



Linnæus University

Sweden

Degree project

The transformation to digital

*How industry 4.0 affects the digital transformation
– a study of industry 4.0 and how it affects the
digital transformation at a large Swedish
manufacturing company.*



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Abstract

The fourth industrial revolution is the latest revolution that has emerged within the industrial sector. The concept has become more known in recent years and with the different technologies it brings to the companies, it creates a race around the world for companies in order to be among the first to implement the new technologies. With the growing interest in industry 4.0 and the implementation of the new technologies, it has created a need to rethink on how to be successful in this transformation. To be successful in implementing industry 4.0 it is important to involve all the different aspects of a company's supply chain. This qualitative study aims to investigate how industry 4.0 affects the digital transformation at a large manufacturing company in Sweden. The thesis includes five different technologies within industry 4.0: *Internet of things, the cloud, simulations, autonomous robots and big data and analytics*. The five technologies are then investigated on how they affect the digital transformation of the chosen company.

The results of the findings shows that industry 4.0 has an affect on the digital transformation of the company after it was implemented. However, the results also shows that some technologies have had a greater impact to the digital transformation then others, but there isn't one technology that has not affected the transformation at all. Additionally, the results shows that the part of digital transformation that is affected the most from industry 4.0 is the changes it creates in the value creation of the company.

This thesis aims to create a better understanding about industry 4.0 and how it affects the digital transformation of a large manufacturing company.

Keywords

Large manufacturing company, Industry 4.0, Digital transformation, Internet of things, Big data and analytics, Simulations, The cloud, Autonomous robots.

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1. Introduction

This chapter presents the concept of industry 4.0. After the concept of industry 4.0 is provided, the research question that will form the base of this thesis will be presented as well as a topic justification. The chapter will conclude by presenting the scope and the limitations for this thesis. Lastly, a structure of the thesis will be presented.

1.1 Introduction and research setting

Industry 4.0 is the latest revolution that has emerged within the industrial sector. The term was originally introduced by the German government back in 2012 as one of the technologies that was being developed to be used in the manufacturing sector (Helbig, Kagermann and Wahlster, 2013). Even if there isn't an agreement regarding what an industrial revolution actually is, there is four different phases explained on what has changed from a technological point of view. The first revolution was introduced for around 200 years ago with the implementation of water and how water could be used as a source of power to run a factory by creating steam-power. With time passing on, the companies learned how to use electricity in order to run the factories in a more effective way than what steam-power offered. With the implementation of industry 3.0 in the manufacturing industry, the understanding of using IT to create a more automated process was introduced for the first time (Drath and Horch, 2014). Ever since the German government started to research and develop around industry 4.0 back in 2012, the interest regarding the topic has become more and more relevant. One of the aspects regarding industry 4.0 that has created much interest in recent time is Internet of Things (Atzori, Iera and Morabito, 2010). With the growing interest regarding industry 4.0 and the different technologies it brings, it has created a race around the world by the different companies that wants to adopt the latest technologies that comes with industry 4.0 (Foresight, 2013). As the manufacturing industry is in an everyday process of finding and adopting new technologies to stay competitive and ahead of their rivals (Belvadere, Bielli and Grando, 2013), the implementation of industry 4.0 becomes an important part of their transformation moving forward.

A great number of the technologies that industry 4.0 provides is already existing in many different companies, but the technologies aren't working after the concept of the fourth industrial revolution. With the aim of adopting industry 4.0 into companies, the goal is to change the way the technologies are used as an isolated unit to a more integrated and automated flow throughout the whole chain. These changes are based on the new technologies that industry 4.0 offers such as sensors, machines and Cyber-physical systems (CPS), and by adopting and implementing these technologies throughout the whole chain, it transforms the way they operate. One of the most notable changes with the implementation of industry 4.0 is that it creates an opportunity to collect and analyse data from multiple different machines at the same time. This helps the companies to adjust the process if needed to make it more effective. And with more effective processes the companies gets more productive which increases the growth of the company (Rüßmann et al., 2015).

Industry 4.0 can be broken down into different technologies such as *autonomous robots, big data and analytics, internet of Things, the cloud & simulations*. All the different technologies within industry 4.0 are created for different purposes, but with the same goal to contribute to the digital transformation of a company and also to enhance the effectiveness and competitiveness of that same company. Big data and analytics and the cloud are two technologies that collects, evaluates, stores and shares a big amount of data that has been collected through different systems or employees in the company. Internet of Things (IoT)

and autonomous robots is two technologies within industry 4.0 that allows the machines to interact with each other and work together alongside the humans. The last technology that originates from the fourth industrial revolution is simulations. With the use of simulations, the companies can use data collected in the real world and test it in the virtual world to see the different outcomes without actually doing anything physically (Rübmann et al., 2015).

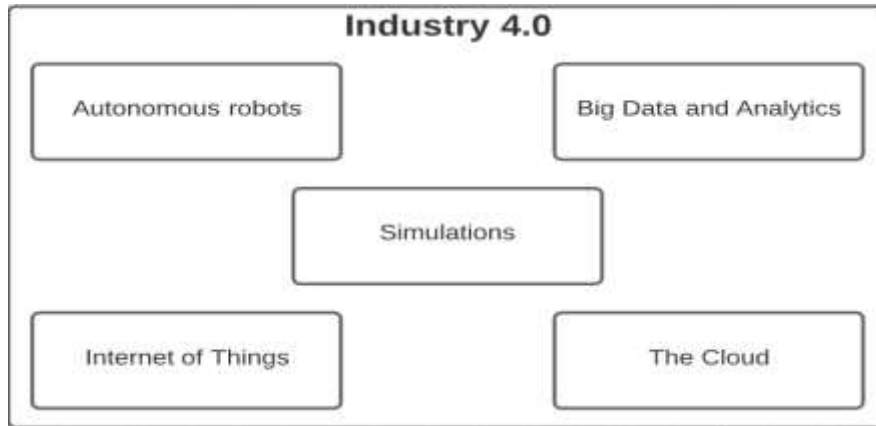


Figure 1: Industry 4.0.

With the rise and implementation of industry 4.0, it has created a need to rethink about the concept of digitalization for different companies (Queiroz et al., 2019). To be successful as a company in taking the next step into the new digital era, it is important to involve all aspects of the company and its supply chain. That includes the different structures and processes as well as the different products that is a part of the supply chain (Swaminathan and Meffert, 2017). Another aspect that has pushed companies to become even more digitalized at an even higher speed is the current pandemic regarding Covid-19. Even if the companies are looking to use AI, robots and other digital technologies more than before, the quest for them isn't to replace the humans, but to implement those technologies to allow the humans to be more effective and safer (In context to the pandemic). The current situation around the world has changed the way people approach the job they are doing. With the increase of digitalization, humans will not completely lose their jobs to autonomous robots, but they will have to change their tasks in context to the technologies. Covid-19 has created a new normal regarding social distancing, and as that is becoming the new normal, companies are looking to adopt to that by keep developing the digital aspects of their companies. Covid-19 is and will be an important aspect of why there is new it-companies being created as the needs for those companies are rising. At the same time, already existing companies will have to adapt to the new normal regarding digital transformation in order to stay competitive against the up and coming companies, as well as their traditional competitors who most likely also will be trying to adopt to the new technologies (Soto-Acosta, 2020).

1.2 Purpose statement and research question

This research aims to study how a large Swedish company adopts industry 4.0 and its technologies and how it affects the digital transformation of that company. The technologies that will be focused on in this study will be: *autonomous robots, IoT, the cloud, simulations and big data and analytics*.

Research question:

- How does the adoption of industry 4.0 affect a company's digital transformation?

1.3 Topic justification

Ayala, Dalenogare and Frank (2019) conducts a study where they aim to create and understanding on how different manufacturing companies implements the different technologies that industry 4.0 provides. In their study they divide the different technologies into two different categories, front-end and base technologies. One of the most interesting findings that the authors did during the study was that the implementation of industry 4.0 and its technologies depended on the size of the company where the larger companies had a higher probability of implementing industry 4.0 to its processes. The study also showed that cloud computing is the technology within industry 4.0 that most companies are adapting first, which can be interpreted as it is used as a remote option to store data, while Internet of Things (IoT) and big data and analytics are used more to collect and store data in real time. Another result provided by the study is that companies tend to adopt most of the different front-end technologies and not just one of the subsets.

Amaral and Pecas (2021) completed a study regarding small and medium sized enterprises (SMEs) on how they could complete the digital transformation to industry 4.0. The study was conducted on two different companies with two different approaches to create more understanding about industry 4.0 and how they can build their own way into the fourth industrial revolution. The first proposition for the digitalization regarded reaching higher efficiency in a selected process by implementing different technologies, whilst the second proposition regarded extracting data, both passive data and real-time data. The results of their study showed an increase in maturity regarding industry 4.0 with both the different companies and the different ways of implementations. The result of the study also shows that with the implementation of the two different propositions, the two biggest concerns for small and medium sized enterprises to implement industry 4.0 was successfully targeted. The different concerns regarded *skilled labour* and *economic benefits* and the authors, with the help of their study could show that the barriers to implement industry 4.0 and overcome those concern aren't as big as they first seems.

Abrahamsson and Karimov (2019) conducts a study in Sweden regarding small and medium sized enterprises regarding their knowledge about industry 4.0 and the challenges that comes when trying to adopt to it. The result of their study shows that Swedish small and medium sized enterprises has a higher maturity level when it comes to implementing industry 4.0 than companies in Germany. Another results that the authors could present in their study was that the revenue didn't had a big impact on the maturity level regarding industry 4.0 and they could also highlight a negative relationship between a company's size and the maturity level regarding industry 4.0. The biggest challenge for small and medium sized enterprises when trying to adopt the industry 4.0 is the financial aspect and it is the only aspect that differs from SMEs and companies of bigger sizes.

Aheleroff, et al. (2020) conducts a study where they apply different industry 4.0 technologies such as Internet of Things, cloud, edge computing and big data to a completely ordinary refrigerator. The aim of the study is to show how industry 4.0 can increase effectiveness of a product and contribute to the digital transformation of that product. With the implementation of Internet of Things the authors where able to connect the refrigerator to the mobile phone with the use of wi-fi and Bluetooth and allowed the person to collect real-time data from the product. The result of the study shows how industry 4.0 can be used in many different situations to contribute to the digital transformation. The study shows how a completely

ordinary refrigerator could be turned into a smart device without changing longstanding production lines.

Litsiou, Nikolopoulos and Priendl (2020) investigated in their study the impact of industry 4.0 and digital transformation on information sharing. The result of the study shows that with the use of industry 4.0 and digital transformation it could create a new and more effective way of information sharing within different companies by creating centralized platforms. One of the biggest problems for the companies that the authors found was the hesitation of sharing some type of information with their business partners, even if the sharing of information meant that both parties would benefit. Another results from the study shows that the implementation of industry 4.0 and digital transformation had an impact on the decision making being more dependent on the data available, which created a more data-driven company. And by becoming more data-driven in the decision making, fewer mistakes were being made by the employees.

The previous studies mentioned above highlight a lot of aspects regarding industry 4.0 and how it could be used. A lot of the previous studies focused their studies to small and medium sized enterprises. However, this thesis aims to create knowledge about industry 4.0 and how it affect the digital transformation at a large manufacturing company in Sweden.

Form the selected company´s perspective, the findings in this thesis can help them to understand in a better and more structured way on how industry 4.0 and the selected technologies within *int, autonomous robots, simulations, big data and analytics, internet of things and the cloud*, affects the company´s digital transformation.

1.4 Scope and limitations

This thesis will collect its data at a large Swedish manufacturing company, the background and limitations of that company will be presented below, as well as the employees background and limitation that will be participating in the study.

1.4.1 Company background and limitations

The study will be conducted at a large Swedish manufacturing company based in Ljungby. It produces a various amount of different products that can be used by both other companies as well as the ordinary citizens. The company has its main office in Sweden but have production sites all across the world.

This study will only be conducted at this specific company, which leads to that the results of this study only can be applied to the selected company. In order to keep the company confidential, it will be referred as Company X throughout the thesis.

1.4.2 Participant background and limitations

The participants included in this study will be narrowed down to six employees. The employees will be selected thru a purposive sampling technique where the focus will be on selected employees that works within the office sector of the company.

1.4.3 Other limitations

For this study, five of the technologies within industry 4.0 has been included, *autonomous robots, simulations, the cloud, big data and analytics and internet of things*. As a consequence of that, the other technologies within industry 4.0 hasn't been taken into consideration. The absence of those technologies may or may not have affected the outcome of this study.

1.5 Master thesis structure

This thesis follows a linear approach in order to complete the master thesis. The thesis was divided into six different chapters that were completed in the order they are presented in, as can be seen in *figure 2*. The six different chapters include, *introduction, literature review, methodology, empirical findings, discussion and conclusion*.

