



Universitetet
i Stavanger

FACULTY OF SCIENCE AND TECHNOLOGY

MASTER'S THESIS

Study program/ specialization:

Industrial Asset Management

Spring semester, 2018

Open

Author:

Gaute Vagle

(Signature of author)

Program coordinator:

Faculty supervisor: Professor Knut Erik Bang

External supervisor: Øivind Hansen (Draga AS)

Title of master's thesis:

Is your company ready for digitalization?

Credits: 30

Keywords:

- Digitization
- Digitalization
- Digital transformation
- Scorecard

Number of pages: 57

+ Attachment /other: Excel-file containing
scorecards

Stavanger, 14. June 2018

Abstract

We live in exciting times. The digital revolution has just begun and things are rapidly changing. Buzzwords like “Industry 4.0”, “digitalization” and “smart” are often used to describe the development that is happening around us. All types of businesses and industries are affected by this transformation. Robotics, sensors, artificial intelligence (AI), etc., these are just some of the topics that is relevant in the new ways of doing business. But what does digitalizing of a business mean? And how can a business become or stay competitive in this new era?

Many businesses are curious about the development that is happening, but do not know how this affects their business, and therefore seek guidance. In many cases a survey or a scorecard would be enough to point them in the right direction. This was the main cause behind the company Draga AS to provide this thesis, based on companies asking them if their business is ready for digitalization. Draga AS wanted a scorecard they could provide as a quick first step.

In order to create a scorecard that could guide businesses and organizations towards digitalization, the first step of the research is to understand what digitalization means. Terms like digitizing, digitalizing and digital transformation are all important in this context, and to understand the connection between them as much as the differences between them, is not always easy. Technology trends do also have a major impact on what can be digitalized and what cannot. And it is essential to know what kind of possibilities the new technology brings. Blockchain, IoT, Big Data, Cloud, and AI are some of the technologies that would bring benefits to many businesses that have not already implemented them into their organization.

The scorecards have to be something new and a unique solution that could be of valuable use for businesses and organizations. In the research, it was found that consulting companies were already providing surveys and other tools to measure the digital maturity. Therefore the scorecard had to bring a new approach that not yet was provided. The answer was to divide a business or organization into departments that are likely to appear. This way, the scorecards can be specified but still simple enough so that anyone can understand what is meant and confusions can be avoided. Each department is divided into different sections that consists of different responsibilities, and thereafter scored from level 1 to level 5, whereas level 5 is the highest.

The result of the scorecards was presented in an excel-file where you have eight different (tabs) sheets, starting with an introduction, thereafter six different scorecards and last a total score. The total score also gives you an automated calculated level of digitalization for the business. The purpose of the scorecard is to give an insight in where your business is today, related to digitalization, and where your business will benefit the most from putting in more resources into digitalization. For many businesses and organizations, it is important to start the digital transformation. The purpose of this thesis is to provide businesses and organizations with a tool that can help them analyze where they are when it comes to digitalization and point them in the right direction.

Acknowledgements

This has been an interesting and educational process, which has thought me a lot about the new technology and business trends that is emerging. It is exciting times to be alive, and the thesis has thought me that we will see a lot of change in the future, and that a lot of industries will have a massive task in front of them.

I would like to thank Draga AS for providing this thesis and especially Øivind Hansen (COO, Draga AS), for providing guidance and help throughout the process. This has been very helpful and a good support next to the research.

I would also like to thank Knut E. Bang (Associate Professor, UiS), and Muhammad A. Tauqeer (Research Fellow, UiS), for the frequent meetings and their willingness for sharing their knowledge and experience. It has been a productive process and a pleasure to be a part of this study group.

I must also give my gratitude to my colleagues at the Industrial Asset Management master's program. It would not have been the same without the good atmosphere and good discussions that we have had through the studies.

Last but not least, I would like to thank my family and friends for their help and support through the studies. It has been a wonderful support to have during this thesis.

Table of Content

Abstract.....	ii
Acknowledgements	iii
Table of Content.....	iv
List of tables	vi
Table of figures	vii
Abbreviations	viii
1. Introduction	1
1.1 Objective	1
1.2 Scope.....	1
1.3 Methodology.....	1
1.4 Limitations of the study	2
1.5 Thesis structure.....	2
2. Terms and their meaning	3
2.1 Digital	3
2.2 Digitizing.....	4
2.3 Digitalization	5
2.4 Digital transformation	6
2.5 Digital disruption.....	7
2.6 Digital Business	8
2.7 Digital maturity	9
2.8 Smart.....	9
3. Technology trends.....	10
3.1 Blockchain and Distributed Ledger Technology	10
3.2 Industry 4.0, Internet of Things and Industrial Internet of Things	12
3.3 Big Data	14
3.4 Mobile network - 5G	15
3.5 Cloud	16
3.6 Artificial Intelligence.....	17
3.7 VR/AR	19
3.8 Digital twin	20
3.9 Technologies that need to be mentioned	21
4. Business and Organization	22
4.1 Organizational Structure	22
4.2 Business departments.....	23
4.3 Business models and trends.....	25
4.4 Business strategy.....	25
5. Scorecard	26
5.1 Scoring levels.....	26

5.2 Technology trends..... 27

5.3 The scorecards 28

6. Discussion 34

6.1 What is learned 34

6.2 Main challenges 35

6.3 Future research 35

7. Conclusion..... 36

9. Appendix 43

Appendix A..... 44

Appendix B..... 45

Appendix C..... 46

Appendix D 47

Appendix E 48

Appendix F 49

List of tables

Table 1: Management department explained based on appendix A 28

Table 2: Human resource department explained based on appendix B..... 29

Table 3: Logistics department explained based on appendix C 30

Table 4: Operations department explained based on appendix D..... 31

Table 5: Accounting & finance department explained based on appendix E..... 32

Table 6: Marketing department explained based on appendix F 33

Table of figures

<i>Figure 1: Difference between analog- and digital signal, (Nielsen, 2017).</i>	4
<i>Figure 2: The connection between digitization, digitalization and digital transformation</i>	6
<i>Figure 3: Causes of digital disruption, (i-SCOOP, 2018e).</i>	7
<i>Figure 4: Six key steps to build a successful digital business, (i-SCOOP, 2018j).</i>	8
<i>Figure 5: The process of how blockchain works illustrated, (Blockgeeks, 2018b)</i>	11
<i>Figure 6: The difference between blockchain and tangle network, (Foundation, 2018a)</i>	11
<i>Figure 7: Illustration of a RFID device, (Solution, 2018).</i>	14
<i>Figure 8: The 5 V's of Big Data, (Leboeuf, 2016b)</i>	14
<i>Figure 9: The difference in speed between 3G, 4G and 5G, (Burkett, 2018).</i>	16
<i>Figure 10: Principals of traditional programing</i>	18
<i>Figure 11: Principals of machine learning</i>	18
<i>Figure 12: Oculus Rift, (amazone, 2018).</i>	19
<i>Figure 13: Microsoft HoloLens, (Microsoft, 2018).</i>	19
<i>Figure 14: From physical asset to digital twin, (Rajput, 2018)</i>	20
<i>Figure 15: Porter's value chain, (Dudovskiy, 2018).</i>	23
<i>Figure 16: Six common departments inside a business or organization.</i>	23

Abbreviations

AI	Artificial Intelligence
AR	Augmented Reality
CAD	Computer Aided Design
DLT	Distributed Ledger Technology
EU	European Union
FEA	Finite Element Analysis
FMEA	Failure Mode and Effect Analysis
GDPR	General Data Protection Regulation
GPS	Global Positioning System
HMD	Head Mounted Display
IaaS	Infrastructure as a Service
ICT	Information and Communication Technology
IIoT	Industrial Internet of Things
IoT	Internet of Things
LTE	Long-Term Evolution
ML	Machine Learning
NLP	Natural Language Processing
OED	Oxford English Dictionary
PaaS	Platform as a Service
PC	Personal Computer
RFID	Radio Frequency Identification
ROI	Return On Investments
SaaS	Software as a Service
UiS	University of Stavanger
VR	Virtual Reality

1. Introduction

Digitalization is a buzzword that comes up constantly in the media and in discussions about business. Digitalization characterizes the changes that we now see in the industry and influences the way of doing business. It is highly spoken of, and it sounds, as it is the great future, and that if you don't follow, you will never be able to compete with the rest of those that will. In many ways it looks like it's a make or brake for many businesses and that it is vital for a business to go digital.

However, what does digitalization really mean? And how does a business become digitalized? The answers to these questions are complex and have many different aspects that make it difficult to get a clear answer. This is the topic this thesis is trying to get a deeper understanding of and to give a simpler answer to.

1.1 Objective

Draga AS provided the master's thesis, and the objective of the thesis is as the headline says; to find an easy way to measure if a company is ready for digitalization or not. How can we make an evaluation of the companies ability to transform? The ambition is to make a scorecard that shows how far the companies are from the next level, and what benefits that should be expected at the next level. The reason for the thesis is that the word "digitalization" is used a lot in media, and its "known" to be the answer to a more efficient business, with more profitability. The problem is that many people have opinions about it, but few people actually know what digitalization really is. And when businesses are approaching Draga AS in order to help them digitalize, Draga AS have no knowledge of what they actually want to do and what they can expect from the process. Will they even benefit from doing any changes to their organization or will it only be a waste of time and recourses.

1.2 Scope

The scope of this thesis is to understand what is meant when speaking of digitalization and how to make a scorecard that can help a business to understand how far they have come in the digital transformation and which parts of the organization they have the biggest potential in order to improve and where they already have a high level of digitalization. This scorecard will hopefully help the business to invest in the right parts/processes and get the most return on investment (ROI) and perhaps even help to change business strategy to be more digitalized in order to meet the challenges that will come in future.

1.3 Methodology

The method used in this thesis is to collect and reviewing books and articles that are describing digitization, digitalization, digital transformation and other topics of relevance. Thereafter it was necessary to get an understanding of the technology trends and how these can be of impact in digitizing and digitalizing. Because of the common approach we have

chosen, it is important to get an understanding of how an organization is working and how it is build up. After getting an understanding of the technical terms, the technology trends and organizational structure, a scorecard is put together which is trying to be of relevance for any type of business and across industries. The last part of the thesis is a discussion about the qualities of the scorecard and thoughts are made about the outputs from the scorecard before in the end a conclusion is made.

1.4 Limitations of the study

The limitations of the study are that there is a continuously evolving of the definitions of what benchmarks in digitalization are. The new technologies that are coming up in the industries are evolving faster than we are able to cope with. The new possibilities that the new technology is creating, seems only to be limited by the imagination of people. What might have seen impossible a short time ago is now possible, and the changes that seems far away is now closer than ever before. Businesses are not always eager to shear their ideas of the future in order to stay ahead of competition and keep the extra edge. Another limitation is that this study is trying to be relevant for any type of business or organization. Therefore the scoring is kept relatively general to be of relevance for as many as possible. This may limit the quality of the feedback given by the scorecard somewhat, but still it gives very good guiding to what parts that should be looked more into.

1.5 Thesis structure

Structure of the thesis reflects how the work-process was plan and completed. It starts with an introduction before reviewing the different relevant topics when it comes to digitalization. Then the technology trends that should be known by any decision maker and how they can potentially impact their business are reviewed. The next step is about organizational structure and how a common business is built up. The process is then to divide it into different sections or departments. The scorecard is then presented, starting with an introduction of how it works and what's important to do when making sure it will give a good results. After the scorecards are presented, topics like what is learned?, the main challenges, and what future research should focus on are discussed. Toward the end, the thesis is summed up and a conclusion is drawn. The actual scorecards are placed in appendix after the references.

