessary changes. It prevents spending too much time on changing setups in the assembly line for example. Therefore, we aim to freeze the plan for a day, or half a week or even a week, this to prevent being busy too much with set-up times.

ER4: Select one side:  Depends, warehouse is more about following a plan and export service is more required to adapt to changes.

CN: Select one side:  Most of the cases, you change soon. Priorities matter! Depends on the scope, time length, scope of changes, etc.
Identifying Agile principles (Q4):

Q4.1) What does customer satisfaction mean for you (in your work)?

CC: **Customer satisfaction? Y / N**
_This is extremely important to us as our vision is to be the closest partner to our customers._

HQ: **Customer satisfaction? Y / N**
_Refers to Maslow triangle, firstly the products should be safe in use. Furthermore, be comfortable to use for a longer time over the day._

LB: **Customer satisfaction? Y / N**
_It depends on the customer a handshake is done mutually. Various questions are asked and we come down to a mutual decision and hence it is very important._

SS: **Customer satisfaction? Y / N**
_The client is the most important. Basically, anything the customer comes up with related to what the sensors require, we take the challenge and try to make it happen. Even though what had been asked for seemed to be hard or impossible to achieve._

FD: **Customer satisfaction? Y / N**
_It should the centre of attention within an agile environment._

AN: **Customer satisfaction? Y / N**
_Customer satisfaction is always very high and the focus is always to create a win-win situation._

ER1: **Customer satisfaction? Y / N**
_Being (Reliable)/Predictable & Flexible, and also fair & realistic_.

ER2: **Customer satisfaction? Y / N**
_Right quality, on time and complete according to plans. Process and information of the product in estimated time._

ER3: **Customer satisfaction? Y / N**
_Show awareness of what satisfaction means for their customers, even adds this up satisfaction for his employers seen as his customer, who desire a good (instructions) and safe workplace._

ER4: **Customer satisfaction? Y / N**
_Happy with delivery and meet their expectations._

CN: **Customer satisfaction? Y / N**
_Always willing to help, being honest to the customer in regards to decisions and outcomes._
Q4.2) How do you handle changes in projects?

CC: Embracing changes?  Y / N
Yes, we work agile and hence we learn from the changes throughout the course of the project.

HQ: Embracing changes?  Y / N
When an unexpected delay is there, this hardly occurs in practice, we would try to reprioritize the resources in order to organize it in such a way that the things can be done in the time needed.

LB: Embracing changes?  Y / N
Being agile is always to embrace change. It’s a positive approach.

SS: Embracing changes?  Y / N
Depends on the change, most often the priorities are managed via and FMEA evaluation. The later in the process the change come in the more the customer will be challenged. Early in the project, or easy to solve changes we try to implement.

FD: Embracing changes?  Y / N
We aim to identify changes, by being as transparent as possible and welcome to be able to deliver the highest value as possible.

AN: Embracing changes?  Y / N
Change request/ Supplier change request, we have a decision-making matrix to make it easier.

ER1: Embracing changes?  Y / N
Changes are in the DNA of planning, plans keep failing, there are changes all the time. It is frustrating, but you should also be motivated to change and keep going.

ER2: Embracing changes?  Y / N
Now we are working with change management. In the past we sometimes just let a change come through without paying attention to the people aspects of change, we try to improve this now.

ER3: Embracing changes?  Y / N
He tends to embrace changes and sees the production workers as flexible resource.

ER4: Embracing changes?  Y / N
There is a change management request which goes through, which will furthermore walk through several steps to make the processes change according to what is required.

CN: Embracing changes?  Y / N
Priorities, planning, always required. Based on the scope of the project we adapt to changes.
Q4.3) How is your delivery process?

**CC:** Speed delivery?  Y / N
*We believe in delivering as often as possible as we have a lot of developers at our customers project locations.*

**HQ:** -

**LB:** -

**SS:** Speed delivery?  Y / N
*Since it mass production, where a lot of testing is involved and sometimes also ordering of tooling, which can take up to months, it is a rather long process. Some project will run for 1 year or a 1,5year. Certain projects can be done faster, but then it is like a copy project.*

**FD:** Speed delivery?  Y / N
*Continuous weekly delivery.*

**AN:** Speed delivery?  Y / N
*Within the medical industry it is very complicated, the volumes are generally low but the industry is highly volatile. We can’t have the right forecast always.*

**ER1:** Speed delivery?  Y / N
*Quite slow, quite long lead times, this allows for more time for changes. Our current lead time is +/- 6 months.*

**ER2:** Speed delivery?  Y / N
*We have been quicker than before, need to define more clear boundaries, limitations should be defined, set clear targets, vision and goal is needed so that progress can be made.*

**ER3:** Speed delivery?  Y / N
*To become more cross-functional is desired for us.*

**ER4:** Speed delivery?  Y / N
*There are several interfaces in the flow that might slow it down, so different steps.*

**CN:** Speed delivery?  Y / N
*We are figuring that out and trying to get better.*
Q4.4) (How) do you collaborate with different departments? (Eg. Businesspeople and developers)

CC: Collaboration? \[Y / N\]  
We collaborate with various offices in Sweden and also with a joint venture with a company in India.