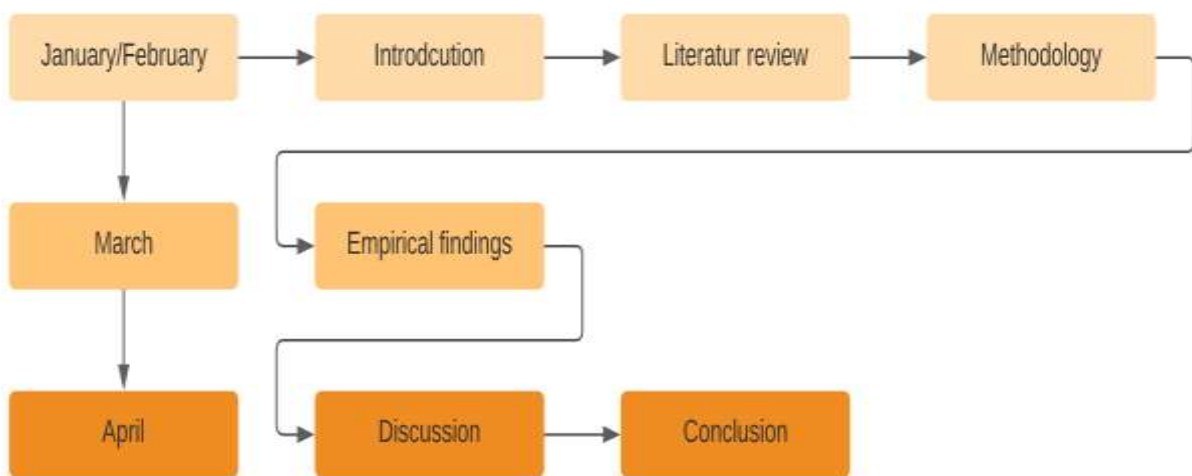


Figure 2: Structure of the master thesis.

2. Literature review

This chapter will provide a literature review of the framework for the chosen topic that will be used throughout the study. It will work as the base of the study and the different concepts that will be a part of it will be presented and described. Industry 4.0 and digital transformation are two of the main concepts that will be presented, as well as the five different technologies within industry 4.0: Internet of Things, the cloud, autonomous robots, big data and analytics & simulations.

2.1 Industry 4.0

An industry, independent of what it produces and in which type of market it operates, is a part of an economy that produces different products that they eventually sell to the people. The production in those industries are operated by machines that works autonomously. Since the start of the industrialization, there has been a lot of different technologies introduced for the aim to create a better and more effective way of operating the industry and its production. These different shifts of the paradigm are now referred to industrial revolutions.

The first industrial revolution provided the industries the concepts of mechanization for the first time, the second industrial revolution introduced the use of electrical energy for a more effective way of operating the production. The third revolution eventually introduced IT into the industries which allowed them to further evolve in the digital world.

The latest industrial revolution that has shifted the way companies operate regards the use of different technologies that are based on the internet. The concept of the fourth industrial revolution is to connect the different machines and products with the internet to create smart objects. The fourth industrial revolution was first introduced by the German government and has ever since it arise become the focal point of different industries strategy for reaching the next step in high-tech. When industry 4.0 is implemented to a company and its production, it further increases the mechanization (First introduced in the first industrial revolution) and automation. More different technical aspects will be implemented in order to create the production to become less dependent of human interaction in the same way, as the new technologies will allow the machines to control and optimize the production be themselves. One important aspect of industry 4.0 is the use of different sensors in the manufacturing process that creates a new way of collecting data. This new way of collecting data changes the companies environment even more into a digital world where new ways of collecting and sharing data is created by the implementation of internet (Feld et al., 2014).

Feld et al. (2014) also explains that with the implementation of industry 4.0, it creates new concepts that the companies need to understand and adopt to in order the make the transformation successful, such as:

Smart factories: The concepts refers to that the manufacturing process of a company will become more connected to sensors and autonomous systems that will control the production process of the company completely autonomously.

Cyber-physical Systems: With the use of CPS, the line between the digital world and the physical merges closer together with each other. One example of where the cyber-physical systems could be most useful is in the maintenance section as it can monitor a machine and the product is produces to see if it differentialize from the normal production procedure. When the CPS recognize that something isn't working as plan it can send out an alarm that the machine needs to be investigated before it starts operating again to avoid it breaking down.

New system in distribution and development: With the implementation of industry 4.0, both the distribution part of the company as well as the development part will start to become more individualized.

With industry 4.0, it is seen as the next industrial revolution that will transform the way companies produce their products. What industry 4.0 will offer the companies that adopt the latest industrial revolution is an increase in flexibility in their manufacturing process. It will also allow companies to mass customize, increase the productivity of the manufacturing process and also create products with a better quality. With the implementation of industry 4.0 and the increase of flexibility and quality, companies will be able to cope with the challenge of producing more individualized products at a higher speed and with a better quality. The fourth industrial revolution allows the companies to transform their existing resources that they use today to become more smarter by implementing sensors. The sensors allow the resources to sense and act within the environment they are working in, creating a more intelligent manufacturing process.

Industry 4.0 allows the companies to connect their technologies used in the production process, with the intelligent processes that are working at the same time. The combination of the two aspects creates a new way of approach that will change the whole value chain of a company. Within the concept of industry 4.0, there are three major approaches for companies to operate their business: *intelligent manufacturing*, *internet of things-enabled manufacturing & cloud manufacturing*. The three different approaches of operating the company differentiate as intelligent manufacturing is the broadest of the three and aims to use the full capacity of advanced information and manufacturing technologies in order to optimize the production. Internet of Things-enabled manufacturing focuses on creating SMOs, or smart manufacturing objects. By creating SMOs, the objects will be able to sense and interact with each other automatically.

The last approach of manufacturing the company is with the use of the cloud. By adopting the cloud to the manufacturing process, the company uses different technologies, such as Internet of Things, to operate their production. With the different technologies being used, the product becomes more of a resource that can be shared between different people with the use of the cloud (Klotz et al. 2017).

In the last couple of years, the manufacturing industry has experienced a growth in the complexity and requirements due to different circumstances. One of the circumstances is that the world is becoming more connected than ever, international competitors are becoming as affecting on a company's business as companies that operate in the same country. The traditional approaches that the companies have relied on for years don't suit the quick changes in the technological world. Digitalization has become a part of the everyday lives of companies and when the German government introduced the concept of Industry 4.0 in 2011, it started a new wave that companies wanted and needed to be a part of to stay competitive against their rivals, both domestic and international (Hofmann and Rüscher, 2017).

Bartodziej (2017) continues by describing how the German government was in a pursuit of finding a strategy to reach the next step in digitalization within the industrial sector. The Germans wanted to make sure that they stayed competitive against international competitors by investing in technological innovation.

Industry 4.0 and its technologies are supposed to be seen as a tool to control the whole value chain within the company. It means a total control already from the start where the idea is

created by the customer, throughout the order, development, manufacturing, all the way to the final step that is the delivery of the finished product. Industry 4.0 allows this to be possible by the connection of all the different components and the availability of real-time information (Bartodziej, 2017).

Industry 4.0 is built upon nine different technological parts that create the whole concept of the revolution. Five of those parts will be used in this study and those can be found in *figure 1* and contains: *Big data and analytics, Simulations, autonomous robots, internet of things & the cloud*. The five parts will also be presented and described in this chapter moving forward.

2.1.1 Big data and analytics

Big data and analytics is considered to be one of the most important aspects within the fourth industrial revolution. In order for a company to make their system intelligent, it has to be able to gather and process a large amount of data (Big data). Although companies focus a lot on developing the automation within their company, it is with the help of big data and analytics that it becomes possible (Ayala, Dalenogare and Frank, 2019).

George et al., (2014) explains that big data and analytics can be used in many different situations where it can create value for the user, for example:

- Production equipment.
- Industrial automation.
- Information systems.
- Management systems.

Big data can be divided into five different subparts: *volume, variety, velocity, veracity & value* with the two most important subparts when collecting data being veracity and value. Big data and analytics is built up on its principles in collecting a great amount of data and extracting the knowledge that is asked for. With the knowledge extracted from the data, the decisions made with that knowledge become data-driven. With the use of big data and analytics, the goal isn't just to collect and extract knowledge from data, but also to at the same time measure different aspects of the company's performance as well as finding and defining different aspects that can be used as an advantage against the company's rivals (Wamba et al. 2015).

With the use of big data and analytics, companies are always prepared to handle quickly and efficiently with the always growing amount of data. What big data and analytics allows is both to separate and analyse data so that only the data that is needed and of importance is used (Witkowski, 2017).

2.1.2 Simulations

In the environment that industry 4.0 creates, large amount of data exist and can be collected and analysed with the help of big data and analytics. The data can also be stored and accessed from all over the world with the use of the cloud technologies. What those two parts of the industry 4.0 environment can't do is to link the virtual world with the physical world. With the use of simulations and cyber-physical system that becomes possible. Simulations use its tools in order to connect the virtual world with the reality. At the same time the cyber-physical system uses sensors in order to collect data from the real world which it later on

passes on to the simulations so that it can be connected virtually. With the connection that the simulations creates between the virtual world and the real world, the virtual platform becomes more flexible (Dev, Shankar and Qaiser, 2020).

The use of simulations also leads to a shorter production and design time for a product. With the use of different subparts within simulations such as: *virtual modelling, digital design & 3D printing* the product development can be integrated with the physical and digital production in a more effective way (Fonseca, 2018). Jahangirian et al. (2010) describes that simulations is the second most used technique when a company deals with its operations within the manufacturing process.

Chang et al. (2011) presents simulations as data-driven where the user uses different data inputs in order to create a simulation model without the need of programming, the different models created can later be used within the automotive manufacturing, as one example.

2.1.3 Autonomous robots

An autonomous robot is just like any ordinary industrial robot. The difference lies in that the autonomous robot can work and collaborate with other autonomous robots during the manufacturing process. What that collaboration allows the autonomous robots is a higher efficiency with the manufacturing as well as the ability to perform more complex tasks. An autonomous robot is a part of what is called artificial intelligence (AI), this allows the robots to both learn and “think” in a more logical way by themselves. This makes them less depended on humans that usually has to write different programs that later on is installed in the robots (Benotsmane, Dudás and Kovács (2019).

According to Gonzales et al. (2017), autonomous robots works in four different stages where they uses navigation to complete each stage.

- Mapping.
- Localization.
- Planning.
- Execution.

Amadu and Othman (2018) describes autonomous robots that works together as collaborating robots. Robots that work together and can do that without any human interaction is a big part of the fourth industrial revolution. Autonomous robots, or collaborating robots, is a part of the machine-to-machine (M2M) term. The term is a description of how information and communication technologies (ICT) collaborates with intelligent devices without the need of humans interfering in the process.

As the world autonomous suggest, the robots are perfectly capable of working without any human interaction. At the same time, these robots can also be used alongside humans in different processes. The autonomous robots are designed to complete different tasks whilst they also are focusing on being safe, collaborative and flexible (Graetz and Michaels, 2018) The concept of autonomous robots have been developed continuously to meet the different demands that industry 4.0 brings (Alves et al., 2018).

2.1.4 Internet of things

Internet of Things (IoT) focuses a lot on how the company can work with the data that they have. Internet of Things allows companies to both store and share the large amount of data that they have collected in a more effective way with the help of connecting the data with the internet. With the data being uploaded online, people that has an internet connection can access that data from all over the world. With the use of Internet of Things, different devices can be connected through a gateway that allows for high speed data transfer. By implementing Internet of Things, it allows the technology to browse through the data that has been collected, and at the same time remove data the isn't needed or is a duplicate of an already existing data. Internet of Things also plays a vital part within Industry 4.0 with the creation of secure applications that can be used by the employees at different companies (Kulatunga and Sampaio, 2019).

According to Witkowski (2017) Internet of Things grounds on mainly three different characteristics:

- Context refers to that the object can interact with the environment that it operates in.
- Omnipresence refers to the objects ability to collaborate with each other.
- Optimization refers to the objects functionality.

Mehnen and Turner (2018) highlights the importance that Internet of Things have when a company starts to adopt Industry 4.0. Internet of Things have a vital role when it comes to the infrastructure that needs when a company wants to become connected to the internet. By applying different sensors that collects data in real time, Internet of Things allows those sensors to then send that same data to the internet where it can be operated. This allows the production to become more digital.

2.1.5 The cloud

The word cloud is used to describe different applications that doesn't have a fixed place but rather works more remote. With the implementations of new technologies into different companies, the machinery and management of data will shift from the more traditional way to become more based on the cloud technology. The cloud systems offer the companies a much faster way of delivery when it comes to data then what the traditional standalone systems does. With the use of the cloud, the technology offers the companies that adopt it the simplest way of storing the data online. Another aspect that is beneficial when adopting the cloud is that it doesn't requires any installation of any sort, the only thing you need to be able to use the cloud is an internet connection (Nuñez et al., 2017).

With the older and more traditional computers, it isn't sure that they can handle the large amount of data that exists in today's world. To avoid any problems when it comes to handling big data, the cloud technology emerges as the perfect solution as it doesn't have the same problems as traditional computers when it comes to handling big data (Gursev and Oztemel, 2020).

Further on, the cloud enables the opportunity for employees and customers to access the same data at the same time, without the need of meeting. The cloud offers its users a more flexible way of storing and sharing data. It also reduces cost, extends the area of work as well as it offers the users a way of accessing the data at any time wherever they are. The cloud can be

categorized into four different systems: *private cloud*, *public cloud*, *hybrid cloud* & *community cloud* (Li et al., 2017).