2. Terms and their meaning

There are many new words circling around with the vision of the future and a new area involving big changes in all sectors and opportunities that was seen only in sci-fi movies. Buzzwords like digitalization, digitization, digital transformation, digital business and digital maturity is only a few of the words that seems to be on everyone's minds these days.

We hear about digitalization and how important it is in order to meet the evolving markets, that it is the answer to making your business gain more revenue and create more profit. Digitalization is seen as a solution on many problems that firms face today, and it is said in the media that it will revolutionize businesses for the better. But what does digitalization mean? How do you digitalize your business? These are questions that have different answers depending on who you ask and which setting you are in.

When we hear the word digitalization it sounds self-explanatory, but when you study this phenomenon in a more academic way, we see that there is different understandings of what its meaning. The dictionaries that usually have a clear definition of terms like this, has not yet been able to give a clear definition. In order to understand how to become more digitalized, you have to understand the terms and be able to relate them to what your business is doing. Digitalization will have a different meaning if you are in service business or if you are in production line of business. It is seen that there is a lot of uncertainty in how the different terms are used and that the definitions sometime gets mixed and that this causes a lot of confusion when trying to get your head around the definitions of each term and the ability to get more insight and references. Even if there are different definitions, there is still a red line, in this chapter I try to find this line and explain the terms such as it is relevant for the majority line of businesses.

2.1 Digital

In order to see how we can define digitalization, the term "digital" must be looked into. From Oxford English Dictionary (OED) the adjective "digital" has several definitions or use cases, (OED, 2018a):

- a) *Designating a whole number less than ten; (of a number) represented as a series of digits.*
- b) *Of signals, information, or data: represented by a series of discrete values (commonly the numbers 0 and 1), typically for electronic storage or processing.*
- c) *Of a computer or calculator: that operates on data in digital form; (of a storage medium) that stores digital data.*
- d) *Of technologies, media, etc.: involving digital data; making use of digital computers or devices. Also: of or relating to such technologies or media.*
- e) *Of an electronic device: that makes use of data in digital form.*
- f) *Of a sound recording, image, video, etc.: encoded in the form of digital data; recorded using digital equipment.*

Basically the word "digital" has many meanings. Most of us think of digital as something related to computers and data, but in reality this is just one of the definitions. This non-

specific definition I believe is much of the reason why there is misunderstandings between different people when they are discussing the topic. When people have different understanding of the basic definition its hard to have discussions on a highly academic level. This uncertainty I believe is past on to the new terms regarding digitalization and etc. And the process of “going digital” is a lot more complex than it sounds and relates to building foundational digital capabilities, (Dörner and Edelman, 2015).

2.2 Digitizing

The first step of going digital is digitization. In order to understand how to digitalize we need to know about the term digitizing and what it would mean to your business. Digitization is in many ways the key in order to be able to digitalize. As (OED, 2018c) define it, is it the action or process of converting data to digital form. It can be seen as the building blocks that are required to use the tools of digitalization and it is a necessity to know how to digitize. Digitization is in general to make analog data into a digital format that can be processed by a computer. It is about creating 0's and 1's that can be stored on a disk and that can be used by a computer program.

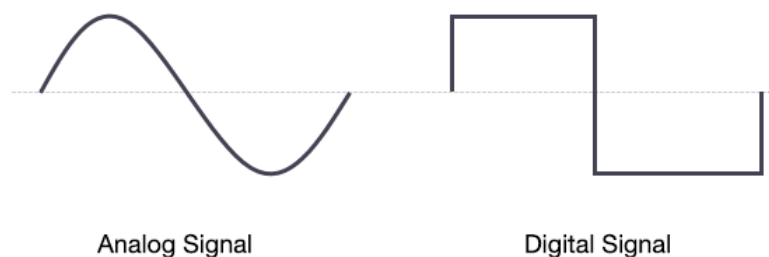


Figure 1: Difference between analog- and digital signal, (Nielsen, 2017).

To digitize a process is not possible, this is often mixed with the automation of a process, which can be possible by digitizing information together with technology. Typical examples on what we can digitize is physical things like documents, music, video, pictures/images, signatures and maps, these are all physical things that you now can use/see on a computer or a smartphone. Simply said it's about making something non-digital, digital, (Leonard, 2018). Typical examples on digitization are to scan a document, take a photo with a digital camera, record music directly to a computer or signing documents on Adobe Acrobat. Bank ID is a result of digitizing user identification; it enables users to identify themselves online in order to have a secure way to handle confidential documents and operations. On the other hand there is a lot of things that cannot be digitized, examples of this is a building or a vehicle. These are physical things that's purpose not can be replaced with the help of a computer. By taking a digital picture or drawing a 3D drawing in a CAD software of the building, you have digitized it but not replaced the purpose of the building therefore it's not fully digitized. Buying a ticket on your smartphone has replaced the need to physically go to a ticket office and buy a paper ticket therefore it is considered as a digitized. When you are

able to replace the purpose of something into a digital format, you are able to digitize it, (Brynjolfsson and McAfee, 2014). Muhammad, (Tauqeer, 2018), has come up with a two step approach on how to digitize:

1. Identify all the analog or physical data streams in a product, service or value creation process.
2. Look for alternatives if these data streams can be stored into digital format.

These are simple steps, which are about identifying opportunities which digitization is possible. There are several reasons for why we should be digitizing. The main reasons are to increase productivity and to be more cost efficient. Then you will also get benefits, such as to have easy, and always access to your data, and you can easy copy your files. The transparency will be higher, where verification and origin can easily be found, you are able to save space related to physical items, if a disaster occurs, you are able to have your data stored at multiple location which helps you recover faster, and environmental friendly by saving space and paper, (i-SCOOP, 2018g).

2.3 Digitalization

Digitalization is the key word in this thesis. In order to answer the question “are you ready for digitalization?” it is vital to get a deeper understanding of the term and what the definition of it is. There are many opinions about this term and there is a lot of buzz around it, the definition of digitalization might come easy for some, but totally nonsense for others. There is no doubt that we are moving towards a more digitalized society where digital solutions is central in changing the way people live and how things are done. (OED, 2018b) is defining digitalization as to adopt or increase the use of digital or computer technology. This is a vague definition and underlines the room for interpretation that comes with the use of the term. A more precise definition of digitalization is the use of digital technology and of digitized data in order to create revenue, improve business and create a digital culture where digital information is in the DNA of the organization, (Espen Andersen, 2018). This definition draws the context between digitalization and digitization, where digitalization is the process of using the digitized data with digital tools or technology.

The process of digitalizing can be done essentially of anything. Products, services, workflows, production facilities, supply chain, businesses, etc. can all in some way be digitalized, (Tauqeer, 2018). Digitalization can affect all aspects of a business or organization it all depends on what degree of digitalization you want to achieve. Some processes have the ability from the technology available, to become fully automated without any human interaction. While other processes don't have the necessary technological advances and still need some sort of human interaction. The level of digitalization is inconsistent and may vary from the perspective you look at it. With the fast evolving technology there is no consistent benchmark in what the highest level of digitalization is, (Rojek, 2016, i-SCOOP, 2018g).

2.4 Digital transformation

When management talks about digitalization of the business, they most likely are referring to the process of digital transformation. Digital transformation is the process of going from a state of no digital solutions towards a fully digitalized state. It is about evolving the business towards more digital solutions. It means to use new technology, replace old procedures and implementing digitalization throughout the organization in order to create more value, (Boyer, 2018). The rules of business has changed, if you're not able to cope with al the changes that is happening you will in most cases find yourself without any business in the near future. David (Rogers, 2016) highlights five domains that is central for the digital transformation, customer, competition, data, innovation and value. These are all domains in which new technology is redefying their principles of strategy and operation. The rapid change that is happening is connected to all the domains and has an important role in the digital transformation. Digital transformation is about implementing new technology and new digital solutions into the DNA of the business. It is the process of changing the way of doing business in all aspects and digitalize in all areas where it is possible. The link between digitalization and digital transformation is clear, but the digital transformation ha a greater extent beyond digitalization, (i-SCOOP, 2018f, Bloomberg, 2018). Digital Transformation is much more than implementing new technology, (Burkhardt, 2015). It is about converting a business to handle the disruption and new challenges that emerges, and this must start with organizational- and management change. The transformation has to come from the top and then propagate throughout the organization for it to be successful, (Berntsen, 2018, Haraldsen, 2018, Dittrich, 2017). As a summary of digitization, digitalization and digital transformation, figure 2 shows how my interpretation of the terms are, as simple as possible. There is a clear connection between all three terms, however the scope increases from each step.

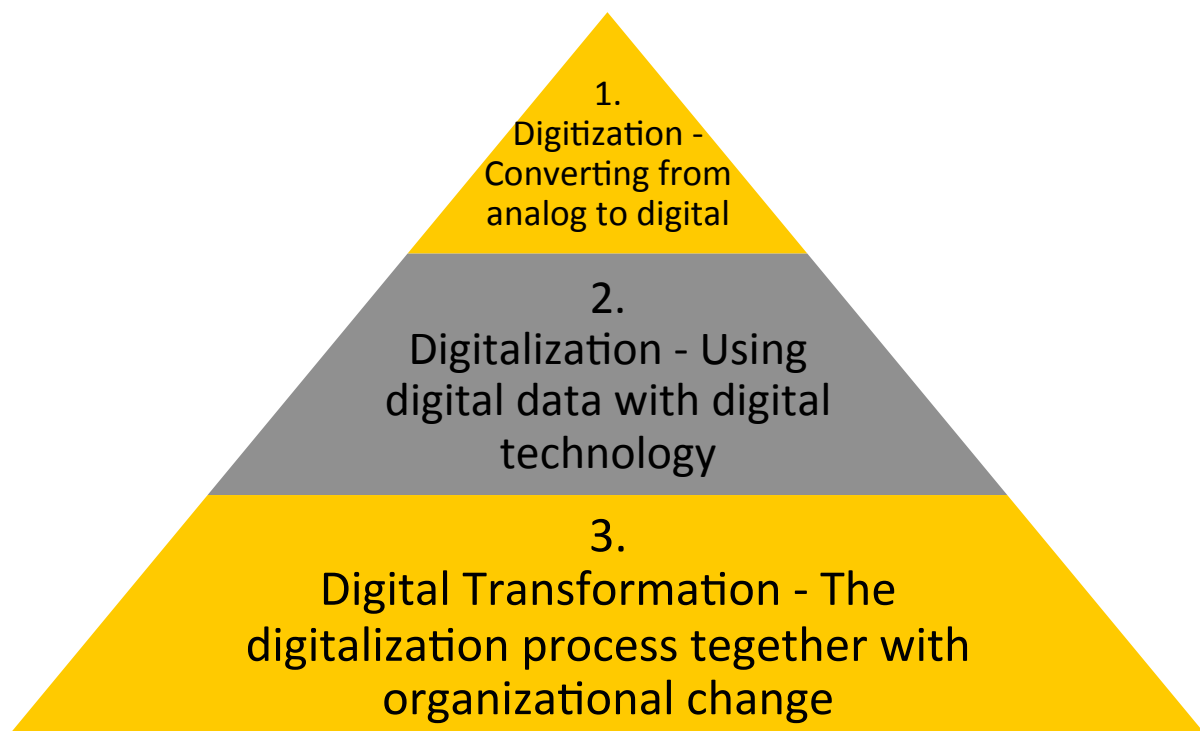


Figure 2: The connection between digitization, digitalization and digital transformation.