HQ: Collaboration? \[Y / N\]  
Close interaction with the team and alignment through different departments.

LB: Collaboration? \[Y / N\]  
We generally do a value stream mapping to see our most important partners in a project and how maximum value can be added.

SS: Collaboration? \[Y / N\]  
Open door policy and we work with different departments together to share information and set goals. However, for example for customer contact the project manager and design engineer are more involved in that.

FD: Collaboration? \[Y / N\]  
Close collaboration with project team and business people is being done.

AN: Collaboration? \[Y / N\]  
The collaboration is in between the procurement and the facilitator which is important within the supply chain.

ER1: Collaboration? \[Y / N\]  
Among all departments working very well, we have very tight communication. Aim to prevent lots of firefighting being done, preference to develop a better strategy (in order to prevent this).

ER2: Collaboration? \[Y / N\]  
Not much as of now, but we will start doing VSM according to “swim lane analysis” soon, from June, which will require a lot of collaboration with various departments.

ER3: Collaboration? \[Y / N\]  
Project teams, collaboration between them. We have both scheduled on daily basis and ad-hoc communication. There is collaboration and communication going across to solve problems together.

ER4: Collaboration? \[Y / N\]  
Weekly meeting together with marketing, share challenges, manage staff accordingly. We have also geographically different locations (Europe, US, England, most heavy welding suppliers from eastern-Europe).

CN: Collaboration? \[Y / N\]  
Daily meetings with the development team, weekly meetings within the whole company which gives you market insights, team meetings every week. A lot of talking of course! TFS (Management tool).
Q4.5) What does empowerment mean to you (in your work)?

**CC: Empowerment?  Y / N**
*It’s the team that does the work and as a manager your job is to create an environment by giving them autonomy as well as responsibility.*

**HQ: Empowerment?  Y / N**
*Asking my employees, what would you do? Preferable that employees don’t come and ask for a decision, but that they bring up a decision and ask for permission or a critical view before going through.*

**LB: Empowerment?  Y / N**
*Thinking about things and deciding on what is best for the team in order to perform well.*

**SS: Empowerment?  Y / N**
*Not applicable.*

**FD: Empowerment?  Y / N**
*Giving the team the opportunity and authority to self-organize and to do their work. They know their own work better than anyone else.*

**AN: Empowerment?  Y / N**
*He defines empowerment, as giving both responsibility and authority at the same time. He says, “Responsibility should come with authority if all your responsibility is given, but you don’t have authority. So, you know, you literally cannot do anything of it”. So responsibility along with authority is something which he calls empowerment.*

**ER1: Empowerment?  Y / N**
*Stimulating individuals to take their own decisions, this while considering various limitations (investments, budgets, responsibility, etc.), allow to make mistakes as long as this is taken as a learning opportunity.*

**ER2: Empowerment?  Y / N**
*Make sure everyone in the company owns their actions and goals, drive actions to improve their goals. This by ensuring people are responsible for their work and improvements in their work.*

**ER3: Empowerment?  Y / N**
*To have everyone to trust their own abilities to make the right decisions, to encourage decisions and give forgiveness for mistakes.*

**ER4: Empowerment?  Y / N**
*That people get proud of their work so that they want to achieve more.*

**CN: Empowerment?  Y / N**
*On a high level, its defined how things should be. Its more specific to the individual.*
Q4.6) How do you generally communicate with your team?

CC: Effective communication?  Y / N
Quite often, we have regular meetings. We believe in having consistent meetings and recurring discussions, open door policy.

HQ: Effective communication?  Y / N
Direct personal contact every second week half an hour to evaluate how everything is going, if there are any issues and if they need any help.

LB: Effective communication?  Y / N
Prefers face to face interviews on site. Mails have chances of being misunderstood and she believes that face to face interactions are more personal and effective.

SS: Effective communication?  Y / N
Open door policy, face to face communication, meetings on regular basis and informal internal culture.

FD: Effective communication?  Y / N
Direct face to face contact with the team.

AN: Effective communication?  Y / N
They have bi-weekly and monthly meeting. He also follows an open-door policy.