2.2 Digital transformation

Benlian, Hess and Matt (2015) points out that every company in all the different industries have completed a number of different projects in order to implement new technologies into their business in order to further evolve themselves. By implementing new technologies it changes and transforms the businesses key operations. Downes and Nunes (2013) continues by explaining that the changes that the new technologies creates are often affecting large parts of the company and even impact on how they work with their products and different processes. The changes that the companies sees after adopting to new technologies are often an increase in the companies productivity, which leads to an increase in sales. The companies also creates a better connection with its customers which indicates that by adopting to new technologies and in that way transforming the company digitally, it reshapes the whole business model. Benlian, Hess and Matt (2015) concludes that it is of great importance that a company creates and uses some sort of strategy plan that has been created before the digital transformation start, by using a plan the company can in a more effective way coordinate, prioritize and implement the necessary changes needed.

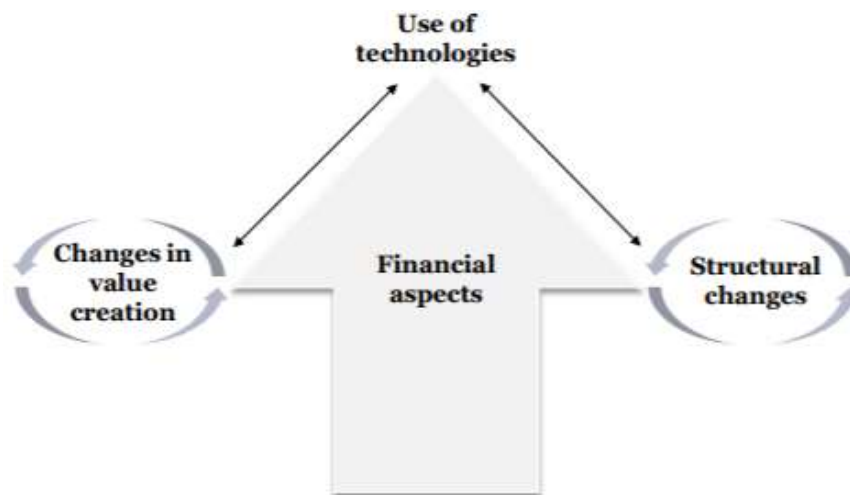


Figure 3: The four different dimensions of digital transformation (Benlian, Hess and Matt, 2015).

Downes and Nunes (2013) elaborates that companies biggest challenges is to find and adopt new technologies into their business. They also point out that there isn't any sector that can look the other way when it comes to digital transformation as the possibilities and opportunities it creates are often larger than just for some specific product or process. Bonnet et al. (2012) presents a result where 9 out of 10 leaders of different companies in the United States and UK believes that the implementation of IT and different technologies will have a large impact on the strategic approaches the companies will have moving forward.

Benlian et al. (2016) highlights that the question regarding digital transformation has changed from: is it something we as a company need to adopt, to how can we adopt the digital transformation in the best way in order to stay competitive. As can be seen in figure 2, there are 4 different dimensions when it comes to a digital transformation: *Use of technologies*, *changes in value creation*, *structural changes* & *the financial aspect*.

Use of technologies: It reflects on how much a company is willing to try new technologies in order to succeed with the digital transformation. It also refers on how the company works to identify new technologies that can be used.

Changes in value creation: This aspect reflects on how the implementation of the new technologies have transformed the companies value creation.

Structural changes: With the implementations of new technologies, companies need to address the different changes it creates to the organizations structure. The digital transformation can lead to processes changing and as well as new skills being necessary to learn in order to operate with the changes in the most effective way.

Financial aspect: The financial part of a digital transformation can be divided into two different parts. The first part is the need for change in order to increase the sales of the company so it generates more money. The other part is that the company needs to have the right amount of money saved in order to succeed with the digital transformation.

Hess and Singh (2017) breaks down the digital transformation into two different components when it comes to the interactions between companies and its customers. The first component is the *technology-enabled research* and refers to when a company adopts new type of technology in order to create a better relationship with its customers. The biggest changes is in the way the company collects data about its customers, from collecting data through market researcher to using new technologies. These new technologies enables the company to collect data through search engines which has led to the opportunity for companies to use the collected data as different indicators about the customers behaviour. The other component that digital transformation is broken down into is *integrated marketing*, it refers to the changes that has arisen with new technologies that has changed the companies strategies when it comes to marketing their products.

Eaves et al. (2018) describe the importance of information and communication systems (ICT) when working towards implementing a successful digital transformation. The three most important technologies that is combined by the ICT-systems are: *virtualization systems (cloud computing)*, *mobility systems (Internet of things)* & *embedded analytics systems (Big data)*. Companies that successfully integrate and combine the three different key technologies into their business will receive a significant strategic advantage over its rivals. Marsh (2012) describes the digital transformation from a manufacturing perspective where the new technologies will enable companies to create customized products for their different customers in the same way, and at the same price that the companies mass produces today.

Baiyere, Salmela & Tapanainen (2020) points out in their article that the companies recognizes the challenges the customers has when it comes to digital capabilities. Digital transformation is described as the different opportunities the companies sees in putting itself in a position where it can be in a front position against its competitors when it comes to creating digital innovations. Digital transformation has become an important part for already existing companies as they recognize the threats for example digital start-ups brings.

Vial (2019) addresses that a digital transformation is seen as a process where different technologies that are being implemented creates needs for companies to change their value creation process as well as handling different structural changes to the organization that the implementations can bring, both positive and negative.

A successful digital transformation is an important factor for companies in all industries to stay competitive against their rivals. New technologies that emerges with the forth industrial revolution can lead to companies increasing their productivity and improvement with the customer interaction. To investigate how these technologies within industry 4.0 affects the digital transformation of a company, allows for a better understanding of two aspects that are crucial for a company's future.

2.3 Summary of literature review

The academic literature review conducted provides information and background around the latest industrial revolution, also referred to Industry 4.0. It also highlights digital transformation as one of the biggest challenges that different companies needs to face in order to stay competitive against their rivals. The review highlights five distinct factors within industry 4.0: *Big data and analytics, the cloud, simulations, internet of things & autonomous robots*. The highlighted factors are described and presented as highly capable of affecting the digital transformation of a company. An important finding amongst the material is the need to consider how these different factors within industry 4.0 could affect a company's digital transformation. The literature review has created a good insight in both industry 4.0, as well as in digital transformation and how important these aspects are for companies. This has generated in a deeper understanding regarding the research question for this thesis and will allow more accurate findings in the empirical sections of this study.

The literature review have provided a framework that will be used to form the base for the questions that will be used later on to gather the empirical data that is required in order to successfully be able to answer the research question. The data will include industry 4.0 and the five different factors in relation to digital transformation, as well as the affect those have on the digital transformation. The review have provided a good insight in both the different technologies within industry 4.0 (Autonomous robots, simulations, internet of things, the cloud & big data and analytics), as well as digital transformation.

3. Methodology

The chapter will provide the methodological tradition and approach that the study will use. After they are presented, the data collection will be presented as well as the technique used for analysing the empirical finding. The chapter will be concluded with a description of the ethical consideration and the validity and reliability of the findings in this thesis.

3.1 Methodological tradition

There are two different approaches when conducting a research, there is ontology and epistemology. Within these two different branches of research approach, there are also two different subbranches within each branch. In ontology the two different subbranches are realism and nominalism, whilst the two subbranches within epistemology are positivism and interpretivism. The two different branches of research differentiates from each other as ontology more focuses on how to study different phenomenon in the real world. The ontological aspects highlights that the reality that we live in are what it is, and we as humans cannot affect it in any way. Epistemology on the other hand is the opposite of ontology as it explains reality as something that is created and described by the humans and the society (Myers and Avison, 2002).

For this thesis, as it takes the human aspect into consideration when gathering the empirical data, epistemology is chosen. When further explaining the methodological tradition in the context to IS, four different main paradigms can be identified: *positivism, interpretivism, action research and critical research.*

Positivism: The positivist paradigm focuses the world as an objective place where it is independent of the humans. This means that a researcher can examine the world and create an objective fact about the studied aspect.

Interpretivism: The interpretive paradigm is the opposite of the positivist paradigm. Interpretivism is built upon that the reality is dependent on humans and aims to study how the humans are modifying the reality.

Action research: This paradigm has its three main aspects in *action, situation and consequences.* While adapting the action research, every possible method is used in order to successfully understand the problem.

Critical research: Within this paradigm, the people are seen as the producers of the social reality. The paradigm also incorporates political aspects.

From the four main paradigms within IS that are being presented above, the interpretive paradigm is chosen for this study. As the study aims to describe a phenomenon from the interpretations of humans, interpretivism provides good conditions in order to successfully accomplish that.

Interpretivism focuses on using the subjective aspects that already exist in the world such as to acknowledge that they exists, to understand them, to be careful not to disrupt them and to use the different subjective aspects in order to create a theory (Goldkuhl, 2012).

3.2 Methodological approach

There are three different methodological approaches to select from when conducting a research. The three different approaches are: *quantitative, qualitative and mixed methods*. When applying a quantitative approach to a study, the researcher uses different statistics and numerical methods in order to investigate the natural phenomenon. In contrast to the quantitative approach, the qualitative approach aims to study the cultural phenomena that is created by the social interpretations and interactions. The qualitative approach uses methods such as interviews and observations in order to gather the data that is needed for the research. The third approach is the mixed methods approach, as the name suggests it is a combination of both the qualitative and quantitative approach. By applying the mixed methods approach, the researcher aims to utilize the strengths of both the other approaches (Myers and Avison, 2002; Creswell and Creswell, 2014). The most distinguished difference between the quantitative and the qualitative methodological approach is the difference in which paradigm they are linked to. The quantitative approach is more drawn to the positivism paradigm while the qualitative paradigm is more drawn to the interpretive paradigm (Taylor, 2017).

The chosen methodological approach used in this thesis was the qualitative approach. Kaplan and Maxwell (2005) describes how a qualitative research involves the use of interviews, observations and documents in order to both understand and explain the social phenomena. Crang and Cook (2017) further elaborates that a qualitative research aims to study a defined phenomenon in its natural settings by trying to make sense of the phenomenon with the use of peoples meanings.

The primary data collection for this study will be semi-structured interviews. Interviews allows the researcher to gather a richer data in a fast speed. Interviews also allows the participants to answer the questions in a way where they can provide information of what their motivations and beliefs are regarding the studied phenomenon. As all data collection methods, it has its disadvantages. The main one is the risk of the person being interviewed becoming affected of the researcher, and in that way becoming biased with their answers. With the use of semi-structured interviews, the researcher prepares a set of questions beforehand, but still allows for discussion throughout the interview (Crang and Crook, 2007; Creswell and Creswell, 2014; Taylor, 2017).

Kumar (2014) describes the definition of secondary sources as data collected by someone else. These sources can be different documents provided from the company where the study will take place. The documents will mostly be focused on different releases and yearly reports provided by the company.

3.3 Data collection methods

This part of the thesis highlights the procedure of how the data was collected regarding both the methods used.

3.3.1 Interviews

As described in the previous part of this chapter, semi-structured interviews was used to collect the empirical data. The different interviews were conducted during a two week period between the 18th of March to the 2nd of April. The interviews took place during the

working hours of the office workers in the selected company, which are 07:00 AM to 16:00 PM. The different interviews were conducted in order to gather the necessary information needed to produce a result in regard to the research question of this thesis. When selecting the appropriate respondents for the interviews, the purposive sampling was used (Dolores and Tongco, 2007). By using the purposive sampling technique, the participants for the interviews are purposely selected, in this case the selection was done by a discussion with my contact person at the company. The selected people created a depth regarding different important aspects that was important for the study. In table 1 that could be found down below the included persons, and their different roles are listed.

As the interviews are the main source of data collection, the structure of the questions need to be able to provide data that is useful in context to the study. To assure that the questions fulfilled that, several different steps were taken. After the first examples of the questions were created, they were examined by the supervisor of this thesis. After the supervisor got the chance to read through the questions, his feedback and critique was taken into consideration. After the necessary changes were made, the contact person at the company got the chance to put their input regarding the questions. After another set of necessary changes were made, the questions were sent to my supervisor one last time for his final input before the final example were created. These different steps were important to go through in order to create a set of questions suitable to provide data that could be used to create knowledge about the research question.

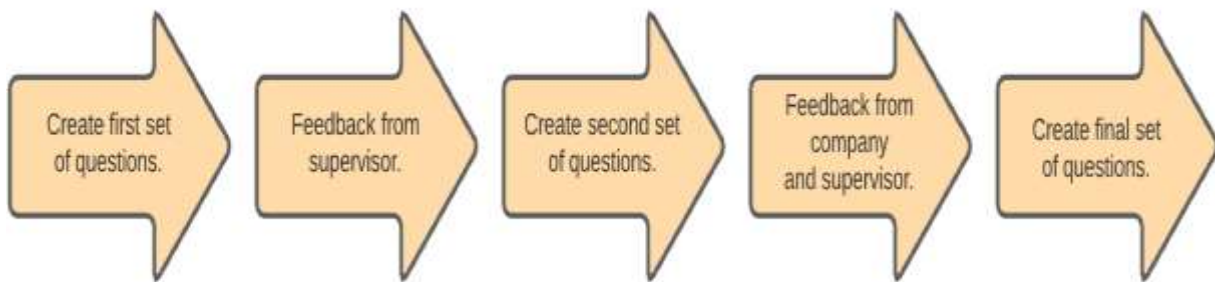


Figure 4: The creation process of the questions used in this thesis.