2.5 Digital disruption

Disruption explains a process where a smaller company with limited economic resources is able to challenge the larger enterprises. Often the big enterprises have their focus on enhancing their service for their biggest clients and therefore ignoring some low-end markets. The new disruptive vendors start to attack these ignored markets with lower prices and the established enterprises let them be because of the markets low attractiveness. The new companies start with good enough products at a lower price and get a foot into the market. When they have established their brand, they start to challenge the bigger players and stealing some of the market, (Dale, 2018, Berntsen, 2018).

Disruption is possible because of low-end market segments that gets ignored by existing vendors or that new players create a whole new market by making non-customers into customers. An example is to give the public access to a product that has been developed for the business market like when the personal computer (PC) where introduced pricing itself a lot lower than the computers already in the market, (Hill, 2017).

Other causes of disruption from (i-SCOOP, 2018f):

- *Technological innovations* – Leverage and adoption of technologies by customers, workers, new entrants etc.
- *Customer behavior and demands* – As a consequence of technological adoption/innovation or as a need, which becomes pressing. For example the customer experience through Internet.
- *Innovation- and innovation-induced* – Innovations and inventions with a profound impact on society
- *Ecosystem induced* – Changes in economy, partner ecosystems, regulations, and geological-politics. A recent example that will have a large impact on many businesses is the General Data Protection Regulation (GDPR) that is mentioned in chapter 4.

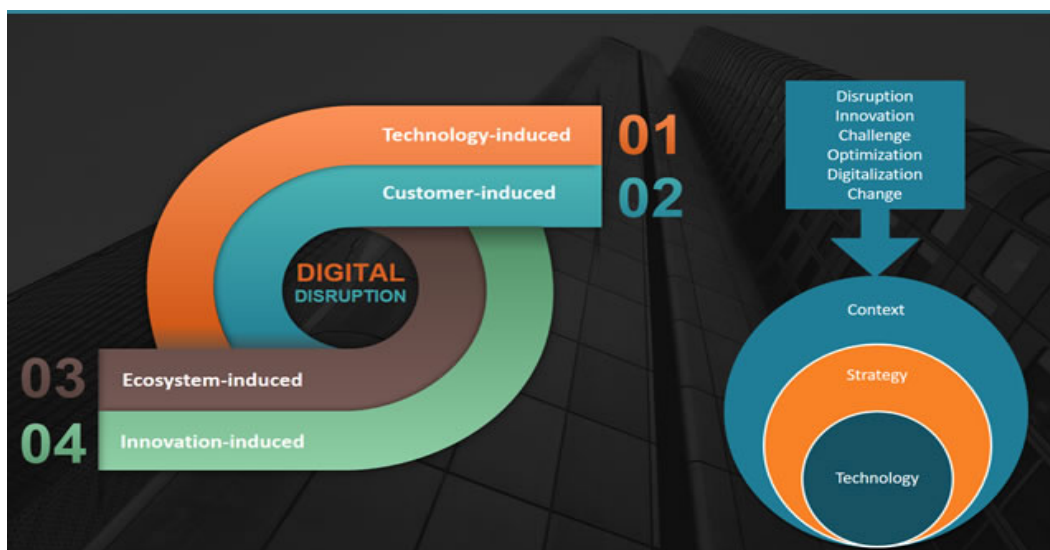


Figure 3: Causes of digital disruption, (i-SCOOP, 2018e).

As figure 3 shows, the technology is only one of the causes of disruption and is part of strategic solutions in a context of solving challenges, among which can be disruption.

2.6 Digital Business

Digital technologies have evolved the way we conduct business and how we relate to other businesses. The digital evolution is changing the game of business, and to keep up with these new changes you have to transform your business into a digital business, (Heaslip, 2015). Gartner's definition of digital business is as follows: "Digital business is the creation of new business designs by blurring the digital and physical worlds", (i-SCOOP, 2017) In order to understand what they mean by this definition, you can for example look at how banking businesses is working today. The technology inside the banking industry is doing more of the business functions, even in the physical branch. Which can be seen as blurring the lines as the definitions called it. Gartner also introduced "six step to build a successful digital business"(figure 4), (Stamford, 2014), these are as Gartner says crucial steps that can help business leaders to change the game, and build a successful digital enterprise.



Figure 4: Six key steps to build a successful digital business, (i-SCOOP, 2018j).

Digital business is about creating a new business model with the balance between technology, humanity and efficiency. As seen from the steps in figure 4, you need to start from the top in order to get the best transformation. To be a digital business, you need to have the right mindset and strategy throughout the organization. A top digital business can often be seen as a benchmark in digitalization, and it uses new technology in order to create more value for themselves and their customers, (i-SCOOP, 2017).

2.7 Digital maturity

The difference between digitization, digitalization and digital transformation and digital maturity is that the maturity have the meaning to reveal how experienced a business is in the use of digital assets and what level of digitalization they are in, (Bascuas, 2014). Easily explained is digital maturity about grading a business in relation to how digitalized they are.

The need to understand how far a business has come in the process and what will be the best next step, have created a big business opportunity in grading a business's digital maturity and some companies have models or surveys that can guide and help businesses against digital disruption and to see how far the digital transformation has come, (Deloitte, 2018, Forum, 2018a, Difi, 2017). This is in many ways very similar to the objective for this thesis and shows that it is a topical theme that is relevant for businesses today.

2.8 Smart

Beside digitalization and other words relating to digital, one of the biggest buzzwords that are used today is the word "smart". Smart has become widely used in marketing and promoting of new products and systems, and has become a known word in the industry and by consumers. The definition from (OED, 2018d) is vague and describes "smart" as:

Programming which makes a computer capable of some independent action; the ability of a device or other machine to vary its behavior in response to differing requirements, varying situations, or past events. Also: processing power.

IGI (Global, 2018) has their definition of "Smart Technology" which gives a more modern explanation of the term:

- 1. The technologies that is capable to adapt automatically and modify behavior to fit environment, senses things with technology sensors, this providing data to analyze and infer from, and drawing conclusions from rules. It also is capable of learning that is using experience to improve performance, anticipating, thinking and reasoning about what to do next, with the ability to self-generate and self-sustain.*
- 2. Technologies that allow sensors, databases, and wireless access to collaboratively sense, adapt, and provide for users within the environment. Such smart technologies are currently found in housing designs for elderly and educational environments similar to sensors and information feeds within museums.*

Use cases of "smart" are many, some examples are; smart house, smart buildings, smart city, smart supply chain, smart manufacturing, smart contracts etc. And every case has their own definition, for example the definition of a smart device is: Electronic devices that can interact with other devices through Wi-Fi, mobile network, Bluetooth, NFC, (Tauqeer, 2018). The context of all cases is new technology.

3. Technology trends

Technology changes from day to day, and what we see as best today will probably not even be seen as relevant tomorrow. We live in some very exciting times, and the technology has become a part of the way we live and how we do things, (Bang, 2018). Technology has got the purpose of making life easier and to enhance our quality of life. As (Brynjolfsson and McAfee, 2014) write, the Moore's law regarding exponential growth in processing power and storage capacity still exist almost half a century after the claim.

The evolving technology has enabled new possibilities and we can now determine that today's supercomputers are smarter than humans in almost any aspects (Knapton, 2017).

From the business point of view it is important to see that in order to stay on top of the market, it is necessary to keep up with the technological trends and to understand how they can impact or be a disruption to your business. The new technologies play a vital role in the digital transformation of businesses and organizations. Therefore is the ability to keep up with the new trends and tools highly important for staying ahead of your competitors. Despite all these new technologies that are trending, not all are relevant to your business. This makes it even more important to have an insight in what new technologies mean to the business. As management you do not want return on investment (ROI), to be invested in something that you would not benefit from, or that would lower your profits.

When it comes to digital transformation and digitalizing, the right use of new technology is one of the most important ways to make it happen, (Dudley et al., 2017). New technology is the key for making digital solutions possible and gives people the opportunity to digitize everything from files to physical processes. Technology trends are in many ways the cause for benchmarks in many industries, and the companies that are able to implement new technology is already ahead.

In this chapter some of the newest and most "hyped" technologies will be looked into and discussed to see which part they might have in the digital transformation of a business. Technology trends such as blockchain/distributed ledger technology (DLT), industry 4.0, Internet of Things (IoT), the cloud, artificial intelligence (AI), AR/VR, digital twin play a central role in digitalization in its own way and will be the trends that is addressed the most in this thesis.

3.1 Blockchain and Distributed Ledger Technology

Blockchain is by many seen as one of the "new" big evolutions in technology, and people view that it will revolutionize how we will conduct business in the future. Blockchain is often known as the idea and technology that powers the crypto currency Bitcoin, which has had an enormous gain in value over the last year, reaching an all time high of just under \$20.000 18. December 2017, (Blockgeeks, 2018a) from a value of only around \$4.000, five months before. Blockchain or distributed ledger technology (DLT) which blockchain is a part of, will change the way we wire money, ownership, business transactions and much more. The possibilities that come with this type of technology will in many ways improve efficiency, cost, tracking and transparency of business. The decentralization of servers and data provides a level of security that has not been thought of before. The trust between peers is basically achieved

based upon the fact that there is no need of trust when using blockchain. All parties involved have a copy of the ledger that cannot be altered with. As shown in figure 5, it is rather simple process that can happen because of the network of computers that is connected to the blockchain.

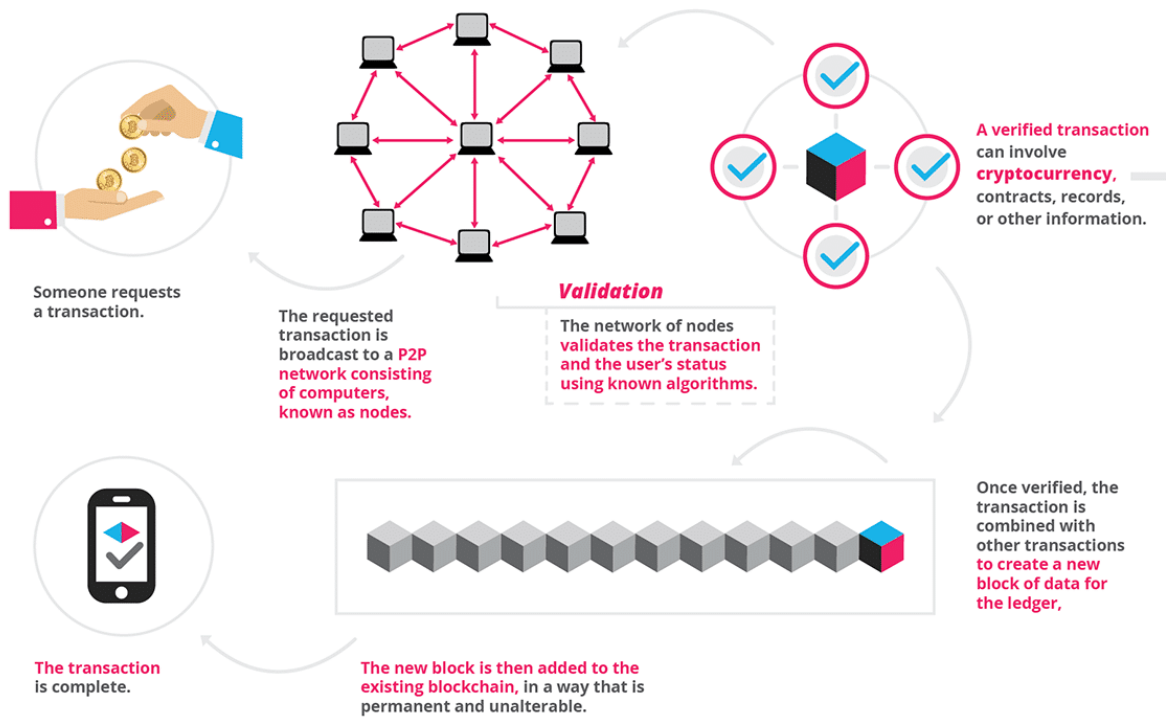


Figure 5: The process of how blockchain works illustrated, (Blockgeeks, 2018b).