ER1: Effective communication?  Y / N
Daily, every morning meetings, mixture of emails and walking around, dept meetings once a week and we have an improvement plan.

ER2: Effective communication?  Y / N
Face to Face communication, pulse meetings, daily or weekly meetings, monitor results to determine if we are on target or off, work smarter and not harder. When we are off-target face to face meetings is extra important over just sending an email.

ER3: Effective communication?  Y / N
Daily pulse meetings, Bi-weekly meetings where clear direction are set, but this could also be done ad-hoc when necessary.

ER4: Effective communication?  Y / N
Weekly meeting with management team, but also daily meetings.

CN: Effective communication?  Y / N
Face to face interactions, Verification & Validation is followed throughout.
Q4.7) What is your core measure of progress?

CC: Good metrics?  Y / N  (if answer “working software” → Y)
We have different metrics to measure progress, we are open minded and come up with the best solutions.

HQ: Good metrics?  Y / N  (if answer “working software” → Y)
Regular meeting structure, biweekly, but also monthly. Targets are set in per project.

LB: -

SS: Good metrics?  Y / N  (if answer “working software” → Y)
Certain planning, containing deliverables. An FMEA is made, expected changes in production are estimated. Furthermore, we walk during a project across several phases: development phase, pre-launch phase, etc.

FD: Good metrics?  Y / N  (if answer “working software” → Y)
“know your goal”, we have a product backlog which is maintained as ultimate transparent way to manage progress.

AN: Good metrics?  Y / N  (if answer “working software” → Y)
We have a dynamic system to check the progress according to the targets that we set and it changes throughout based on the scope of the project.

ER1: Good metrics?  Y / N  (if answer “working software” → Y)
Improvement plan, at least half an hour every week.

ER2: Good metrics?  Y / N  (if answer “working software” → Y)
Pulse meetings, daily or weekly meetings, monitor results to determine if we are on target or off, work smarter and not harder.

ER3: Good metrics?  Y / N  (if answer “working software” → Y)
Yes, we have Key Performance Indicators (KPI’s) in place to monitor our progress.

ER4: Good metrics?  Y / N  (if answer “working software” → Y)
Individual development meeting every year. On the projects we have weekly meetings on the progress.

CN: Good metrics?  Y / N  (if answer “working software” → Y)
We have some list and tools, an approach to follow for specific issues to follow. In case there is no tool or processes we list the issue to document them.
Q4.8) (How) do you manage your development pace in a project? (“lagom” or varying?)

CC: Steadiness?  
Y / N  
*Depending on the project, we make a plan and work agile in most of our internal projects.*

HQ: Steadiness?  
Y / N  
*Face to face contact on regular basis and targets are set in a constant pace.*

LB: Steadiness?  
Y / N  
*Chart an implementation plan in the beginning and make a checklist of things to do.*

SS: Steadiness?  
Y / N  
*There is a monitoring system which monitors if deliverables are managed according to project plan, ensuring a steady progress.*

FD: Steadiness?  
Y / N  
*Sprint goals are set for every sprint and are the fixed end goal, we work from sprint to sprint.*

AN: Steadiness?  
Y / N  
*Depending on the product, it is generally steady as utmost importance should be given in the development phase as its very important while in the health care industry.*

ER1: Steadiness?  
Y / N  
*It could go fast at the start and at the end it could be a rush, but mostly in between it goes slow.*

ER2: Steadiness?  
Y / N  
*It’s like KANBAN. More than one project, short and fast. Every project manager has 1-3 projects on hand. Not to much, not less.*

ER3: Steadiness?  
Y / N  
*Lot of speed in the beginning and end, buts slow in between.*

ER4: Steadiness?  
Y / N  
*The projects require goods to come in bulk sometimes and sometimes not at all. However, purchasing does not always know for which project they buy, they just have a get the goods in, which they do in a steady constant flow of purchasing.*

CN: Steadiness?  
Y / N  
*We organize a day to day team planning to help in owning a more steady state.*
Q4.9) How often do you check your technical resources? (Continuous/ Once in a while?)

CC: Operational Excellence? Y / N
We have regular feedback and training sessions.

HQ: Operational Excellence? Y / N
A lot of evaluation is taken place and direct contact with the resources to evaluate the status.

LB: Operational Excellence? Y / N
Of course trainings are necessary and encouraged but sometime you would also need to adapt to changes.

SS: Operational Excellence? Y / N
We have a software tool for this, where the project manager can fill in the time and dates and at stakeholders to it.

FD: Operational Excellence? Y / N
Emerge from themselves, raise awareness by themselves. We offer an environment to be able to do this.