In the table below, the six different participants, their roles and the years of working at the company will be presented.

Table 1: Participants A-F, their roles and the amount of years working for the company.

Participants	Position at company	Number of years working for the company
Participant A	Process owner	22 years
Participant B	Planner	15 years
Participant C	Process technician	22 years
Participant D	Technical manager	16 years
Participant E	Process owner	2 years
Participant F	Global quality manager	-

3.3.2 Documents

As the primary source for this study relies on interviews, the documents will be used as a complementary source of data collection. The main type of information that will be collected through the various documents will be historical and descriptive information regarding the company in context to the purpose of this study. The releases and yearly reports provided by the company provides good complementary information that is necessary in order to obtain a complete result.

3.4 Data analysis

The data collected from the interviews could be analysed multiple times as each of the interviews were recorded. By creating the opportunity to relisten the interviews, the researcher enables the possibility to find valuable information that wasn't obtained during the first interview.

One of the disadvantages with the use of interviews as the source of data collection is that it allows the participants to be very rich with their answers, which creates a great amount of information that later needs to be analysed (Creswell and Creswell, 2014). To analyse the large amount of data collected, a thematic analysis was selected. The thematic analysis allows the researcher to identify different concepts and themes within the information collected (Lichtman, 2014). The thematic analysis consist of six different steps that the data needs to go through: *initial coding, revisiting the coding, creating a list of categories, modify the list by reading through the material again, create a new list of categories and create different concepts out of the categories*. The thematic analysis can also be described in three different C's: *coding, categories and concepts*.

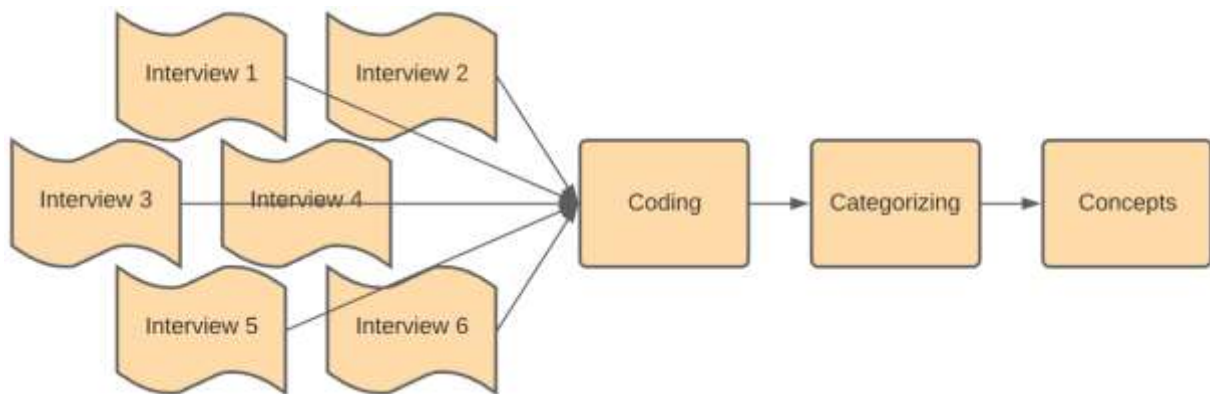


Figure 5: The different steps within the thematic analysis used to analyse the data.

As can be seen in figure 5, the analysis started with that each of the participants interviews being recorded. After all of the interviews were completed, the initial coding started where the search for the same words or phrases between the interviews were highlighted. After the first step of coding were completed, the interviews were relistened to and the different codes were reevaluated as some of the codes were removed in order to keep the codes that were more appropriate to use for this study. After the coding was done, the different codes were then put into different categories that they were found most suitable. As a last step of the analysis, different concepts were created out of the different categories.

According to Lichtman (2014), around 5-7 concepts are a good amount to include in an analysis.

3.5 Validity and Reliability

One important aspect that a researcher needs to highlight in their study is what is being done in order to provide a result that can be reliable (Creswell and Creswell, 2018). The most important thing when creating reliability in a study is to assure that the approach of the research contains consistency across all the different parts (Gibbs, 2007). If a study has a high reliability, it can be conducted by another researcher in the same way, and still achieve the same result.

Validity on the other hand highlights in which way the result of the study is valid from the viewpoint of all the persons affected such as the researcher, the participants and the readers (Creswell and Miller, 2000). According to Creswell and Creswell (2018), one way of ensuring a high validity for the study is to include multiple sources when collecting data. Another approach taken in this study to ensure a high validity is the ongoing with the supervisor throughout the whole process. By having a continuous dialog with the supervisor, the information and guidance provided from that communication can be incorporated into the study.

To ensure that the data collected in the interviews are valid, a short summary and discussion is held with the participant in questions to reassure that the answers provided are what the participant stand by (Creswell, 2014). In contrast to that each of the participants conducts a short summary and discussion after each interview to increase the validity of the results. Multiple amounts of participants are included to further ensure the validity of the study.

To ensure the reliability of the study, the approach of the study has been consistent throughout the research. As this study is of the qualitative approach rather than the quantitative, the data collected has been focused on providing information that is of high and rich quality rather than collecting a high amount of sparse data.

As the results of this study relies on the participants view, the interviews have been conducted in times and place where they feel the most comfortable. This is to increase the honesty and truthfulness of their answers (Creswell, 2014).

3.6 Ethical considerations

An important aspect when conducting interviews is the different ethical precautions that needs to be taken. The ethical considerations allows the researcher to both see the good and bad outcomes that can come out of the study, as well as set a strategic plan on how to make the participants as comfortable as possible without them feeling exposed at any point. By applying different ethical considerations it also allows for a higher quality of the study (Ok, MacIntosh, 2014). Creswell and Poth (2017) further states that the ethical considerations are used as a form of protection for the participants so that the information they provides doesn't get exposed.

The ethical considerations must be implemented into the study already at the beginning. Before the different interviews started, the purpose of the study was described for each of the participants, this is according to Sarantakos (2005) an important step. As important it is to include ethical considerations in the beginning of a study, it is also important to apply it at the end. The researcher needs to present all the different findings within the study and not hide any results that may not suit the preference of the researcher (Berg, 2001). Neuman (2009) continues to describe the importance of ethical considerations and how the researcher need to be truth to the study and not chase answers from the participants that they don't stand by, it is

also important to not falsify any of the data collected in order to benefit the outcome of the study.

As the participants were the main source of data income, the priority was to make sure that they felt comfortable and not stressed when participating in the study. To assure that, the participants were contacted in good time and presented by several different times within their working hours to choose from. Further on, as the COVID-19 pandemic still was ongoing during this study, the interviews were conducted through a video and audio conferencing tool in order to keep a safe social distance. The participants were asked to find a private and quite room to ensure that they didn't felt any pressure in their answers from other employees.

As discussed before, the privacy of the company and the participants is one of the most important factors when conducting a study (Yiannis, 2018). Therefore, the name of the company and the names of the participants will not be presented in this study. Instead, the company will be addressed as company X and the participants will be addressed as participant A to F, as shown in *table 2*. This is to create a complete confidentiality, both for the company and the participants. The participants was also presented that they had the opportunity to back away from the study at any time if they felt that they didn't want to answer the questions. This creates a feeling for the participants that they have a total free will and that they can, at any time, ask to withdraw from the study. As an evidence of that the participant were participating voluntarily, a written consent was sign under before the interviews started. Another aspect that is of importance when conducting interviews is the confidentiality. Therefore, the participants were informed that the answers from their interviews would only be used by the researcher (Ok, MacIntosh, 2014; Yiannis, 2018).

As one last step before the interviews started, the participants were also asked for the permission to be recorded.

Table 2: Participant A-F regarding the ethical considerations.

Company	Participant	Approval of being recorded.	Looked through and approved the consent form
Company X	Participant A	Yes	Yes
Company X	Participant B	Yes	Yes
Company X	Participant C	Yes	Yes
Company X	Participant D	Yes	Yes
Company X	Participant E	Yes	Yes
Company X	Participant F	Yes	Yes

4. Empirical findings

This chapter of the thesis will provide the answers from the participants of company X. The findings are presented in a detailed way in context to the research question of this thesis. The findings will present how industry 4.0 and the different technologies affect the digital transformation of the company.

4.1 Existing knowledge about industry 4.0

Early on in the interview a question regarding the participants knowledge about industry 4.0 was asked to see how much they rate their own knowledge when it comes to the concept itself.

Participant C responded:

‘I know the basics on what it is based on, but nothing more in-depth’.

Participant D highlighted that:

‘I have not studied it in detail, but we (As a company) are working on it and I feel that I have a good knowledge of it’.

The participants were asked to rate their knowledge about industry 4.0 from a scale from 1-5 where 1 was the lowest and 5 was the highest. The answers fluctuate from participant to participant where some find themselves more familiar with the concepts whilst others know about it but nothing more. The results of the question can be seen in *table 3* below.

Table 3: Participant A-F regarding their knowledge about industry 4.0.

Participant	Knowledge about industry 4.0 on a scale from 1-5
Participant A	1
Participant B	1
Participant C	3
Participant D	4
Participant E	3
Participant F	2

As can be seen in the table above, the majority of the interviewed felt that they had a good base knowledge about the concept of industry 4.0.

As can be seen in table 3 above, **Participant E** feels that the own knowledge about industry 4.0 is average as the participant commented that:

‘It is a broad topic and it is hard to know everything about it’.

The study also looked through, in context with the purpose of this study, which technologies within industry 4.0 has been implemented, the results can be shown in *table 4* below.

Table 4: The five different technologies and if or not they are implemented within the company.

Technology	Implemented – Yes/No.
Internet Of Things	Yes
Autonomous robots	Yes
Big data and analytics	Yes
Simulations	Yes
The cloud	Yes

4.2 Use of technologies

One important aspects of a digital transformations is how willing a company is to search and use new types of technologies that are introduced.

Participant A addressed that:

‘‘Yes it becomes an important part. I feel our disadvantage here at the company is our business system. The system is really great, but not many people know the business system anymore. It is quite old and you are looking at replacing it. This leads to looking at new parts and solutions’’.

Participant B also talks about how important it is for the company to search and use new technologies as the participant responded:

‘‘ Yes. We have quite a few people outside the company visiting quite often and I actually think we are at the forefront when it comes to this. The biggest change within the company was perhaps 10–12 years ago when we implemented the lines and removed the manual aspect. Now we are more in a phase where we want to develop and broaden it by making it available throughout the factory and not just during the assembly part’’.

On the other hand, **participant D** feels both that it is important for the company and at the same time it isn’t as the participant responded:

‘‘ Both. For example, something that has not been implemented yet that we should perhaps implement is collaborative robots. We have ordinary autonomous robots, but we lack the implementation of collaborative robots. It is an important part for the company to find new technologies and present and be involved, but when it comes to implementing the technologies themselves, we have lost a bit of momentum. This also has to do with the investment money only going to profit instead of reinvesting. For the company, it is important to find new technologies and we are very interested in new technologies, but it is the actual implementation of these technologies that we have backed down a bit. One aspect that maybe has an affect on this is that there are so many new technologies all the time that the company does not really have time, and once you implement something, it can already be old’’.

To conclude the importance for the company when it comes to find and implement new technologies, **participant E** highlighted that:

“ Yes, it is. No matter what area you are talking about, it is important to keep up with the latest technology. If we look back a few years and look at where we are now, and especially where we will be in a few years, you notice that the technical development goes straight up and if you are not active in the changes all the time, it is easy to fall behind and lose the edge to your competitors. Even if it costs a bit, it is well-invested money”.

From the findings between the participants it becomes clear that it is an important aspect for the company to always strive in their search for new technologies that the company can implement. Participant B perceives that the company is in forefront when it comes to this aspect as they have a lot of visitors outside of the company that looks into their organization. A key finding to note from this section is the participant D feels that the company is good when it comes to be a part of finding and discussion new technologies, but that they then lack when it comes to implementing it into the company. Overall all the participant shared the same view regarding this section with the exceptions of participant D when it came to the implementation part.

As a follow up question regarding the importance of finding and implementing new technologies within the company, the participants answered about if the company actively works towards finding and implementing new technologies.

Participant B points out that:

“ Yes, we are actively looking for new technologies. A major project now is that the global part of the company wants to implement one and the same business system in all factories. The group has a new factory in Thailand and there they will test the new business system to see how it works”.

In context to that the global part of the company is actively looking for new technologies to implement, the individual company in Ljungby are also working on some new technologies to implement as **participant C** addressed:

“ We have a stop time system that we call 1.0 and now I am evaluating a new stop time system that we call 2.0. In the new stop time system, we have added some new areas of use. An example of a new area of use in the new stop time system is that you can send an email directly from the machine, so if a problem arises you can notify this immediately without looking for a computer”.

Participant A follows up by describing that the company in Ljungby also is:

“ Actively looking to find and implement new solutions that can improve the company. What we are looking at now is to implement the pace system in the remaining parts of the production besides at the lines where it already exists”.

As a continuing theme from the last question, **participant D** highlights both the positive and negative aspects of the company when it comes to how the company works with new technologies:

“The company has good ideas and good will when it comes to finding and implementing new technologies. The company works actively to find new technologies but may not actively work to always implement them. It is an absolutely important part for the company to become more and more digital. It is perhaps more important down-up than it is top-down within the company when it comes to digitization. We who work a little closer to the floor see a greater need for digitization than those at the top do, of course they do too, but it is more we who drive this forward. Something we at the company have noticed is that there is no one who can systematize before implementing. Systematization is something that is needed for us as a company to be able to cope with industry 4.0”.