Blockchain has been around for over 10 years and cannot really be seen as a new technology. It is because of the hardware development in recent years, it has been able to flourish. But some people think blockchain has too many restraints in order to be the game-changer that so many people believe it is going to be, (Shane, 2018). The bottlenecks regarding speed and cost of transactions and that the majority of mining pools are owned by just a few, have made people focus on further develop the technology and try to find some sort of DLT that will have a more realistic opportunity to realize its potential. This has resulted in many sorts of DLT's, some of the most known is Ethereum, Ripple and IOTA. One of the newest ideas of DLT is to go from a blockchain towards tangle network, see figure 6. The best example of this is IOTA, (Foundation, 2018b) which many (Shane, 2018) claims has solved the problems blockchain has regarding transaction and processing requirements.

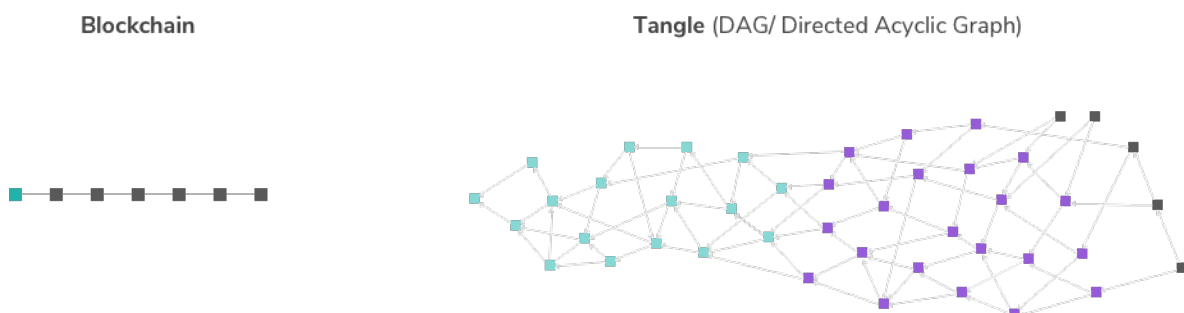


Figure 6: The difference between blockchain and tangle network, (Foundation, 2018a).

DLT can change a lot of ways we conduct business regarding transactions, banking and other processes such as supply chain where IBM and Maersk (IBM, 2017), have started to implement blockchain into the containers on board of vessels that ships them across the world. The transparency that DLT provides makes it also brilliant for use in trading where authenticity is vital, such as fairtrade products or diamonds, (Everledger, 2018).

3.1.1 Smart contract

One of the most exiting use cases of blockchain is the implementation of smart contracts. Smart contract is a fully digital contract that works like a computer software, and allows visibility, and transparency, (IBM, 2017). The best explanation of the smart contract is that it works like a “if this, then that” program. It is a digital contract that contains rules and terms of a normal contract, but can trigger processes by events that are agreed upon beforehand. When a process is triggered, the software will automatically verify.

An example on how a smart contract can work, (Rosic, 2017), is funding a project. People with interest in funding a specific project can send their money to the smart contract, which will foresee that the project meets the goal set before action before funding it. If the goals are not met, the money will be returned to the supporters. In a supply chain, the smart contract will ease the process of certification and processing through customs and regulations. Smart contracts could be a time saving game-changer in many scenarios where multiple parties are involved in some sort of transaction. The process of buying a house for example will be much easier with the use of a smart contract. In this case all legal documents can be uploaded to the smart contract, where the buyer can see that everything is in order. Even the bank can confirm that the loan will be given and they can see that the house has no remarks that could be altering the payments by their customer.

3.2 Industry 4.0, Internet of Things and Industrial Internet of Things

3.2.1 Industry 4.0

The first industrial revolution was the introduction of water and steam power that revolutionized the way of production. The second revolution was the introduction of electricity-powered machines, which gave a lot more possibilities in the layout of fabrics, and the use of mass production became reality. In the third revolution, the electronics and information technology gave us the ability to program machines. As a result of this computerized system controls became a big part of production. Now we are heading towards a fourth revolution that seems to have the same impact as the first revolution, (i-SCOOP, 2018h). Industry 4.0 refers to the fourth industrial revolution. It is about the integration of Internet of things (IoT) and services into the production.

The benefits that comes with industry 4.0, (Øydegard, 2017), is enhanced productivity through optimization and automation of processes. You get real-time information from everything such as data, supply chain and economy. You most likely get higher business continuity through advanced maintenance and monitoring possibilities, and you get better quality products through real-time monitoring, and IoT-enabled quality improvement. In addition the industry 4.0 should lead to better working conditions and sustainability. Finally, you will be able to personalize and customize for the “new” consumer.

3.2.2 Internet of Things

Internet of Things (IoT) is the definition on physical objects that are connected with each other through Internet, creating a network that allows them to send, receive and exchange data with one another, (Duffy, 2016). It is a technology that already exists and made possible because of “smart products”. A smart product consists of three components: a physical item, a smart component (that could be a sensor, microprocessor, storage unit etc.) and a communication unit such as an antenna or Bluetooth. The possibilities and opportunities that IoT provides for businesses will change a lot of the way we do things today. To have all machines connected in a network will give you a deeper insight in how to optimize processes. The different ways of connections it enables are: 1-to-1, 1-to-many, and many-to-many, (insight, 2017). IoT will benefit businesses in all aspects and combined with other technologies such as AI and robotics, will it change the world towards the digitalized era.

3.2.3 Industrial Internet of things

Industrial Internet of things (IIoT) is based on the same principals as IoT but separated from consumer level. IIoT has only the perspective of the industrial segment and has a clear connection towards machines and operations, (Øydegard, 2017). IIoT affects all industry scale, cyber physical assets that keeps critical business infrastructure running smoothly. IIoT brings growth opportunities to companies through collecting, processing then analyzing the big data and using it into the value chain in real-time. The assets will learn from each other and thereby continuously improve and optimize their performance, (Daugherty et al., 2015). The benefits from IIoT is that you will get a data driven, smart world, where decisions are faster, more rational, and you get real-time information that leads to more efficient actions. Factories can with the help of IIoT become smarter related to reduction of energy use and in CO2 emission, it also enables less downtime and reduces waste related to operations.

3.2.4 Radio Frequency Identification

The barcode has a vital role in a vendors business, it helps them know their inventory and fasten the process of their customers when they want to buy something. The limitations of the barcode however are clear, it only reads one item at a time and the information is fixed. The next generation of barcode is fixing all these limitations and is already used in some industries and its called Radio Frequency Identification (RFID), (Sebastian, 2015).

The RFID consist of three components, an antenna, a receiver with a decoder, and a transponder or a radio frequency tag, see figure 7. The RFID can be seen as a wireless barcode where the frequency tags consist of unique information that is programed from a computer. The RFID uses the energy from the devices that reads it, which makes it able to work without a battery. The ability that RFID gives you can be for example when you are out shopping, you can take the groceries direct into your bags, then when you have all you need, you go through a receiver that will read all your items without the need for scanning each individual and giving you a complete bill. Another way of using RFID could be to control your inventory at real time. Scanners can read how much of a product you have in stock at real time giving you full control of when to order more, (Sebastian, 2015).

RFID is already used in tracking of goods and it enables automated sorting that increases the speed and accuracy of shipping but also makes customers able to trace their goods real time over Internet.

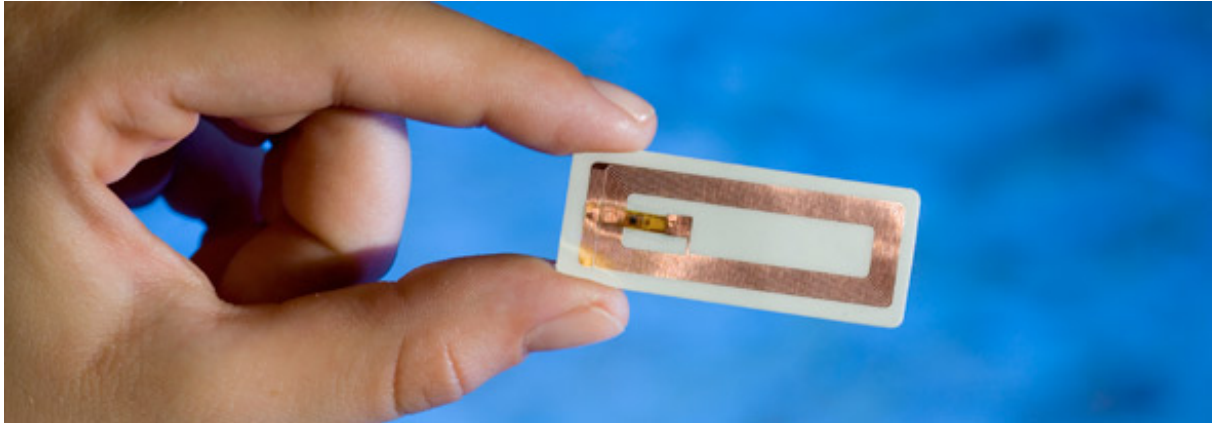


Figure 7: Illustration of a RFID device, (Solution, 2018).

3.3 Big Data

Clive Humby declared: “Data is the new oil” (Aalst, 2014), and he seems to be right.

It has been a massive increase in data gathering since the beginning of IT. The biggest reasons behind this increase, is the use of PC, smartphones, tablets, Internet and sensors, (Berntsen, 2018). Gathering of data happens at all times when we are using the Internet, the amounts of digital traces that are left behind when using a smartphone or credit card are massive. The traces show who your friends are, what you are buying, what you like to do and where you are going. In the industry, (i-SCOOP, 2018c), the use of sensors in production and logistics give companies the possibility to use the data gathered in order to optimize their procedures. And with AI tools like machine learning will machines be able to process these data and learn from it and continuously improve.

With Big Data, management has the possibility to measure and understand more of the markets and the processes. It can help to give faster and more reliable decisions, and the ability to provide tailor-made customer service is much easier with deeper understanding. Big Data is about extracting more information and the ability to see patterns and connections between different data sets that will make businesses able to find new business opportunities, make better quality assurance, and provide better service.

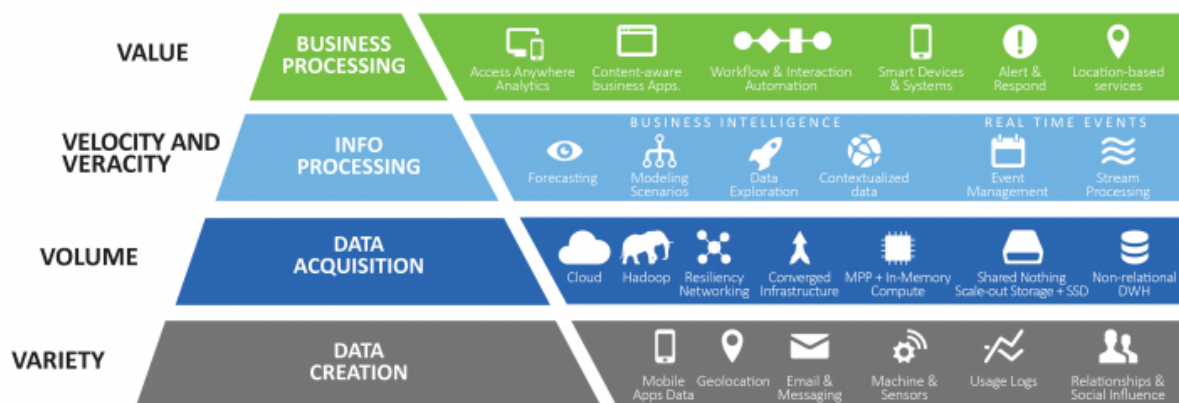


Figure 8: The 5 V's of Big Data, (Leboeuf, 2016b).