AN: Operational Excellence? Y / N
Quality department has regular checks based on our requirements.

ER1: Operational Excellence? Y / N
Since I am the planning manager this is a really important part of my job to be aware of and keep track off.

ER2: Operational Excellence? Y / N
Competitiveness within departments of Epiroc are in place to remain aware and conscious about how we perform. Thereby as producers in Sweden we should make sure we add more value then for example in India, this since the labour is more costly here.

ER3: -

ER4: Operational Excellence? Y / N
We generally don’t require trainings on a regular basis for my staff.

CN: Operational Excellence? Y / N
We are constantly pushing our developers to learn themselves.
Q4.10) How would you classify your current work flow to be? (Simple/Complex?)

CC: Simplicity? Y / N
It completely depends on the project we are doing.

HQ: Simplicity? Y / N
Super complex, especially because of the current manual → automatic assembly transition.

LB: Simplicity? Y / N

SS: Simplicity? Y / N
Not simple, but also not complex. Depends on what level of detail you look at it.

FD: Simplicity? Y / N
Some projects have by nature a complex composition, depending on the Stacey-matrix. Agile is not about making things simpler, but is more a tool how to handle, approach and work with this complex cohesion and uncertainties.

AN: Simplicity? Y / N
It completely depends on the product that you’d be making.

ER₁: Simplicity? Y / N
Since there is mostly changes coming through, throughout the delivery process the process itself is complex. Those changes have a lot of impact on the planning and demand of resources.

ER₂: Simplicity? Y / N
Many connections, they go back and forth, process mapping needs to be done. Complex yet, the swim lane-analysis (starting in June) will help us to create overview and create simplicity.

ER₃: Simplicity? Y / N

ER₄: Simplicity? Y / N
Complicated since the suppliers are spread all around, even on global scale, which makes it a complicated whole.

CN: Simplicity? Y / N
Q4.11) Do you promote self-organized teams?

CC: Self-Organization? Y / N
Definitely, a team should have end to end possibility.

HQ: Self-Organization? Y / N
He promotes decision making by employees and thereby also lessons learned between employees.

LB: Self-Organization? Y / N
Yes!

SS: Self-Organization? Y / N
If I see something, we can improve I can book a meeting and invite stakeholders which are according to me important to be involved in the discussion. (as answer to 1.3.1.1). Project manager allocates tasks over the (process) engineers.

FD: Self-Organization? Y / N
The project team is centre of attention to authorize them over their own work. (see answers other questions to support this).

AN: Self-Organization? Y / N
We have a supplier performance review but then it wasn’t result oriented. Monthly results are obtained from them and work is assessed. Now, authority and responsibility is given to suppliers to report results.

ER1: Self-Organization? Y / N
Aiming to give individuals the opportunity to take decisions, but also form teams to solve problems.

ER2: Self-Organization? Y / N
Not sure, the teams need to be smaller, we should have smaller teams, currently we have teams of 25-40 employees. Ideally, we should be 5-8 and it would be easier.

ER3: Self-Organization? Y / N
Everyone should feel they have the authority to organize amongst themselves (to do and take decisions).

ER4: Self-Organization? Y / N
They work in different teams depending on the area, this is not self-organized but put together.

CN: Self-Organization? Y / N
I would prefer so teams but then it depends on the people, I need to have good people.
Q4.12) Do you have ongoing feedback sessions?

CC: Continuous Improvement? Y / N
*We have sessions of improvement, regular meetings and interactive sessions.*

HQ: Continuous Improvement? Y / N
*Yes, this is being done by the “Husqvarna operating system” toolbox which uses lean tools.*

LB: Continuous Improvement? Y / N
*Every second week we have a session of feedback where lessons of improvement are shared.*

SS: Continuous Improvement? Y / N
*Personal development feedback every half a year. Also, bi-weekly meeting with manager, discussion the on going projects.*

FD: Continuous Improvement? Y / N
*Retrospective meetings*

AN: Continuous Improvement? Y / N
*We have biweekly meetings and I follow an open door policy. So, yes!*

ER1: Continuous Improvement? Y / N
*We have improvement plans and regular feedback sessions.*

ER2: Continuous Improvement? Y / N
*Lessons learned is always done when a project is over. Thereby weekly 30 minutes session of Performance feedback is given. “Kaizen” events are planned to be hosted in the future.*

ER3: Continuous Improvement? Y / N
*Structured meetings, but also ad-hoc communication.*

ER4: Continuous Improvement? Y / N
*Individual meetings with her staff.*

CN: Continuous Improvement? Y / N