Zooming out to look at the global part of the company again, **participant E** describes that:

“ The company has decided that since we are so many factories around the world and all factories have their own way of managing the production itself, the global management of the company has said that there should be 2 systems to be used by the different factories in terms of production. These two systems will now be implemented in all factories to create a type of standardization”.

When summarizing the answers of the participants, the key takes is that the company, both independently in Ljungby but also globally, are actively working to find and implement new technologies. Participant A and C gave some concrete examples of different projects that are ongoing at the factory in Ljungby at the moment. Whilst participant B and E describes different projects that are ongoing in a more global aspect. This shows that the company, both within the factories, but also globally are actively working to find and implement new technologies. Another key take from the answers is that participant D addresses the same point as before that the company maybe always isn't as good as it can be when it comes to implementing the different technologies that they find.

By reading through the annual report from the company, it is clear to understand that the company wants to be in the front row when it comes to meet the different requirements the customers may have. The company also addresses that in order to succeed with that, they have to, amongst other aspects, *“further invest in the digital transformation”*.

Another important point that is highlighted in the annual report is that the company has as a goal to *“Increase the efficiency by digitization, automation and modularization”*. The company openly describes the importance digitization and digital transformation has for the company moving forward in order to stay competitive against their rivals.

By reading through the available annual reports that the company offers it is clear to see that the digitization and digital transformation has been an important part from the company for a number of years now. In their annual report from 2016 the company states *“Mobile solutions and Internet access provide requirements for the company and creates opportunities to interact with consumers in new ways. Digitization is also creating great opportunities to develop increasingly advanced products, such as for example, connected products”*.

4.3 Changes in value creation

In order for an implementation to affect the digital transformation of a company, it has to provide changes in the company's value creation.

Participant D addresses the changes autonomous robots have brought:

“ Mainly in terms of quality. There is no human factor that can affect that particular process. The autonomous robots are integrated into the process itself and not just implemented at the end. This allows the robot to stop already after the first or second bad component. Then you can call the employee to correct it and then let it drive on. It is not only that they work autonomously but also that they can detect these errors and stop so that the errors can be corrected in a much faster way”.

Participant A follows up by pointing out that:

“The autonomous robots do a lot. It is very heavy handling that the robots have been able to take over. This is where you get a lot of wear and tear on humans and this is where the robots are efficient to use. Instead of a human standing and picking up a piece of sheet metal every ten seconds, the robot can do this autonomously instead. Even though the robots can handle the tasks themselves, it must be manned and the humans can instead program and do other tasks at the same time. With the help of the autonomous robots, you do not need to have one operator on one machine, but you can now have 2 operators on 3 machines, for example.”.

Participant E also adds:

“ We can produce more with the help of a robot as it is tireless. With the help of the autonomous robots, we have also received minor wear and tear on the staff as the robots can do that job. Productivity has increased as production can be kept unmanned”.

In the company's annual report from 2020 it can be read that the company has increased its automation by a lot, from 4% in 2019 to 23% in 2020. Another important aspect that the automation has brought is that the number of accidents has decreased by 10%.

Participant B describes the importance of autonomous robots and internet of things when talking about the changes it has brought:

“ Between the punch and the edge bend, the machines can now talk to each other so that they know what position they are in. The punch always knows if the edge bay is ready to receive the plate. We also have in the line system where the system talks between the different stations within the line, for example, the system can tell you that the machine is ready to leave d10 to move to d20. Even if the different stations at the line is in the same system, that system has a lot of different stations between them where it is important that the information is available and shared between”.

Further on, **participant B** talks about the changes that autonomous robots bring to the effectiveness of the process:

“Where do we benefit from deploying a robot to streamline the process? With the implementation of autonomous robots we become more quality assured. At the same time, we

now have the person who performed the job earlier that we can put on new assignments where he or she can do a job that brings value to the company''.

Participant F simply addresses that the autonomous robots have brought:

''A stable quality and a stable flow''.

Participant D follows up by also talking about the importance of the two different technologies participant B described:

''At our shoulder turn, we have raw materials in a stool where we have a vision (A type of machine) to see how they lie as they can be unorganized. The robot goes down and picks up a shaft, he puts the shaft in a transformation station, takes it over, puts it in the lathe, the lathe answers it, the robot picks it out of the lathe and puts it in an optical measuring machine, that measuring machine measures it and sees how it lies against the tolerances, then it sends data in correction back to the lathe and says, for example, that it is a little low in the tolerance value. Then the measuring machine sends data to the lathe to compensate up the tolerance a few hundredths. If the axis is then okay, the measuring machine sends a serial number to a marking machine, the marking machine marks a number in the axis that is connected to the measurement data and then the axis is complete. There, the different robots talk to each other and send data between each other. If the shaft is completely out of tolerance, the robot scraps it completely''.

Participant D also follows up by addressing:

'' On the lines we also have something we call a linkbox, when an operator finishes his machine at his station, it presses okay on its touch screen, then it talks via the internet with the track system itself so that it can start the engine on the track system to forward the machine. These two components talk to each other to see if they are ready to move the machine one step further or not''.

Participant C, much as participant D, highlights the changes the automated lines have brought:

'' The automated lines have improved the company in terms of quality. Before we started with the lines, we had a service call rate of around 40% and after implementation it was down to 9%. So a pretty big improvement. Service call rate means the time it takes before one of our service technicians has to go out and repair the machine in some way. In terms of time, we have become more productive, we knew the exact number of machines we could run in one day. Something that also improved was also something we call TTR, which means time to react. When placing a sales order, how long did it take to deliver it. Before the lines we were on 14 days and after the implementation of lines we ended up on 3 days''.

Participant F describes more in-depth of the changes the implementation of internet of things has brought:

'' We have a standardized IoT solution we call Connectivity which is being implemented on more and more products. It enables for example Fleet Management, which is remote control of prices and monitoring for our customers, as well as big data for new development and

quality follow-up for us. We also have individual products that can talk to each other directly (Oven and quick freezer)''.

Participant C describes that it can occur problems if the different robots doesn't talk to each other:

'' It became a valley. Because when the different robots work together, we have shortened the lead times on the details. But when it does not work properly, because sometimes we have problems with them losing communication between each other, it brings us back on the same page as we were before we implemented them. Once it works, you see an improvement''.

Moving forward from the autonomous robots and internet of things, **participant E** discusses about the change's simulation has provided, even if it isn't something that hasn't been fully implemented within the company:

''At RnD we have a simulator. When a customer makes a requirements specification for a new product (for something that does not yet exist), this simulator will build up that product and test run it in a VR environment and get a test data so that we can then use the data to quality assured the product in the end. Instead of doing the test manually, you can do it via the simulation and it saves a lot of hours''.

Participant D further adds on that the company also uses simulation externally in some parts of the production:

'' When we are going to cast an aluminum hatch, we send a 3D model to the supplier who puts it in their casting programs and does a simulation. This is something used by the company but that process is more externally''.

Although the company still feels that it is in the beginning of the implementation with simulations, the differences before and after can be seen very clearly. Another technology that the company have come further in the progress with is the implementation of the cloud.

Participant B points out:

'' A huge step for the cooperation between different factories within the group. It has added efficiency. Instead of sending a document back and forth, you can open up a common document where everyone can sit and write and change without having to send it between each other. The implementation of cloud has streamlined the use of document management. From having had 10 steps to go through before, it is now only 1, you streamline the process by 90% with the help of cloud services. The cloud services have enabled us to work in the same document as our colleagues in Italy. The cloud services are used a little more on the office side of the company''.

Participant A highlight a small but useful change the cloud has brought:

'' The cloud services have improved the ability for us to see and share information in a much faster and more efficient way than before. The cloud has made it possible to use and save in various Excel files. And it is something that is being used more and more. A small but still effective use of the cloud is when planning the holiday, now an excel file is sent out to everyone with the periods that are available and everyone writes it in the same file. It

becomes easier for everyone to be on the same page and that you individually do not have to save and send it to the managers.’’

Participant C addresses that the use of cloud has change some aspects within the assembly part of the company:

‘‘ Everyone gets access to the different standards. Something we also want to get up on the cloud is the element blade, which is our assembly instructions. Right now we have these instructions in a folder at the station. But we want to post this on the cloud so that everyone has access to it and it allows for a simpler process when it comes to updating these instructions’’.

Participant D describes the implementation of the cloud as something that has streamlined the accessibility when it comes to different documents:

‘‘ What has improved with the cloud is that you avoid using VPN to connect and to access the company's servers. Before when I would access my documents that were on our local server, I had to connect to a VPN. So the advantage of the cloud is that I can access my documents on all different devices without having to connect to a VPN’’.

Both Participant E and participant F discusses the advantages the cloud has brought in terms of quality assurance on the documents as well as minimizing the misunderstandings.

Participant E responded:

‘‘The cloud makes everything available. Quality assurance of the documents as it should always be the latest version. Although, there are still some problems between the cooperation with some factories in other countries as they haven’t come this far with their use of the cloud’’.

Participant F briefly pointed out:

‘‘ Big simplification of data sharing with efficiency gains due to access and reduced misunderstandings’’.

The company is aware of the challenges the amount of data they collect every day brings, therefore they also understand the importance of collecting and analyzing that type of data in order to maximize the use of it.

Participant A points out:

‘‘ It enables us to work on the right things. The analyzed data helps us to identify with what we should work with to become more efficient. It allows us to know what we have to work with and where we have the biggest problems. The data that is collected and analyzed at the lines can then be used to see what the biggest problems were and how we can do to minimize these problems and thus create a more efficient flow. The clock system collects a large amount of data such as stop time on the lines. The data we receive can then be used to streamline the processes and ensure that we work smart and that we don’t have any dead times’’.

Participant E highlights the changes big data and analytics has brought to the financial aspect:

“ The financial sector gets a tool where they can really compare our different factories in a right way. Also an economic analysis of what costs a factory the most, for example if you have run the wrong products, if you have damaged the products during the assembly or assembled the wrong ones. With the help of big data and analytics, we can see this and act on this to save it. It helps the company to act faster on what costs the company money”.

Participant B still feels that the company lacks a proper tool to analyze the big amount of data the company work with:

“ What we are missing here is a tool that can analyze the data. Because we have different machines that collect a lot of data about really everything. Everything is also saved, but we do not have a tool that can analyze the data itself, this is something we have to do ourselves. This is important to work with because it makes no sense to have a large amount of data if you cannot use it. We have many different tools in different parts of the company that collect and save the data that we can go back and check what has gone wrong and what we can do to improve”.

Participant D is on the same line as participant B:

“ The data has been used and is still used in improvement work. But with the help of a good analysis tool, it can be even better”.

By summarizing all the different participants answers it is clear to see that the implementation of the different industry 4.0 technologies has made a significant impact on the value chain of the company. Whilst some technologies have made a more significant impact such as the autonomous robots, internet of things and the cloud, both simulations and big data and analytics have also provided some changes after they were implemented. Especially when it comes to big data and analytics, participant B and participant D addressed that there is a lack for an analytic tool in some parts of the company. This, according to the participants, makes it a little bit harder to work with all the amount of data the company gathers during a working day. The changes that the different technologies bring to the value chain of the company are easy to recognize for all the participants and the answers shows that the changes have been implemented both internally within the company, but also externally in terms of the collaboration with other factories.

Participant A summarizes the changes the different technologies have provided to the company:

“ The different implementations have made us work with what we are supposed to work with. We work with parts that we know earn us more and we reduce the time at work that does not give us as much, both in money and in time. These 5 different technologies within industry 4.0 have improved the process we work in”.

4.4 Structural changes

Another important aspect when defining a digital transformation is the structural changes it makes to a company.

Participant D responds:

“ Digitization has created more jobs, especially when it comes to the office side of the company. Initially, more people will be needed if you are going to digitize as it places higher demands on information than it did before. If there is wrong information for the employees at the assembly, he or she will stand and assemble wrong. The same applies if there are wrong details that are in the roadmap to a machine, that will “tell” the machine to produce wrong. It places much more demands on data when you digitize”.

Participant E follows up by addressing:

“ The work with the digitization of the company has created the team I sit on at the moment. There is an intention to work with new technologies for the company”.

Participant C is clear to address that the implementation of new technologies such as autonomous robots haven't led to anyone losing their job, but created new tasks for the employees:

“ Even though we at the company are working to digitize as much as possible, the digitization has not meant that anyone's areas of responsibility have completely disappeared. Digitization means that employees receive other tasks than they previously had”.

Participant B continues on the same line as participant C:

“ With the implementation of the automated lines, a fitter has become a fitter. Now the fitter only needs to focus on assembling the machine. Before the lines were implemented, the fitter also had to go around and look for the right parts to assemble. No implementation of a technology has meant that we have sent home 3 employees, but we have found other tasks that are value-creating as the operator does instead. The operators have more responsibility for the maintenance of the machines now and ensure that the robot works as it should”.

Participant A also addresses the automated lines when describing the structural changes:

“ The implementation of the automated lines has meant that you work at one and the same pace throughout the day. This means that you do not have to stress and that you can work at a leisurely pace. Before the implementation of the automated lines, an operator could stress all morning to finish all his machines that were to be made and then just stand and fidget during the afternoon. This was one of the biggest changes for them in production. The implementation of the line system has made it possible for everyone to work at the same pace regardless of age”.