Big Data is about creating value and that is done by using the five V's: Variety, volume, velocity, veracity, and value, (Marr, 2014). As seen in figure 8, and from (Leboeuf, 2016a), the different V's can be categorized into four steps; data creation, data acquisition, info processing and business processing. These steps show how Big Data is valuable and in itself can create business opportunities and that data are valuable and that it could generate more profits for businesses.

3.3.1 Big Data Analytics

Big Data analytics will probably be a goldmine in the future. There is still a lot of uncertainty of how to use all the data that sensors and computers have allowed businesses to gather. There is more information than we could imagine, and to be able to use this information will create huge opportunities and value, (SAS, 2018a). Customer behavior, brand performance and market development can all be understood through Big Data analytics, but the difficult part is to now to decide what kind of analytics to do in order to gain the insight that could lead to substantial impact, (Hariharan, 2016).

3.3.2 General Data Protection Regulation (GDPR)

One of downside with all these data being collected about you, is that the level of privacy have decreased. For example through the use of smartphones, everyone have now a GPS tracker that could reveal your location at all time. The European union (EU) has come up with a new regulation covering the ownership of data. This regulation was put into effect in EU from May 25. And it has had a mayor impact on how businesses and organizations need to handle their customers' privacy data. According to new law, violations of the new regulation will have big consequences for the businesses.

From (Eidem, 2018) and (Datatilsynet, 2018) the main features are:

- All companies must have a easy understood privacy policy.
- All companies have to assess risk and policy implications.
- All companies have to implement privacy into new solutions.
- Many businesses have to have their own privacy representatives.
- The law also applies to businesses outside of Europe and of subcontractors.
- All companies must have procedures for non-compliance.
- All discrepancies must be notified to the "Datatilsynet", it will be illegal to hide discrepancies.
- Everyone must be able to fulfill the citizens' new rights.

Any violations of the new regulations will be fined up to four percent of annual turnover with a maximum of 20 million Euro. This is a substantial amount, and will be enough that businesses must comply with the new rules.

3.4 Mobile network - 5G

Mobile network have had a massive impact on making the new technologies available for a mainstream use. The use of Internet has become an important part of doing business and therefor the availability that mobile network gives people, has enabled business to be done anytime from almost anywhere, (Segan, 2018). The quality of the mobile network has increased much over the years, but also the demands from consumers have increased almost exponentially. In today the mainstream mobile network is the 4G/LTE, before that it

was 3G, and even longer back it was Edge. This development in the mobile network has gone quick, and soon the next generations of mobile network 5G will be entering the market, giving even more possibilities to mobile devices and IoT, (Kavanagh, 2018). Figure 9 shows the difference in speed between 3G, 4G and 5G. If the IoT revolution is going to happen, then the networks need to be capable to handle all the different devices and all the data that is generated. The need for faster network speed and better coverage will be the keys to success.

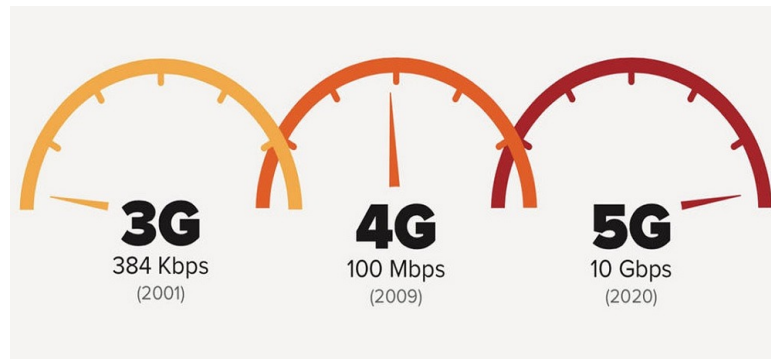


Figure 9: The difference in speed between 3G, 4G and 5G, (Burkett, 2018).

3.4.1 5G network slicing

One of the most interesting features that the 5G networks will bring is the network slicing, (Kavanagh, 2018). The network slicing makes it possible to divide the network band into multiple virtual networks that can provide individualized networks customized to the need of the customer. This can provide different types of network subscriptions that targets markets such as IoT devices, autonomous cars, smart cities etc.

3.5 Cloud

Storage of data is of huge importance for a business and the impact of it is increasing rapidly with the digitalization process. The necessity of big servers that could store all the data that your business generates has been a big part of the cost. The cloud gives people and businesses the ability to outsource the server storage to external companies and at the same time have access to all their data at any time and from almost anywhere with an Internet connection. The cloud is giving you the ability to pay for just the amount of processing power that you need and when you need it. You will not have to own your own servers anymore where you will have to pay for the hardware and for keeping them running all the time. By using the cloud you will have no need to upgrade the hardware when you want to increase the processing power. And the ability to work from almost anywhere where it is connection to the Internet, gives you a lot more opportunities regarding mobility, (Sebastian, 2014). The risk related to owning your systems and the need of maintaining the system up to date can be mitigated with the move towards the cloud.

3.5.1 Cloud migration

The process of moving data, applications and other digital assets to the Internet is called cloud migration. To replace physical hard drives and replace it with remote access through Internet allows businesses to focus on their strategic assets instead of using resources to assure the servers are operating properly and that they are not exposed to contamination of any sorts, (Team, 2017).

3.5.2 Cloud computing

Cloud computing give you access to applications and software without having to install them on your local computer. It gives you the ability to run more demanding programs that you would not be able to do with your current hardware. Cloud computing means to do your storing and accessing of applications, photos, videos, etc. over the Internet and instead of through your local hard drive. Cloud computing could be seen as a service that provides IT and computing capability that you can subscribe to and get on-demand access, (i-SCOOP, 2018d). IBM (IBM, 2018) classifies cloud computing into three different services and three different clouds:

- Software as a Service (SaaS) – Enables software to be run on distant computers.
- Platform as a Service (PaaS) – Provides the customer with a cloud-based environment that enables the building of web-based applications.
- Infrastructure as a Service (IaaS) – Provides customers with digital infrastructure that includes servers, networking, storage, and data center.

- Public cloud – A cloud that can be accessed from a public network with public servers.
- Private cloud – A cloud only accessible from a private network. It is used to increase efficiency and allow highly automated management.
- Hybrid cloud – A cloud where companies can access public services but also keep sensitive data in a traditional data center or private cloud.

3.6 Artificial Intelligence

Artificial intelligence (AI) is maybe one of the most exiting new technologies that we see spreading out rapidly both to people and businesses. The idea of machines, that can “think” and act like humans is as taken out from a Hollywood movie. There are many fields of use were robots and computers can take over from humans. Not only simple tasks, but also more difficult tasks that has a need for deeper understanding can now be done with the use of AI and advanced algorithms, (i-SCOOP, 2018a, i-SCOOP, 2018b). Some of the most relevant technologies that have come out from AI are machine learning, natural language processing, and computer vision.

3.6.1 Machine learning

Machine learning (ML) is based on the idea that machines are capable of learning from data, identifying patterns and make decisions without human intervention, (SAS, 2018b). In simple words, traditional programing as figure 10 describes, you have data and a program you run trough a computer and then get some output. In machine learning as figure 11 describes, you have some data and desired output that you run through a computer, and make the computer make the program that enables it to create the desired output, (Grimson, 2017).

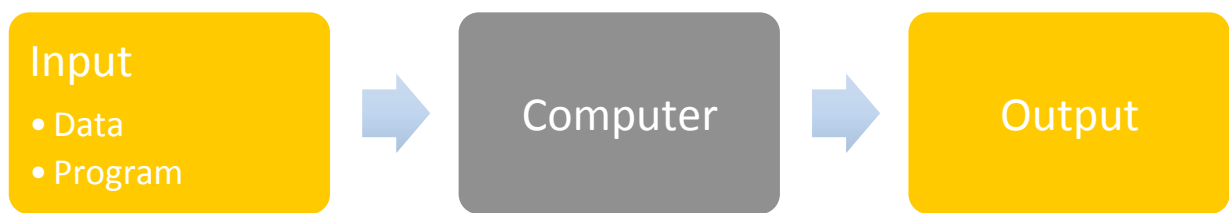


Figure 10: Principals of traditional programming.



Figure 11: Principals of machine learning.

3.6.2 Natural language processing

Natural language processing (NLP) allows computers to understand, interpret and manipulate human language, giving people the ability to interact with a computer using text or voice, (SAS, 2018c, Tauqeer, 2018). The ability to speak to a computer by using natural language has been a goal since the beginning of computers. It is only in recent years the technology has developed far enough so we actually can do it. The key applications based on NLP are text summarization, translation, keyword generation, sentiment analysis, and chatbots. Most of us are already using NLP tools on a daily basis such as autocomplete, predictive typing, spell checker, grammar checker, auto-correct, duplicate detection, spam detection, and email classification. These are all applications from NLP and are important for the effective use of computers and smartphones, (Medelyan, 2016).

When it comes to the digitalization of a business, the chatbot is one of the most interesting applications that come from NLP. It can in many ways replace the need for human contact in customer service and makes customers able to communicate with a computer software that can answer any questions they may have. Chatbot is fast and available 24-7 which means your customer service is not restricted by your normal working hours, (Carson, 2016).

3.6.3 Computer vision

Computer vision is the application that allows a computer to understand automatically what is shown in an image or video content. It is about enabling the machine to see the visual world, even to see things beyond humans, like air or temperature, (Avoyan, 2018).

Computer vision allows the use of tools like facial recognition, movement recognition, automatically license plate reading, and image editing, etc. New technology like autonomous cars is relying on computer vision in order to function, and all smartphones are already embedded with some sort of computer vision, (Esteban, 2017).

3.7 VR/AR

3.7.1 Virtual reality

Virtual reality (VR) is a computer-generated technology that gives the user a virtual world that can be experienced and interacted with. In VR the user is completely blocked from the outside world and engages into a replaced reality. The equipment that enables the user to experience VR has a main target to trick your brain into believing that you actually are in this new world. Oculus Rift (figure 12), HTC Vive and PlayStation VR are all head mounted displays (HMD) aiming to replace your reality. VR has already been used for some time in aviation training, but as the technology gets better and more realistic there are permanently new fields of use developed, (Kauffold, 2016).



Figure 12: Oculus Rift, (amazon, 2018).

3.7.2 Augmented reality

Augmented reality (AR) or mixed reality as some may refer to it, is about adding things to the actual reality. By adding a layer on top of what you see, it gives you information about what you are looking at, and therefore creates an augmented vision, (Jansen, 2010). Snapchat filters is a good example on how AR is already a mainstream technology, another example is the smartphone game Pokemon Go that made their whole business model based on AR where the person who plays the game is using the camera on his smartphone to capture creatures, (Szymczyk, 2016). Google glasses and Microsoft HoloLens (figure 13) are two of the biggest developers of AR glasses and more tech companies are also developing their own glasses, (Levy, 2017). This is a technology that will become more and more relevant and can open up for new business opportunities and markets.