Participant D points out that the implementation of new technologies has created a need to learn new skills for a certain group of people within the company:

‘‘ For those who work in production, it has not created any new requirements for learning new things, but digitization has mostly simplified their work. But for the employees in the office, this has created higher demands on IT skills. It is not enough just for a technician today to go out and order different components or explain how to assemble things. Now it is more a digital technology that requires a higher IT knowledge. Here you can see a difference in the age groups in how easy it is to adapt to the new requirements where the young people have an easier time learning than the slightly older ones’’.

Participant A describes the changes in a similar way to participant D:

‘‘ In some places in the company, it does. The machines are becoming more and more advanced. There is more use of data and it creates a need for our employees to know how to handle the data in the right way. You have to know a little more IT and you notice that people in their 20s do not have such big problems when it comes to adopting to it, while if you bring in someone a little older, it is more difficult’’.

Participant B addresses the ergonomic changes the implementation has provided for the employees at the company:

‘‘ The operators are still needed during all stages of the process. On the other hand, we streamline the process and it also becomes ergonomically better for the operator. The operators have learned the technical aspect at a completely different level. To put it bluntly, it is not just pressing on/off now but more that the operators have learned to program machines in a completely different way’’.

Participant C states that some additional trainings have been necessary for the employees in order for them to understand how the new machines work:

‘‘ It was a bit difficult for the operators to adapt from the old machines to the new ones. Both that the new machines were a little faster than the old ones, but also the technological side. The machine looks the same, but the components inside the machine are completely different. And this required additional training for the operators so that they would know how to handle it properly. But even if a new training has been required for the new machines, they are still much easier to learn to work in than the old ones were, thanks to the digitization’’.

Whilst the other participant talks about the changes created at the moment, **participant E** points out the needs that will be important moving forward:

‘‘ Instead of being a fitter who performs all the steps, you will be more of an inspector to see that the robot performs all the steps correctly. All our services will be printed against a system knowledge base’’.

The consensus from the answers between the participants is that the implementation of the technologies have created a bigger need for IT-competence from the employees than it did before. Changes and the need to learn new skills hasn't been necessary in all parts of the company, where participant D pointed out that the most changes and needs to learn new skills have been in the office part of the company. A number of participant also highlighted that the

changes have been easier for the younger generation as they are more used to IT than the older generation are. Participant C carefully included that the implementation of new technologies didn't mean that the employees were replaced by different machine, but that the employees got new tasks to complete. To conclude, the digitization of the company have created more work for the employees and in some part of the company it has created a whole new job position.

4.5 Financial aspects

For a company to be able to invest in new technologies, it needs money. Another important aspects is if the company, after it has implemented a new technology, generates more money.

Participant D responds:

“ What the implementations of these technologies have done is that they have reduced quality errors and increased delivery reliability to customers. The implementation of the technologies may not have increased to higher sales, but it has increased productivity within the company, and it has led to a significant amount of money being saved”.

Participant B describes the changes in a similar way to participant D:

“Everything we do today we are able to do in a more efficient way with the various implementations. Today we create a product for a cheaper price than we did before, which means that we make more money on the products”.

Participant A points out how the company works with the budget for these implementations:

“ At the beginning of the autumn, we always set next year's budget. And then we can request that we want to replace or introduce something new and how much it would cost This must then be paid back to the company within a certain amount of months/year. For each implementation, you must make a home calculation of how much it will cost and how many months/years it will take to earn the money it has cost. If you want to implement a new technology, you send in a proposal and how much it will cost, then that proposal must be approved before it is entered in next year's budget. Even if you get an approval, the company can in the meantime choose to postpone it for a year if the company believes that it isn't enough money at the moment. We have both a long-term and a short-term investment plan for these implementations”.

By reading through the companies yearly report from 2020, it is clear to see that the COVID-19 pandemic had an effect on the budget, and the company addressed that it had to rethink and reprioritize the investments its had planned from the beginning. Some of the investments was pushed forward in time whilst some investments were completely abandoned.

Participant B highlights that the factory in Ljungby doesn't have its own budget:

“ Yes, we have a budget for new investments. Ljungby does not have its own budget, but the company has one together. Each factory can then send in what they need to do in their own factory and it can be about anything. To get it approved, you explain the investment and what is needed to do”.

Participant D further elaborates on that the company doesn't have a specific budget just for investments in new technologies:

“ No direct budget for just the implementation of new technologies. We have an annual budget where everything is included. It can be reinvestment in old machines, upgrades of existing machines. But it can also be renovation of roofs or windows. But it can also be an investment when it comes to implementing new technologies”.

The answers of the participants highlights that the implementation of the new technologies have reduced the errors created in the value creation and this has led to a higher delivery reliability to the customers. The implementation of the technology haven't increased the number of sales, but it has created a higher productivity within the company and in that way saved the company money. Although the company doesn't have a specific budget just for the investment of new technologies, it has an overall budget where the different factories can apply for money in order to succeed with the implementations.

4.6 Industry 4.0 technologies and the digital transformation

The participant highlighted which out of the five technologies included in this study they felt had have the most impact for the company. The majority of the interview believed that the implementation of autonomous robots had the biggest impact on the company, whilst participant D stated that the cloud was the technology that has had the most impact.

To ensure which part of the digital transformation had been most affected by the implementation of technologies within industry 4.0, the participants answered that question and the majority agreed that the part that had been most affected was the changes in value creation.

Table 5: Participant A-E and which technology they feel have impacted the company most.

Participant	Which technology have impacted the company the most after being implemented
Participant A	Autonomous robots
Participant B	Autonomous robots
Participant C	Autonomous robots
Participant D	The cloud
Participant E	Autonomous robots

Participant B responds:

“ The robots have made the whole process more quality assured. Efficiency and quality have been incredibly affected after autonomous robots have been implemented”.

Participant E points out:

“It is the autonomous robots that have been around the most and got the most impact. But I don't think that it will be the technology that has the most impact on our company in the future”.

Table 6: Participant A-E and which part of the digital transformation that has been most affected with the implementations of the technologies.

Participant	Part of the digital transformation that has been most affected with the implementation of the technologies
Participant A	Financial aspects
Participant B	Changes in value creation/Financial aspects
Participant C	Changes in value creation
Participant D	Changes in value creation
Participant E	Changes in value creation

Participant D addresses:

“Changes in value creation goes together a little with structural changes. But the implementation of the new technologies has changed our mindset throughout the whole processes of value creation”.

Participant A highlights some other aspects:

“ If you do not have money and you do not save money for just such things, it will not be possible for the company to invest in new technologies. It is important to save money to be able to invest in new technologies in order to then be able to implement these and thus generate more money back.”

5. Discussion

In this chapter, the empirical findings from the interviews will be discussed in context to the literature review, related studies and the purpose of the study.

Benlian, Hess and Matt (2015) discuss the digital transformation of a company in four different parts, these parts are:

- Use of technologies
- Changes in value creation
- Structural changes
- Financial aspects

In order to have a successful digital transformation a company needs to incorporate all the four different aspects. From the interviews that was held and by reading through the annual reports of the company, it became clear that this is something that is ongoing and has been for a couple of years already. Both the participants and the annual reports highlighted the will and understanding the company has for the digital transformation and how important it is to always work on it in order to stay competitive. The outcome of the empirical findings shows that all of the five industry 4.0 technologies has been implemented in the company in some way. The results also shows that all of the technologies have not been implemented in every part of the company and some of the technologies have been used for a longer period of time. However, the results shows that the company always are actively both searching and discussing new technologies that can be implemented, and that this also is an important part for the company as they understand the importance of the digital transformation. In regard to use of new technologies, one participant pointed out that the company, in later days, have lacked a little bit when it comes to actually implemented new technologies. The participant addressed that the company actively works towards finding new technologies, but when eventually find a new technology, they aren't always the best to execute the implementation. Further on, the participant believed that one reason for that could be that the share amount of new technologies is too high, so when the company implements a new technology, it can already be old in a couple of months. This situation fits in perfectly with what Downes and Nunes (2013) highlighted that the biggest challenge for a company is to find and also adopt new technologies into the business. As one of the participants pointed out, the company have good intentions and works hard to always be in front row to find new technologies, but that the problem sometimes can be that the technologies that are being found doesn't get implemented, a problem that Downes and Nunes (2013) describes as one of the biggest challenges for a company. By reading through the answers of the participants it was clear that the search and adaptation for new types of technologies that can further develop the company is of great importance in all of the different parts in the company. This is further also understood as this has been a big part in the company's annual reports, as well as that all the five different technologies that is used in this study has been implemented.

Out of the five different technologies presented in this study, autonomous robots where the one technology the majority of the participant found had impacted the company most. Alves et al. (2017) explains that the autonomous robots have constantly been developed in order to reach all the criteria that industry 4.0 requires. By analyzing the results from the empirical findings, this fits in well with how the company have worked with autonomous robots as it was the first of the five technologies implemented. The robots have over the years been developed further and small changes has been made on a regular basis in order to get full use of the robots. The results from this study

Ayala, Dalenogare and Frank (2019) found out in their study that larger company has a higher probability to implement industry 4.0 into their organization. The result from this study strengthens that as the company in this study have been working with industry 4.0 and its technologies for some years. Another aspects that Ayala, Dalenogare and Frank (2019) found out is that companies most of the times implements the cloud as the first technology, this isn't the case for the company in this study as the first technology implemented was autonomous robots.

Table 7: Top three relevant comments regarding the companies use of technologies.

Participant/Source	Comment
Participant D	<i>“The company has good ideas and good will when it comes to finding and implementing new technologies. The company works actively to find new technologies but may not actively work to always implement them. It is an absolutely important part for the company to become more and more digital”.</i>
Participant E	<i>“ Yes, it is. No matter what area you are talking about, it is important to keep up with the latest technology”.</i>
Annual report, 2020	<i>“Further invest in the digital transformation”.</i>

Benlian, Hess and Matt (2015) refer to the term *use of technologies* on how willing a company is to find and adopt new technologies in order to succeed with the digital transformation. From the findings in chapter 4 it is clear to understand that the company understands the importance of finding and adopting new technologies, and even if they aren't in the front row when it comes to implementing them at the moment, the company has good ideas and good will and works actively to become more digital.

Vial (2019) explained that the digital transformation is seen as a process where a company implements new technologies and at that time also change their value creation throughout the whole company chain. This is reinforced by the answers of the participant that can be found in chapter 4 as they describe the changes the different technologies have brought to the value creation of the company. Autonomous robots are the technology the participant first discusses regarding the changes it has brought to the company, where the biggest change is at the punch and curb machine that now operates autonomously without any interaction from the employees. This is, according to Graetz and Michaels (2018), the purpose of implementing autonomous robots as they should be able to perform different tasks and at the same time be safe, collaborative and flexible. Mehnen and Turner (2018) addresses the importance of implementing internet of things into the organization in order to fully adopt to industry 4.0. With the use of internet of things, it allows company to use sensors in different parts of the production that allows the company to collect data in real time and upload it on the internet, this data can then be accessed by others. From the empirical data collected and presented in chapter four it is clear that the implementation of internet of things have changed the value creation of the company, as it has allowed different machines to talk to each other and send data between each other in order to operate in the most effective way. The data is collected by different sensors in real time that then are transferred to the internet where the other machine

can collect it and further use it. This is also something reinforced by the study conducted by Kulatunga and Sampaio (2019).

Further on, particularly participant E discusses the changes that simulations have provided for the company after it was implemented. With the use of simulations the company can test products in a simulated environment and get the necessary data from that product without actually building it. By using simulation, the company can use the data created and assure that the products are at the highest level of quality when later being produced. Another aspect that the use of simulations has brought is that it has saved a lot of working hours for the employees as it can perform the testing in a much faster way than before. Dev, Shankar and Qaiser (2020) also points out the same aspect when discussing the use of simulations as it connects the real world with the virtual world. By having an idea of a product in mind, the data necessary for that product idea can be implemented in the virtual world in order to test how it would work in the real world. With the data created in the simulations, the necessary changes can be made before creating the product in the real world, connecting the two worlds in order to create a good product. A negative aspect when analyzing the results from the study is that simulations has not been fully implemented within the different parts of the company, which makes that the knowledge from the participants isn't as broad as the other technologies, this is something that goes against Jahangirian et al. (2010) as their findings shows that simulations is the second most technology within a company's operations.

In contrast to the use of simulations, big data and analytics is a technology more well known in the company and what changes it has brought after implementation. All of the participants highlighted how the amount of data in the company has grown exponentially over the last years. The answers from the participant in this study follows the results Litsiou, Nikolopoulos and Priendl (2020) got in their study that companies are being more depended on that the different data is available, creating a more data-driven company. Participant B mentions that the company has different machines that collects and saves data about everything. This data can later on be analyzed to see for example where within the process it isn't working as it should, and by recognizing where in the process the problems have occurred, it becomes easier to correct the issues. Another aspect where big data and analytics is being used is in the financial sector of the company, by analyzing all the data, it has allowed the company to act faster on the things that costs the company money, and in that aspects saved the company money. Although the company have different machines that collects data about everything, the participants pointed out that the company lacks a proper analytic tool that can help them analyze the great amount of data that is being collected. At the moment the company needs to analyze the data manually, and by doing this it takes the company a lot of time as there is so much data to be analyzed. Participant B highlights this problem by pointing out that there aren't any meaning collecting all the different data the company does without knowing how to use it in a proper way, therefore it is of great need to implement a good analytic tool to become even better with handling all the data. Wamba et al. (2015) addresses the same aspect as participant B mentions in their studies that the goal with big data and analytics isn't just to collect the data, but also use the data to measure different aspects of the company's performance. Another aspect the result of this study shows is that with the use of big data and analytics, the company have been able to act on different problems in a much faster way, something that reinforces what Witkowski (2017) presented in his study.

Klotz et al. (2017) mentions the cloud as a technology within industry 4.0 that is used by people in order to be able to share different resources. This is something participant A, B and D specifically highlights in this study by pointing out the differences the cloud has brought to

the company. The sharing of resources and information has become much more effective and the steps required to receive, change and send back information has become drastically less. This is also something Li et al. (2017) highlights in their study regarding the cloud. Another aspect that the cloud has provided is that the data in different documents that are stored in the cloud always are up to date. Hofmann and Rüsç (2017) presents in their study that the traditionally boundaries between companies aren't as clear as they were a couple of years ago as the world has become more connected. This is something that the result of this study shows as well. Especially with the implementation of the cloud has allowed for a more effective and easier collaboration with the company's business partners in other countries. An important point participant E mentions in this study is that the use of the cloud haven't come as far into the development as it have in Sweden, and therefore creates a bit of problem from time to time.

Table 8: Top five relevant comments regarding the changes in value creation.

Participant/Source	Comment
Participant E	<i>“ We can produce more with the help of a robot as it is tireless. With the help of the autonomous robots, we have also received minor wear and tear on the staff as the robots can do that job. Productivity has increased as production can be kept unmanned”.</i>
Participant D	<i>“ When we are going to cast an aluminum hatch, we send a 3D model to the supplier who puts it in their casting programs and does a simulation. This is something used by the company but that process is more externally”.</i>
Participant C	<i>“ Everyone gets access to the different standards. Something we also want to get up on the cloud is the element blade, which is our assembly instructions. Right now we have these instructions in a folder at the station”.</i>
Participant D	<i>“ The data has been used and is still used in improvement work. But with the help of a good analysis tool, it can be even better”.</i>
Participant F	<i>“ We have a standardized IoT solution we call Connectivity which is being implemented on more and more products. It enables for example Fleet Management, which is remote control of prices and monitoring for our customers, as well as big data for new development and quality follow-up for us”.</i>

Feld et al. (2014) presented in their study that the humans will become less vital in the company as the technologies will allow the machines to work more autonomously. This is something that isn't shared by the participants in this study as they states that the humans still are needed, but in different ways. The implementation and adaptation of industry 4.0 have created new tasks and new knowledge needs for the employees at the company as it is becoming more digital. The demands on the employees IT-knowledge has become more important as the implementation of new technologies creates a need for the employees to know how to handle the machines if an error occurs. And in contrast to what Feld et al. (2014) presents, participant E points out that his position at the company was created because of the needs the company feels that they have in order to stay in the front when it comes to new technologies.

Two important aspects that the participants mentions in chapter four is that the implementation of new technologies streamlines the process as well as it makes the job easier for the employees. With the new technologies being implemented it has taken away some of the heavy work the employees did before, meaning they can be placed to preform different tasks that creates value that aren't that tiring for the body. The other aspects that is mentioned by some of the participants is that the changes that comes with the implementation of the new technologies are easier for the young generation to adopt than it is for the older. Further on, the structural changes that has been created with the different implementations is as earlier mentioned that the IT-competence within the employees have increased. Today, an employee needs to know how to program a machine so that the machine can perform the way it should. Before the implementations of the new technologies, it was enough for an employee to know how to push to on/off button, this has changed as it now requires more IT-knowledge in order to operate the machine throughout the whole process. An interesting aspect mentioned by participant D however is that the implementation of new technologies haven't created changes for the employees that work within the production, but more for the employees that work in the office.

Table 9: Top three relevant comments regarding the structural changes.

Participant/Source	Comment
Participant B	<i>“ The operators are still needed during all stages of the process. On the other hand, we streamline the process and it also becomes ergonomically better for the operator. The operators have learned the technical aspect at a completely different level”.</i>
Participant E	<i>“ The work with the digitization of the company has created the team I sit on at the moment. There is an intention to work with new technologies for the company”.</i>
Participant D	<i>“ For those who work in production, it has not created any new requirements for learning new things, but digitization has mostly simplified their work. But for the employees in the office, this has created higher demands on IT skills”.</i>

Abrahamsson and Karimov (2019) points out in their study that they conducted in Sweden regarding industry 4.0 in small and medium sized companies that the only difference between SMEs and large companies are the financial aspect. This is highlighted by the authors as being the biggest challenge for SMEs when trying to adopt to industry 4.0. As the company in this study is a large manufacturing company with a yearly revenue of 116 billion SEK and with factories all over the world, this problem doesn't occur. All of the participant addresses that the company has a yearly budget where the different factories can request for money in order to complete an implementation. Although the company doesn't specifically have a budget just for investments, they have an overall budget where everything is included. The participants describes that every request needs to be presented in order to get it approved, and when the request is presented it has to be described how that implementations is going to be paid back and how long it would take. Even if the company is a large manufacturing company, the COVID-19 pandemic affected the company and some investments that were ongoing had to be pushed forward and even cancelled.

When discussing the financial aspects and what benefits the implementation of the new technologies have provided, the participant can't say that it has increased the number of sales. What the participant however can point out is that the productivity in the company have increased, as well as the number of errors has reduced. By lowering the number of errors created and increasing the productivity, the company has in those aspects saved a significant amount of money. Further on, the company's key numbers have become overall better after the implementation of the new technologies. Also, the company today creates the product for a cheaper price than they did before, and this also contributes to more money being saved. According to Benlian, Hess and Matt (2015), having a budget and increasing the money earned is an important part of a company digital transformation. And in context to Abrahamsson and Karimov's (2019) study, this isn't a problem for the company as they have a yearly budget where they include investments into new technologies.

Table 10: Top three relevant comments regarding the financial aspects.

Participant/Source	Comment
Annual report, 2020	The COVID-19 pandemic had an effect on the budget, and the company addressed that it had to rethink and reprioritize the investments its had planned from the beginning. Some of the investments was pushed forward in time whilst some investments were completely abandoned.
Participant D	<i>“No direct budget for just the implementation of new technologies. We have an annual budget where everything is included. It can be reinvestment in old machines, upgrades of existing machines. But it can also be renovation of roofs or windows. But it can also be an investment when it comes to implementing new technologies”.</i>
Participant B	<i>“Today we create a product for a cheaper price than we did before, which means that we make more money on the products”.</i>

One important issue to take into consideration is that the negative aspects of the implementations of the technologies wasn't discussed in the same extent as the positive sides. The reason for that can be that the participants doesn't have had the chance to work with all the five technologies within this study for a long time and therefore haven't encountered with any negative aspects yet. Although the negative aspects aren't as highlighted in this study as the positive, one of the participants mentions a few negative aspects regarding the digital transformation, which at least includes some aspects of the negative side. The negative aspect that the participant mentioned the most was the fact that the company had become worse at implementing the different technologies that they find.

Another important fact that needs to be addressed is that the result of this study heavily depends on the interpretations the participants have, as well as the annual reports the company releases. This creates a limitation to the study as it doesn't include much performance related data. By also including more performance related data, the results of the study could have been different.

Within the participants of this study, there are some different strategic levels between them. The similarities from the answers are a lot, but one notable difference is when the technical chief discusses on how the company is willing to find new technologies but have struggled to implement them in recent times. The reason for the struggle is both a lack of motivation to implement them, but also the speed of all the new technologies being created that makes it impossible for the company to implement all of them.

It is also important to address that the study only regards the affect industry 4.0 has on the digital transformation at one company in Sweden. The results of the study could have been different if a greater number of companies were included as well as companies from other countries.

In terms of the outcome of the study, it aligned in many extends to the assumptions made before. Industry 4.0 have a big impact to the digital transformation of the company. The findings highlights that the company's work with industry 4.0 contributes in all of the four aspects of the digital transformation. Although the findings concludes that industry 4.0 contributes to the digital transformation, it is important to highlight that there are some differences in the different technologies and how much they contribute to the transformation, as some technologies have been implemented and used more than others. Also, the findings of the study shows that even if industry 4.0 affects all of the aspects within the digital transformation, the participants are clear that the parts that is affected the most is the changes in value creation.

6. Conclusion and future research

This is the concluding part of the thesis. In this part some reflections and future research are presented.

The aim of this thesis focused on investigate if industry 4.0 affects the digital transformation of a manufacturing company. The thesis included five different technologies within industry 4.0:

- Big data and analytics
- Simulations
- The cloud
- Autonomous robots
- Internet of Things

These five technologies within industry 4.0 where then investigated if they have an affect on the digital transformation of a manufacturing factory, the digital transformation was divided into four different categories.

- Use of technologies
- Changes in value creation
- Structural changes
- Financial aspects

The research questions of this study were:

- How does the adoption of industry 4.0 affect a company´s digital transformation?

This subject was chosen as the concept of industry 4.0 still is relatively new as it first was coined back in 2012. The number of studies regarding this subject have increased in the last couple of years. What this study brings that has not been investigated before, and especially in Sweden, is about industry 4.0 in larger companies. This study also incorporates how the implementation of various industry 4.0 technologies affect the digital transformation of a manufacturing company. A total of six participants took part in this study, answering questions in a semi-structured interview.

The findings of the study shows that the implementation of the technologies within industry 4.0 have an affect of the digital transformation of the company. Also, the outcome of the study shows that there is a difference in how much the different technologies affects the digital transformation as some of the technologies haven´t yet been fully incorporated in the company, such as simulations that according to the participant only is incorporated in the RnD part of the company. The two most defining findings ware that the autonomous robots ware the technology that was found to be the one that had affected the company most out of the five technologies included in the study. The other notable outcome of the study is that the part within the digital transformation that was affected the most with the implementation of industry 4.0 was the changes in value creation. Although the participants found that some technology affected the digital transformation the most, the result of the study shows that all technologies have had some affect on the transformation. The same thing applies to the different parts of the digital transformation, even if the participant found that some parts of

the digital transformation was affected more by industry 4.0, the results shows that all four of the different parts within the digital transformation was affected by industry 4.0 in some way.

6.1 Contribution

The aim of this thesis is to contribute to a part of the studies regarding industry 4.0 and how it affects the digital transformation at a large manufacturing company that the author, to the best of his knowledge, didn't find when reading previous studies. Previous studies, and especially in Sweden, have focused a lot on small and medium sized companies and the concept of industry 4.0 haven't been studied in regard to the affect it has to the digital transformation of a company. By conducting this study, the author aims to fill that gap in the best way possible.

6.2 Future research

As for the opportunities to conduct future research regarding this study, including of multiple companies can be of interest to get a wider picture regarding this subject. Another interesting aspect that can be further researched is to compare the results of this study with how industry 4.0 affects the digital transformation at a small and medium sized company. By including SMEs into the research question it even further widens the knowledge regarding the subject.

Reference list

Abrahamsson, J.F. and Karimov, E., 2019. *Industry 4.0 and Swedish SMEs: An assessment of current maturity level and challenges*. Thesis. Lund University.

Aheleroff, S., Aristizabal, M., Joa, B., Lu, Y., Velásques, J.P. and Xu, X., 2020. IoT-enabled smart appliances under industry 4.0: A case study. *Advanced Engineering Informatics*. [Online] Available at: <https://www.journals.elsevier.com/advanced-engineering-informatics> [Accessed 6 February 2021].

Akter, S., Ngai, E.W.T., Riggins, F. and Wamba, S.F., 2017. Transforming operations and production management using big data and business analytics: future research directions. *International Journal of Operations & Production Management*, 37(1), pp. 2-9.

Alves, M.V.S., Basilio, J.C., Carvalho, L.K., Gonzalez, A.G.C. and Viana, G.S., 2018. Supervisory control-based navigation architecture: a new framework for autonomous robots in industry 4.0 environments. *IEEE Transaction on Industrial Informatics*, 14(4), pp. 1732-1743.

Amaral, A. and Pecas, P., 2021. SMEs and Industry 4.0: Two case studies of digitalization for a smoother integration. *Computers in industry*. [Online] Available at: <https://www-sciencedirect-com.proxy.lnu.se/journal/computers-in-industry/vol/125/suppl/C> [Accessed 6 February 2021].

Amodu, O.A. and Othman, M., 2018. Machine-to-Machine communication: An overview of opportunities. *Computer Networks*, 145, pp. 255-276.

Atzori, L., Iera, A. and Morabito, G., 2010. The Internet of Things: A survey. *Computer Networks*, 54(15), pp. 2787–2805.

Ayala, N.F., Dalenogare, L.S. and Frank, A.G., 2019. Industry 4.0 technologies: Implementation patterns in manufacturing companies. *International journal of production economy*, pp. 15-26.

Baiyere, A., Salmela, H. and Tapanainen, T., 2020. Digital transformation and the new logics of business process management. *European Journal of Information Systems*, 29(3), pp. 238-259.