Figure 13: Microsoft HoloLens, (Microsoft, 2018).

3.8 Digital twin

A digital twin or shadow as some referring to it is a simulation method where an exact copy is created in order to simulate operations, design, maintenance, etc. In a simple definition is it about creating a virtual representation of the elements and dynamics of how something works and operates, (O'Conner, 2017, Audiopedia, 2017). A digital twin can help you optimize how you design, build and operate something through its whole life cycle. For example did Maserati, the car manufacturer, turn their car manufacturing into a digital twin, this resulted in production increasing three times with the same quality, (Siemens, 2018).

The benefits of having a digital twin are the ability of having a virtual image of your asset, maintained throughout the lifecycle and easily accessible at any time. The downtime of operations will decrease and the profitability increases, making your business generate more value. Regarding safety, digital twins will able the business to have better control on the state of function and when maintenance is necessary as will lead to more safe and sustainable operations, (Rossi, 2017, Wong, 2018). It is clear that a digital twin is the future of simulation, with more advanced technological hardware will the ability to simulate advanced operations be easier, this gives better diagnostics and prognostics.

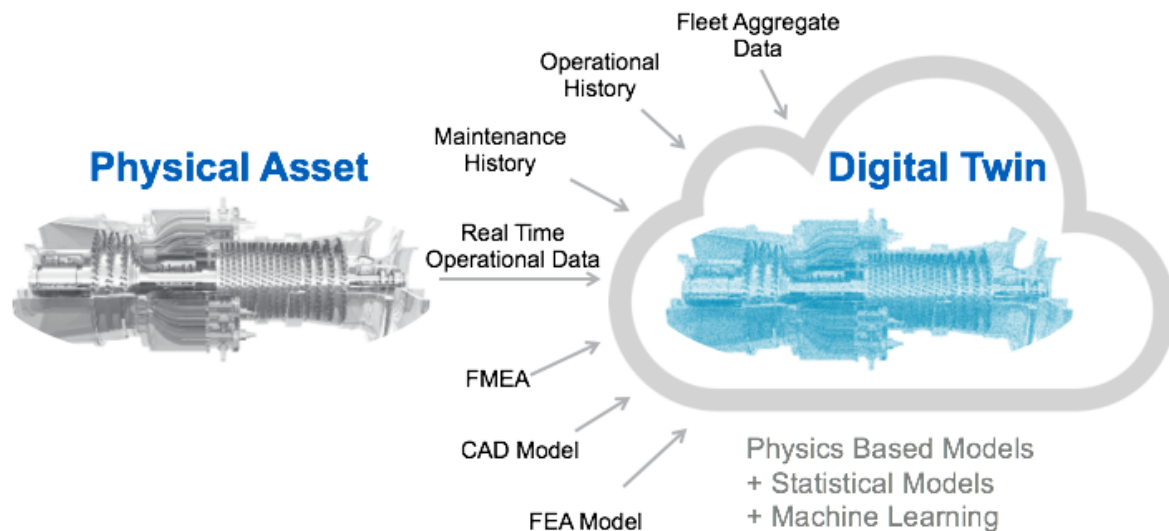


Figure 14: From physical asset to digital twin, (Rajput, 2018).

Figure 14 shows some of the different inputs and applications that a digital twin holds: fleet aggregate data, operational history, maintenance history, real time operational data, FMEA, CAD model and FEA model. With new developed processors software is now capable of running all these data in one process.

3.9 Technologies that need to be mentioned

There are so many exiting new technologies, but those mentioned above is the ones that were found most relevant to go deeper into. Those technologies mentioned below is also important for the digitalization of businesses and organizations, they are more self explaining and it was not found necessary to explain them more than in a few lines.

3.9.1 E-commerce

The way of shopping is something that has a big influence on many businesses. Traditionally there have been many factors to be considered when opening a store. Like location, size, rent, storage room, furnishing and etc. As for many other things Internet has also been a game changer in this area of business. Online shopping has open up for reaching out to a new worldwide market and have made the need for a physical store less important, (Duch-Brown et al., 2017). Digitizing your store will save your business cost related to rent and employees, and it allows you to focus on your products.

3.9.2 Social media/Marketing – Social network

In the recent years, way of doing marketing has changed a lot. With the Internet breaking mainstream and social medias such as Facebook, Instagram and Snapchat a new platform that is vital in order to reach the younger generation has been established. Marketing and commercials needs to be in online newspapers rater than paper print newspapers in order to reach a broader audience. Social media have had a big impact on our personal lives, but also in a business perspective it has become a new important platform to reach out to customers or partners. LinkedIn has a different approach than most of the other platforms. Their focus is the interaction between businesses and employees, business networking and marketing, (Nordmeyer, 2018).

3.9.3 Banking/Funding

Banking is one of the oldest businesses around and have played a major role in developing the society and the way our financial system works. The banking industry has not needed to change much over time and have been a relatively conservative branch. With the new technologies emerging, there will most likely have to be a big change in the role of the bank because of disruption. Vipps, Apple Pay, Bitcoin, crowd funding, they are all hot topics at the moment and will most likely change our economy for good, (Accenture, 2016).

3.9.4 Autonomous cars

One of the most exiting industries to be following today when it comes to new technology is the automotive industry. Big tech companies such as Uber, Google, Apple, Tesla, etc. have all started developing autonomous cars and have already started testing their cars in real traffic. It is estimated that we will see self-driving cars on the public market by the 2020s, (Davies, 2018). An example from Norway, is the public transportation company Kolumbus, (Andersen, 2017) which operates in Stavanger region. They have recently tested an autonomous bus that will operate without a driver on the public road.

4. Business and Organization

The topic of my thesis is to make a scorecard that can help businesses to better understand how digitalization can influence their organization. It is about how new technologies can improve the way of doing business and generate more value for the businesses. In order to give valuable feedback from the scorecard, it is vital to understand how a business works and how digitalization can have an impact on the different parts of the business. The ideal scorecard is one that could be used by businesses across different industries, and that all types of organizations find the characteristics relevant for their operations. But in order to create scorecards that can give useful feedback and still be applicable for all types of businesses, it is important to understand how a business or organization is build. This chapter focuses on organizational structure, business trends and business strategies and also covers how the digital transformation will have an impact on the future aspects of doing business.

4.1 Organizational Structure

In order to make a scorecard that is relevant for as many businesses as possible, the best way to give the scorecard a common approach was to break it up into several more specific scorecards that could focus on the different types of departments. In order to understand an organization or a business it is necessary to get an understanding of how the structure is build up. Organizational structure determines how information flows through the organization and have large impact on how the goals get achieved, (Investopedia, 2018b). The structure can be based on a hierarchy system, a flat system or a matrix system. These have different ways of organizing the relationship between management and employees, (BusinessDictionary, 2016). The structure inside a business will in most cases be customized to the type of business model, but the basic behind the structure is usually very similar to each other, and the way to generate value is often based on the same premises.

4.1.2 Porter's value chain

A good concept on how an organization is organized is Michael Porter's value chain, (Porter, 1998). As shown in figure 15, the porter's value chain consists of support activities and primary activities that together create the company's margin. The four activities in the support activities and the five primary activities are all creating different sorts of value to the organization. The support activities consist of firm infrastructure, human resources, technology development, and procurement, these are all activities that helps the primary activities reaching their full potential throughout the process. The primary activities are activities that cover the lifecycle of a product or service. Consisting of inbound logistics, operations, outbound logistics, marketing and sales, and service, (frixabout.com, 2016, University, 2013). The concept created by Porter is merging the primary activities with the support activities in order to reduce cost and improve the profits and maximize the margins.

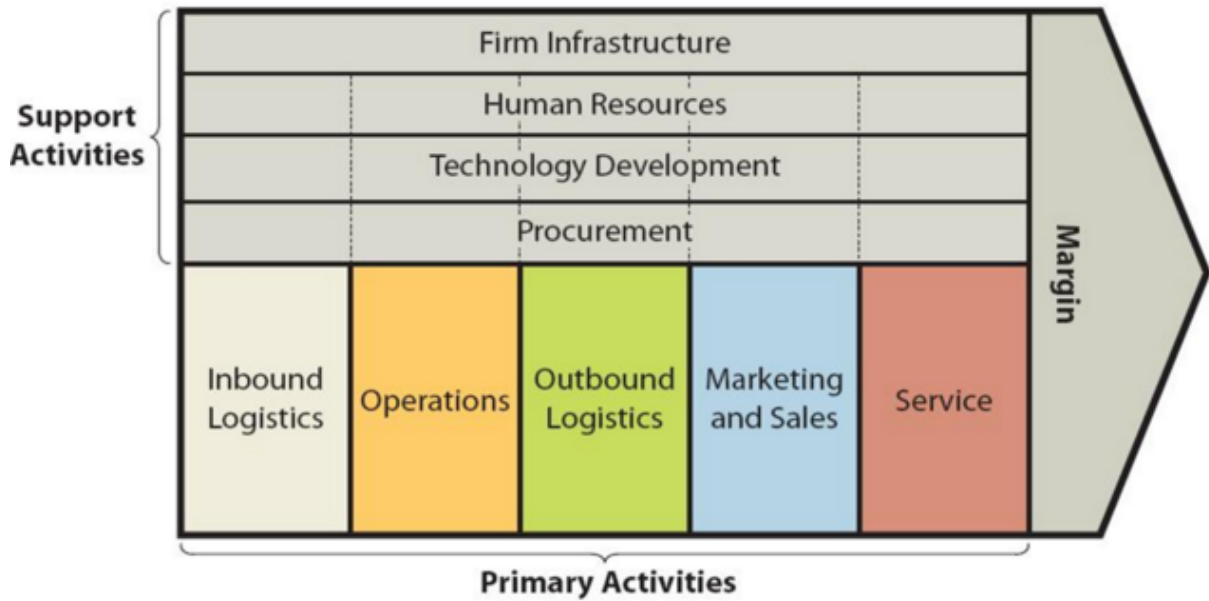


Figure 15: Porter's value chain, (Dudovskiy, 2018).

4.2 Business departments

From the understanding of how a business works and the different tasks that are being done inside an organization, it was found best to divide the organization into different departments that is common in all types of businesses and across all types of industries. Related to what type of tasks that are being done in an organization and how digitalization can be of relevance to the different parts, the different departments was chosen for the scorecards based on (Porter, 1998) and from typical organizational structure (University, 1999, Lloyd, 2016, Marquis, 2018, Riley, 2014). The ones chosen were as figure # shows, management, human resources, logistics, operations, accounting & finance, and marketing. These were all departments that have their own set of tasks that have the ability of being digitized and digitalized.

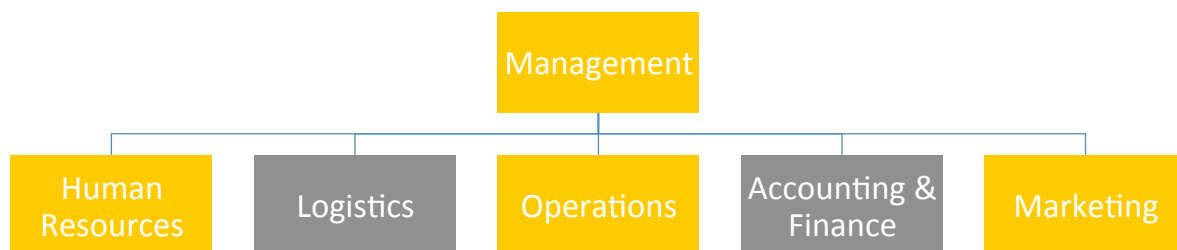


Figure 16: Six common departments inside a business or organization.