Bartodziej, C.J., 2017. The concept industry 4.0. *In The Concept Industry 4.0*, pp. 27-50. Springer Gabler, Wiesbaden.

Benlian, A., Hess, T. and Matt, C., 2015. Digital Transformation Strategies. *Business and Information Systems Engineering*, 57(5), pp. 339-343.

Benlian, A., Hess, T., Matt, C. and Wiesböck, F., 2016. Options for Formulating a Digital Transformation Strategy. *MIS Quarterly Executive*, 15(2), pp. 123-139.

Belvedere, V., Bielli, P. and Grando, A., 2013. A Quantitative Investigation of the Role of Information and Communication Technologies in the Implementation of a Product-service System. *International Journal of Production Research*, 51(2), pp. 410–426.

Benotsmane, R., Dudás, L. and Kovács, G., 2019. Economic, Social impacts and operation of Smart Factories in Industry 4.0 Focusing on Simulation and Artificial Intelligence of Collaborating Robots. *Social science*, 8(143).

Berg, B.L., 2001. *Qualitative research methods for the social sciences*. 4th ed. Boston: Ellyn & Bacon.

Bonnet, D., Ferraris, P., McAfee, A. and Westerman, G., 2012. Talking ‘bout a Revolution. *Digital Transformation review*, 2(1), pp. 17-33.

Chang, G., Li, S., Wang, N., Wang, J. and Xiao, G., 2011. Data driven production modelling and simulation of complex automobile general assembly plant. *Computers and Industrial Engineering*, 62(7), pp. 765-775.

Company X, *Annual report*. 2016.

Company X. *Annual report*. 2020.

Crang, M. and Cook, I. 2007. *Doing Ethnographies*.

Creswell, D.J. and Creswell, J.W., 2018. *Research Design Qualitative, Quantitative and Mixed Methods Approaches*. (5) edition. SAGE.

Creswell, J.W., 2014. *Research Design: Qualitative, Quantitative and Mixed Methods Approaches*. 4th ed. SAGE.

Creswell, J.W. and Miller, D., 2000. Determining validity in qualitative inquiry. *Theory into practice*, 39(3), pp.124–130.

Creswell, J.W. and Poth, C.N., 2017. *Qualitative inquiry & research design: choosing among five approaches*. 4th ed. Los Angeles: Sage Publications.

Dev, N.K., Shankar, R. and Qaiser, F.H., 2020. Industry 4.0 and circular economy: Operational excellence for sustainable reverse supply chain performance. *Resources, Conversation and Recycling*, 153, pp. 2-15.

Dolores, M. and Tongco, C., 2007. Purposive sampling as a tool for informant selection. *Ethnobotany Research and applications*, 5, pp. 147–158.

Downes, L. and Nunes, P.F., 2013. Big-bang disruption. *Harvard business review*, 91(3), pp. 44-56.

Drath, R. and Horch, A., 2014. Industrie 4.0: Hit or Hype? *IEEE Industrial Electronics Magazine*, 8 (2), pp. 56–58.

Eaves, S., Kumar, V., Loonam, J. and Parry, G., 2018. Towards digital transformation: Lessons learned from traditional organizations*. *Strategic Change*, 27(2), pp. 101-109.

Eldabi, T., Jahangirian, M., Naseer, A., Stergioulas, L.K. and Young, T., 2010. Simulation in manufacturing and business: A review. *European Journal of Operational Research*. 203(1), pp. 1-13.

Feld, T., Fettke, P., Hoffmann, M., Kemper, H.G. and Lasi, H., 2014. *Industry 4.0* [Online]. Available at: file:///C:/Users/adis-/Downloads/Lasi2014_Article_Industry40%20(2).pdf [Accessed 7 February 2021].

Fernandez, G., Luna, J. and Nunes, D., 2017. Cloud systems. *Procedia Computer Engineering*, 62, pp. 149-164.

Fonseca, L.M., 2018. Industry 4.0 and the digital society: concepts, dimensions and envisioned benefits. In *Proceedings of the international conference on business excellence*, 12(1), pp. 386-397.

Foresight., 2013. The future of manufacturing: A new era of opportunity and challenges for the UK summery report. [PDF] London: The Government Office for Science. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/255923/13-810-future-manufacturing-summary-report.pdf [Accessed 6 February 2021].

Gamba, P., Li, H., Li, Z., Shen, H., Xia, G. and Zhang, L., 2017. Multi-feature combined cloud and cloud shadow detection in Gaofen-1 wide field of view imagery. *Remote Sensing of Environment*, 191, pp. 342-358.

George, G., Haas, M.R. and Pentland, A., 2014. Big data and management. *Academy of management journal*, 57(4), pp. 321-326.

Gibbs, G.R., 2007. Analyzing qualitative data. In U. Flick. *The Sage qualitative research kit*. Thousand Oaks, Ca: SAGE.

Goldkuhl, G., 2012. Pragmatism vs interpretivism in qualitative information systems research. *European Journal of Information Systems*, 21(2), pp. 135-146.

Graetz, G. and Michaels, G., 2018. Robots at work. *The review of Economics and Statistics*, 100(5), pp. 753-768.

Gursev, S. and Oztemel, E., 2020. Literature review of Industry 4.0 and related technologies. *Journal of Intelligent Manufacturing*, 31, pp. 127-182.

Helbig, J., Kagermann, H. and Wahlster, W., 2013. Recommendations for Implementing the Strategic Initiative INDUSTRIE 4.0. [PDF] Berlin: Industrie 4.0 Working Group of Acatech. Available at: <https://www.din.de/blob/76902/e8cac883f42bf28536e7e8165993f1fd/recommendations-for-implementing-industry-4-0-data.pdf> [Accessed 6 February 2021].

Hess, T. and Singh, A., 2017. How Chief Digital Officers Promote the Digital Transformation of their Companies. *MISS Quarterly Executive*, 16(1), pp. 1-17.

Hofmann, E. and Rüsich, M., 2017. Industry 4.0 and the current status as well as future prospects on logistics. *Computers in Industry*, 89, pp. 23-34.

- Klotz, E., Newman, S.T., Xu, X. and Zhong, R.Y., 2017. Intelligent Manufacturing in the Context of Industry 4.0: A Review. *Engineering*, 3(5), pp. 616-630.
- Kulatunga, N.A. and Sampaio, D.J.B.S., 2019. IoT platforms and hardware integrations for Industry 4.0 applications. 2019 14th Conference on Industrial and Information Systems. [Online]. Available through: LNU Library website <https://www.scopus-com.proxy.lnu.se> [Accessed 9 February 2021].
- Kumar, R., 2014. *Research methodology: a step-by-step guide for beginners*. 4th ed. Thousand Oaks, CA: Sage Publications.
- Litsiou, K., Nikolopoulos, K. and Preindl, R., 2020. Transformation strategies for the supply chain: the impact of industry 4.0 and digital transformation. *Supply Chain Forum: An International Journal*, 21(1), pp. 26-34.
- Marsh, P., 2012. *The new industrial revolution: Consumers, globalization and the end of mass production*. New Haven, CT: Yale University Press.
- Mehnen, J. and Turner, C., 2018. The Internet connected production line: Realising the ambition of cloud manufacturing. 14th International Conference on Web Information Systems and Technologies. [Online]. Available through: LNU Library website <https://www-scopus-com.proxy.lnu.se> [Accessed 9 February 2021].
- Myers, M.D. and Avison, D.E., (eds) 2002, *Qualitative Research in Information Systems*. SAGE Publications, London. Available from: ProQuest Ebook Central. [Accessed 14 February 2021].
- Neuman, W.L., 2009. *Social research methods: Qualitative and quantitative approaches*. 7th ed. Boston: Allyn & Bacon.
- Ok, D. and MacIntosh, R., 2014. *Research Methods for Business and Management: A Guide to Writing Your Dissertation*, Goodfellow Publishers, Limited, Oxford.
- Queiroz, M.M., Pereira, S.C.F., Telles, R. and Machado, M.C., 2019. Industry 4.0 and digital supply chain capabilities. *Benchmarking: An International Journal*.
- Rüßmann, M., Lorenz, M., Gerbert, P., Waldner, M., Justus, J., Engel, P. and Harnisch, M., 2015. Industry 4.0: The future of productivity and growth in manufacturing industries. *Boston Consulting Group*, 9(1), pp.54–89.
- Sarantakos, S., 2005. *Social research*. 3rd ed. New York: Palgrave Macmillan.
- Soto-Acosta, P., 2020. COVID-19 Pandemic: Shifting digital transformation to a high-speed gear. *Information systems management*, 37(4), pp. 260-266.
- Swaminathan, A. and Meffert, J., 2017. *Digital @ Scale: The Playbook You Need to Transform Your Company*, John Wiley & Sons, Incorporated, New York. Available from: ProQuest Ebook Central. [6 February 2021].

Taylor M., 2017. *Information System Research: Fundamentals of Scientific Research for the Consumer*, Momentum Press, ProQuest Ebook Central, <http://ebookcentral.proquest.com/lib/linneebooks/detail.action?docID=5166462>. Created from linne-ebooks on 2021-02-15 16:23:04.

Vial, G., 2019. Understanding digital transformation: A review and a research agenda. *Journal of Strategic Information Systems*, 28(2), pp. 118-144.

Witkowski, K., 2017. Internet of things, big data, industry 4.0 - innovative solutions in logistics and supply chains management. *Procedia Engineering*, 182, pp. 763–769.

Yannis, G., 2018. *Stories and narratives*, in *The sage handbook of qualitative business and management research methods: methods and challenges*, SAGE Publications Ltd, 55 City Road, London, pp. 63-81, viewed 1 March 2021, doi: 10.4135/9781526430236.n5.

Appendix

Interview.

1. Describe your current position at the company.
2. How long have you worked for the organization?
3. What are your main responsibilities?
4. Is it of importance for the company to adopt to new technologies? Why?
5. On a scale from 0-5, where 5 being the best, how would you rate your knowledge about Industry 4.0?
0 1 2 3 4 5
6. Is the company actively working to find and incorporate new technologies to further digitalize the company? Could you describe some examples?
7. Have the company implemented one or more of these technologies?
 - A) Autonomous robots.
 - B) Internet of Things.
 - C) Cloud.
 - D) Big data and analytics.
 - E) Simulations.
8. Out of these three aspects, *financial, changes in value creation and structural changes*, which has been most affected from the implementations of the technologies? Why and in which way?
9. What technology do you think affected to company the most after it was implemented? Why and in which way?
10. On a scale from 0-5, where 5 being the most, how would you rate the affect the technology has had on the digital transformation of the company?
 - A) Autonomous robots
0 1 2 3 4 5
 - B) Internet of Things.
0 1 2 3 4 5
 - C) The cloud.
0 1 2 3 4 5
 - D) Big data and analytics.
0 1 2 3 4 5

E) Simulations.

0 1 2 3 4 5

11. At what year was the technology implemented?

- A) Autonomous robots.
- B) Internet of Things.
- C) The cloud.
- D) Big data and analytics.
- E) Simulations.

12. Where within the value chain of the company are it used?

- A) Autonomous robots.
- B) Internet of Things.
- C) The cloud.
- D) Big data and analytics.
- E) Simulations.

13. How has the implementation of that technology changed the structure of the value chain?

Describe the biggest differences before and after implementation.

- A) Autonomous robots.
- B) Internet of Things.
- C) The cloud.
- D) Big data and analytics.
- E) Simulations.

14. Have the implementation of the technology improved the value chain?

If yes, describe in which way.

- A) Autonomous robots.
- B) Internet of Things.
- C) The cloud.
- D) Big data and analytics.
- E) Simulations.

15. Have the implementation of the new technology created any structural changes for the company in terms of how activities/tasks are assigned?

If yes, describe in which way.

- A) Autonomous robots.
- B) Internet of Things.
- C) The cloud.
- D) Big data and analytics.

E) Simulations.

16. Have the implementation of the new technology created any need to learn new skills for the employees?

If yes, describe in which way.

A) Autonomous robots.

B) Internet of Things.

C) The cloud.

D) Big data and analytics.

E) Simulations.

17. Have the adaptation of the technologies increased the sales and therefore contributed to more money being generated?

If yes, is it a substantial amount and which technology has affected that the most?

18. Have the company saved up money in order to be able to complete the implementation of the technologies?

If yes, is it a substantial amount and for how long was the company saving the money?

Consent form.

Topic: Interview.

Date of interview:

Contact information:

Name: Adis Hodzic.

Mail: ah223jg@student.lnu.se

Mobile: +46 703 875 603.

Purpose of the study:

The purpose of this study is to gather information about industry 4.0 and how it affects the digital transformation of a manufacturing company.

Procedure:

A 45-60 minute interview through a communication platform (Zoom). This is to follow and respects the restrictions in Sweden regarding the ongoing pandemic.

Risk and responsibility:

There is no risk nor responsibility for the company or the participants. The researcher will supply the participants with an interview guide before the interviews. After the interviews, the participants will be able to get a copy of their interview if requested.

Confidentially:

The information regarding the participants and the information collected will remain confidential at all times.

Right to refuse:

The participants have the right at any time and without any need of explanation, refuse to continue with the interview. The participants have also the right to withdraw from their participation after the interview is completed if they feel so.

Signature: Participant.

Name: _____

Date: _____

Signature: Researcher.

Name: _____

Date: _____