The different department that was chosen to represent the common business/organization has all been divided into different tasks and processes that have important roles in the operation of a business. Below is a description of the most common tasks that need to be handled by each department.

4.2.1 Management

Management department is considered as the administration of the organization. Typical tasks that is common for any business are planning functions, organizing resources, staffing structure, directing activities, controlling systems, motivating, and innovation, etc. Management is considered the most important factor when moving towards a digitalized business. The digital transformation has to start in top before it can flourish downwards. The most common functions of the department and found relevant in the scorecard are strategy, innovation, technology, digital solutions, business model, decision making, (Kimberlee, 2018).

4.2.2 Human resources

Human resource department is responsible for new recruitment, health and safety, employee relations, labor law compliance, and training and development. There are great opportunities in digitalizing this department considering that the department is often small and can in some cases be outsourced or moved to management department. The functions of the department that was found relevant and common in all type of businesses, and fit in to the scorecard were recruitment, social media, communication, workplace, follow-up, and performance, (Ruth, 2018).

4.2.3 Logistics

Logistics department is considering supply chain, warehousing, material handling, inventory, etc., (Forum, 2016a, i-SCOOP, 2018i). The most common functions of the department and the ones that was found relevant in the scorecard are planning, inventory, records, inventory, records, inventory management, shared logistics, and automation. These are functions that have a high potential of getting fully automated with a digital transformation, (Forum, 2016b, Gezgin et al., 2018, Forum, 2018b).

4.2.4 Operations

Operations department is most commonly the biggest department in an organization and stands for most of the productive parts. Operations are varying a lot from businesses to businesses depending on what kind of product or service they provide. The most common functions of the department that were found relevant in the scorecard are IT-support, IoT, Big Data, documents and files, meetings, AI, and simulations, (Gartenstein, 2018).

4.2.5 Accounting and finance

The financial aspects of running a business is vital for its existence, the bookkeeping is an important task that makes sure that the business is running as it should and that everything is under control. The most common functions of the department and that was found relevant in the scorecard are financial records, financial reports, DLT, applications, and clerical accounts, (PCG, 2018).

4.2.6 Marketing

The marketing department is seen as the corporate picture outward. Their task is to connect with the customers and identify how the business can satisfy the customers' needs. They are also responsible for advertising and building the business brand. The most common functions of the department that was found relevant in the scorecard are research, market strategy, social media, customer service, AI, and customer understanding, (Linton, 2018).

4.3 Business models and trends

The way of doing business is continuously evolving. New technology results in new opportunities and new ways of doing things. As (Tauqeer, 2018) and (Bang, 2018) lecturing in the thesis meetings, there are many new business models that are coming from the new digital area. Different business trends that is currently relevant are sharing, outsourcing, personalizing, servitization and crowdsourcing, (Altman, 2017). These are all business models that benefits from new technology and in some cases they are possible to implement by the use of new technology only. The context between these models is the ability to keep up with the rapid changes, and to customize the product or service to individualized customers, (Rojas et al., 2015, Shafer et al., 2005).

4.4 Business strategy

The business strategy is a vital part of how a business is planning for achieving their goals, (Schmidt, 2018). The strategy reflects the firm's strength and weaknesses, how resources are used and how the firm act on opportunities. When value creation is coming from digital tools and resources, it should reflect the strategy, (Bharadwaj et al., 2013). If a business is going to keep up with the digital transformation, they also have to transform their business strategy towards a digital business strategy. In order for a business to have a successful digital transformation, there have to be a management team in place that is encouraging the digitalization. And one of the first steps will be to move towards a digital business strategy.

5. Scorecard

When choosing how a potential scorecard was supposed to work, and what kind of features it was supposed to have, there were no clear answers on how to make it. An evaluation of multiple options on how to do it was made. The major goal for a scorecard should be to give the business or organization a fast answer, and measure their digitalization ability with minimal effort. Another important feature for the scorecard was that it is easy to understand and easy to fill out. In the beginning, a balanced scorecard (Investopedia, 2018a, Kaplan and Norton, 1996) was considered the best option because of its ability to measure performance. With further analysis it was found that the balanced scorecard would be best suited for individualized measurement and therefore not suitable for the overall approach that these scorecards were supposed to cover. The thought of making and sending out a survey was also an option and both Google Forms and Survey Monkey were considered. The idea of making a survey that easily could be distributed and filled out was tempting, but it was hard to see how a survey could give a better feedback than a scorecard. In the search for existing scorecards, it was revealed that there were many different approaches to the topic and that measuring of digital maturity was already performed with scorecards developed by some companies, (Forum, 2018a, Deloitte, 2018). Even the Norwegian Directorate for Management and ICT, have made their own evaluation tool for digital maturity (Difi, 2017). Their scorecards were made in excel-files and was easy to understand and very straightforward. This way of making the scorecards was inspiring, and the option that was chosen, was to make the scorecards in an excel-file like (Difi, 2017). In this way there could be several scorecards divided into the different departments that are usually found in any type of business or organization. The scorecard would provide you with a set of characteristics with different levels of digitalization. You check of the characteristic that best fits your business, and then get a score that will tell you the level of digitalization of the business. When finalizing the scorecards it gets clear which departments that scores high on digitalization and which ones you might want to improve. You will also have a total score that gives an estimate of how far your business or organization has come and if you are on the right track in order to secure your business against the rapid changes of the future.

5.1 Scoring levels

When planning the features of the scorecard, there were some considerations that had to be made. It was a goal that the person who would fill out the scorecard, should not be confused by having too many options to choose from. At the same time the aim was to avoid a scale that would allow too much variation of personal interpretation. Therefore the scorecards was divided into five different levels, whereas level one is least level of digitalization and level five is the highest:

- 1) Digitalization is zero or non-existing
- 2) The idea of digitalization is interesting, but the implementation is just starting
- 3) The benefits of digitalization is well known, the implementation is of a medium level.
- 4) Digitalization is a main focus in the organization, and the implementation is of a high level.
- 5) Fully digitalized. Benchmark

In order to get a more detailed description, each level can be described as following:

Level 1: A business that falls into this category is not digital at all. Paper-based processes are still vital for the organization and there are not made any effort in order to become more digitalized. This type of business is very vulnerable for disruption and should consider some change in management in order to handle the future changes.

Level 2: This category consists of businesses that just have started to realize that they need to shift focus towards more digital tools and solutions. There is still a long way to go before these businesses will become fully digitalized and there might be a need of a new strategy towards the implementation of new digital tools and technology. These businesses have taken the first step towards digitalization, but there are many steps left. The important thing is not to stand still on that step, but keep on climbing.

Level 3: This level categorizes the businesses that are in the middle of the digital transformation. They know that digitalization is vital for staying competitive and that the future relies on their approach towards the new technology and the digital solutions that is available. The businesses have still ways to go, and have work to be done. But their mindset is right, the focus should be on not to be satisfied with the present situation and continue the transformation towards a fully digitalized business.

Level 4: In order to fall into this category, the businesses have to be in advanced stages of digital transformation. These businesses know the benefits of digitalization very well, and they have already implemented digital solutions in many aspects of their organization. New technology is well known throughout the organization, and digital tools are prioritized.

Level 5: These businesses are pioneers in digitalization. Digital solutions are fully integrated in every aspect of the organization and these businesses are continuously striving to be the best in their field. These businesses are leading the digital transformation and are seen as a benchmark in their industry.

5.2 Technology trends

Technology trends play a central role in the process of formulating the questions in the scorecard. The opportunities that some of the technology brings, will give important premises for how a business can become more digitalized. As explained in chapter 3, new technology can improve a lot of aspects of an organization and the ability to know which of these new technologies that is relevant for your business is vital for digitalization and how to keep up with your competitors. New technology such as AI, IoT, cloud, DLT, and robotics will have important roles in the future way of doing business and are in some cases the definition of digitalization.

5.3 The scorecards

The scorecard is thought as a guide that not necessarily will give you the exact answers to the question: is your business is ready for digitalization or not? It will rather show possibilities that could be of relevance for your business. The meaning is that the scorecard can be used by all sorts of businesses and organizations and have therefore a relatively wage description in some of the checkups. As decided in chapter 4, six different departments were selected for an individual review and divided into several categories, which then were divided into five different levels of digitalization as mentioned above. Underneath are six tables explaining each section in the departments based on the scorecards that placed under the appendixes.

Table 1: Management department explained based on appendix A

Management	
Digital strategy	Digital strategy involves what kind of knowledge the management has about digital tools. The levels vary from no knowledge to in-depth knowledge about digital tools and implementation in to the organization.
Innovation	This section looks at how innovation affects the organization. The levels vary from not relevant to the main focus. This is because innovation has to be prioritized if the digital transformation is going to be effective.
Technology	The third section has a focus on new technology and the implementation of it into the business. New technology is a big part of digitalizing your business and needs to be implemented in order to achieve its benefits. The level varies from not considered, to up to date on all relevant technology trends.
Digital solutions	This section involves digital solutions and how it can produce value for the business. A fully digitalized business will have large value creation from digital solutions while a business that not has started the digital transformation will consider digital solutions to not generate any value.
Business model	The business model must also evolve with the digital transformation. In this section the levels go from to having a conventional business model towards a digital business model. The business model is the core of the organization, and in order to digitalize the organization, you have to convert the core to suit the digital transformation.
Decision making	The last section of the management scorecard is about decision-making and how they are made. The top level here is that decisions are made by the use of artificial intelligence and Big Data analytics. This is a fairly new way of making decisions, but it is one of the major parts of becoming fully digitalized. The lowest level of digitalization concerning decision-making is by only personal made decisions.

Table 2: Human resource department explained based on appendix B

Human Resource	
Recruitment	Recruitment is a big part of the HR responsibilities. In a fully digitalized business, this can be done by the use of artificial intelligence. This section examines how far the business has come in the digital transformation of the recruitments process. Where lowest level consists of people doing all the work and the highest level consist of fully automated recruitment done by AI.
Social media	Social media is now a well-known platform for communication and sharing of information. In this section the implementation of social media in to the organization is looked at, where the lowest level is that social media has no part of the organization and on the highest level, social media is highly integrated in the organization.
Communication	This section takes care of how communication between coworkers is done. The lowest level of digitalization is face-to-face communication while the highest level is by the use of digital tools such as video calls.
Workplace	In a fully digitalized business, you will have the ability to work from anywhere connected to the Internet with digital solutions implemented in every aspect of the organization, the workplace does not have to be at an office. The lowest level is when the work only can be done from one place, while in the top level, work can be done from anywhere.
Follow-up	Follow-up of employees are also an important role of the HR department, in this section the levels of digitalization goes from personal meetings to the use of digital surveys and online forms.
Performance	In this section performance measuring is looked into and how evaluation can become more digital. The lowest level of digitalization is to hand out paper notices as a feed-back while the top level of digitalization are fully automated and real-time reported evaluations. The top level will neglect any human influences and therefor be completely equal and non-partial.

Table 3: Logistics department explained based on appendix C

Logistics	
Planning	Planning is a vital part of logistics, a well-planned supply chain is important in order to realize the potential profits. In this section the levels of digitalization goes from manual planning towards autonomous just-in-time planning with no need for human interaction.
Inventory	Inventory lists can also be digitalized on a high level. From paper based inventory list as the least digital format you can go towards cloud based lists that has real-time update and that can be accessed from anywhere.
Records	To keep records is an important task in the logistics department. The different level of digitalization goes from only paper based records towards all digital records.
Inventory management	The inventory management can also be classified in different levels of digitalization. (Innovation, 2018) The digital transformation goes from push delivery process towards predictive inbound logistic management.
Shared logistics	The ability to share logistics and by that share some of the cost, the business will be able to generate more profit and reduce vulnerability related take on all the risk your self. The top level of shared logistics is a cross border platform that gives you the ability to have a clear overview of all logistics that will help your planning and interaction between your partners.
Automation	Automation is highly relevant towards the fully digitalized way of doing business. And in logistics there are big opportunities related to automation.(Innovation, 2018) In a top-level logistics department there is no need for a warehouse in the supply chain because all parts are fully automated and operations are based on just-in-time delivery.

Table 4: Operations department explained based on appendix D

Operations	
IT-support	IT-support is highly related to how far the business has come in the digital transformation. As the organization moves towards being fully digitalized, IT-support becomes more central for operations. This section levels IT-support from no dedication in the organization towards having a central role in operations optimization.
IoT	Internet of things is changing the way we do business and has a vital role in the digital transformation. IoT must be integrated into the operations if the business is going to be able to be competitive in the future. In this section the lowest level is that connected devices is not relevant for operation, and in the highest level, the business have launched IoT solutions in all aspects of operation.
Big Data	This section takes care of the use of data sets in the operations. Big Data has come to stay in the modern way of doing business, and has opened up new opportunities that were not possible before. In the lowest level there is no large data sets stored and digital data is discarded, while in the highest-level data is collected from all related aspects of operations.
Documents and files	Documents and files can usually be related to operations, and the way they are stored decides how digitalized the business is in this field. The lowest level in this relation is only paper based documents and files, and the highest level is all documents and files stored in the cloud.
Meetings	Meetings are also an important part of operations and can in some situations be very time consuming, therefor can digital tools help in keeping time used on meetings to the bare minimum. The lowest level in this section regards face-to-face meetings and the highest level are all online meetings through videoconference etc.
Automation	Production is often the main part of operation and automation of the production process is a vital part of making the digital transformation successful. The level of digitalization in production goes from manual labor towards fully automated solutions.
AI	Decision-making is an important role in the operations department and must be made all the time. Machines and AI will more and more handle these decisions and planning processes, making the operations fully autonomous without any human interaction.
Simulations	Simulations are becoming more important in operations and help the business to improve and optimize their processes. Simulations will help to create more value from the same input and enhance the profits. The level goes from no simulation towards having a digital twin that gives you a 3D model of your whole operations.

Table 5: Accounting & finance department explained based on appendix E

Accounting & Finance	
Financial records	Financial records is one of the main responsibilities of accounting and finance department and the level of digitalization in this section goes from paper based records towards cloud based records that can be accessed from anywhere.
Financial reports	Financial reports are also a big responsibility of the department and here as well goes the level of digitalization from paper based towards a high-speed database that enables real-time financial reporting.
DLT	Distributed ledger technology or blockchain is one of the newest hypes in technology. This technology has a potential to revolutionize the accounting and finance department with its smart contracts and the security from contamination. The lowest level in this section has no DLT integrated in their organization, and the highest level has it highly integrated.
Applications	Applications are important tools in this department and how they are stored tells a lot about how far the digital transformation has come. The lowest level is local stored applications and the highest level are applications driven from the cloud, or cloud computing.
Clerical accounts	Bookkeeping, invoices and auditing are maybe one of the most important roles the department has. But these tasks also have a big potential of being done by AI. These tasks are often time consuming and by digitalize some of these, you are able to save a lot of resources. In this section the lowest level is manually bookkeeping while the highest level is the use of AI to do approval and rising of invoices and to do auditing.

Table 6: Marketing department explained based on appendix F

Marketing	
Research	Research is an important aspect of the marketing department and can be the key for being a successful business. The lowest level of digitalization is when research is done by personal conversations and paper based surveys, and the highest level is when research is done by online surveys and Big Data analytics.
Marketing strategy	With the new technology and the new customer behavior, the market strategy must reflect the digital transformation of the business. The strategy has to become digital, where digital tools and solutions are seen as strategic assets. In this section the lowest level is no digital market strategy, and the highest level has a clear digital market strategy.
Social media	Social media has become a big marketing platform and have opened up for new opportunities in promoting your business and get into new markets. In this section the lowest level is no focus on social media, and the highest is that social media is one of the main areas for marketing.
Customer service	Customer service is an important role for keeping customers satisfied and to keep a good relationship with the customers. With new technology comes new and improved ways of doing customer service. The lowest level in this section is customer service through physical appearance. The highest level of digitalization in customer service is when chat bots and AI run it all.
AI	How to market your product or service has also evolved with new technology. The lowest level of digitalization is batch marketing and the highest level is individualized marketing where you through the use of AI are able to make profiles of potential customers.
Customer understanding	The ability to understand the customer is the key for success, if you understand how your customer behave you will have the perfect opportunity to customize your product or service directly to the customer. The way of how information about the customer has improved greatly these last years with the ability to gather more data and better tools to analyze them. In this section the lowest level is that customer understanding comes from historical experience, while in the highest level the business uses big data analytics in order to understand their customer

6. Discussion

The main object of this thesis was to make a scorecard that could guide a business in understanding how far they have come in the digital transformation of their organization. The goal was to create a tool that could be used by different types of businesses across multiple industries and still be specific enough to give a high quality answer.

The answers were to divide the business or organizations into different types of department that are found in almost all types of businesses. The research showed that there were six different departments that were likely to be part of any type of business or organization. These are: management, human resources, logistics, operations, accounting & finance, and marketing. These are all departments that have some common set of tasks that are essential for the business or organization to function.

The first step in the process of analyzing how digitalized a business is, is to understand what digitalization means and what kind of impact it has on the business. The word digitalization is not the only buzzword that is related to this new digital era. There are terms like digitization, digital transformation, digital maturity, digital disruption, and so on. The meanings of these terms are still unclear to most people. Depending on who is writing or talking about them, we get different opinions on what the definition and meaning of the terms is.

6.1 What is learned

The work related to the thesis has shown that the digital transformation is happening faster than thought possible. New technologies such as AI, AR and VR are being implemented in processes and make them look like they are scenes taken from a futuristic movie. The further development is happening faster than many people are able to comprehend. Moore's law is still as current today as it was half a century ago, and there is nothing that implies that it would stop in the near future. If you are going to keep up with your competitors its not enough to look at how you can double your productivity. You have to look at how you can double it 10 times. There is a reason for why some of the new technologies that are emerging get so hyped as they get, they have in fact the possibilities to substantially change aspects of how we live our lives, how we conduct business and how we relate to technology in general.

The thesis has also shown that all data is valuable and that Big Data analytics will be an important tool in regards to benefit from all data gathered and to find new business opportunities. With technologies as IoT and DLT emerging, the amount of data that will be collected is so high that the ability to interpret and utilize the opportunities of the data will be a future goldmine. There is not many exceptions in what that cannot be digitized, and it seems like it is only the imagination that limits us for what digitizing can be used for. It is about having the right mindsets and to push the business towards innovation and new solutions. By using digital tools in the right way, the enhanced productivity will generate more affordable products and services that most likely will lead to higher welfare and a better quality of life for many people.

6.2 Main challenges

The foremost main challenge in this thesis was to understand what was meant with the word digitalization. How can you determine what a business has to do in order to become digitalized? The digital transformation is one of the main processes of taking a business into the future, and it is key to acknowledge digital tools as strategic important assets. The challenge is to keep moving forwards and continuously develop. As the technology level across industries advances it will be vital to not get stuck in the past. Customer behavior changes with the new technology and to still be able to provide customers with your product or service means that you have to keep up with the changes. Another big challenge is conservative businesses that do not see the importance of digitalization and therefore are reluctant to change something that is working today. The problem with that attitude is that what works today, might be outdated tomorrow. And in order to implement some of the new technologies in to the industry, businesses need to be willing to share data. There are still a lot of conservative business leaders that are stuck with the silo thinking among businesses. Therefore it is important to take the step towards of break down these silos to reach full benefits from tools as Big Data analytics. The challenges regarding definitions and standards are still relevant, and it can be confusing to understand what people mean when talking about topics as digitization, digitalization and digital transformation. People need to be consistent in the use of these terms, and consulting firms need to be on the same level when discussing it. If all involved speak the same language, less time will be wasted trying to understand each other and the productivity will increase. As mentioned, the development is happening so fast that is hard for businesses and governments to keep up with the pace. Laws and legislations are in some cases a barrier that holds back on the implementation and use of new technology. It is therefore important that governments see the opportunities that lie ahead and works towards making legislation that will encourage the further experimentation of all these emerging technologies.

6.3 Future research

There is always room for improvement and with the rapid development that is seen today, a scorecard like this cannot last for long without being continuously updated. It is important that new technologies are explored and that the benefits it provides is well known and shared. In order to get even more out of a scorecard like this, a more individualized or customized scorecard could give more specific answers about a business and how best maneuver into the future. It could for example be a scorecard customized after some inputs provided from an organization, or it could be a scorecard that is directly related to one type of industry. The thesis tries to explain the differences between digitization, digitalization and digital transformation, but the terms still crossing each other in some ways. A clearer definition of each word would benefit further development of the new digital world. If there is a clear definition then scientists would speak more the same language and then make it easier to avoid misunderstanding and unnecessary confusion. It is understood that many businesses is reluctant to change, therefor it is good to guide them through how important it is to start with a digital transformation of their business. It does not always have to be a big investment, and simple tools that can guide and help will be sought after when businesses see that they are falling behind.

7. Conclusion

The digital revolution has already started. We are heading towards a new area where all industries are affected by the changes that is happening. The digitalization of businesses are unavoidable and those who will not follow the digital transformation will sooner or later most likely go out of business. The disruption that occurs due to the new technology will be a threat to everyone that will not adapt. Management and boards must change towards digital strategies for their organization. It is important that the change comes from the top, and that employee's get motivated to contribute to the digital transformation of the businesses they work for. Customers and consumers will move towards technologies and solutions that will make things easier for them, and the providers of products and services have to continuously evolve in order to stay ahead of the competition. It is hard to stay on top and with the rapid changes in technology it is getting even harder. The only way to succeed is by using technology as an advantage, and the ability to find new ideas and opportunities of the new technology will benefit the organization from future disruption.

The scorecards have to be something new and unique solution that could be of valuable use for businesses and organizations. With all the consulting companies having their own way of measuring digital maturity of businesses, this thesis had to find its own approach. The result was to divide a business or organization into departments that is likely to appear in all. In this way, the scorecards can be specified but still simple enough that anyone can understand what is meant. The grading and scoring system is automatic and therefore does not need any special qualifications to answer. In addition it was important that the scorecards are easy to understand and provide quick answers without any complications.

The scorecards can only be seen as guides and not correct answer. They are fully able to point you in the direction of where you should exploit the opportunity of putting your resources to enhance the digitalization in your business, although a deeper research should be done before committing to any investments.

8. Bibliography

- AALST, W. M. V. D. 2014. Data scientist: The engineer of the future. *Enterprise interoperability VI*, 13-26.
- ACCENTURE. 2016. *Predictable disruption: Banks need to be proactive to spot the next wave* [Online]. Available: <https://www.accenture.com/us-en/insight-predictable-disruption-banks-proactive-next-wave> [Accessed 07.06.2018].
- ALTMAN, I. 2017. The Top 10 Business Trends That Will Drive Success In 2018. Available: <https://www.forbes.com/sites/ianaltman/2017/12/05/the-top-business-trends-that-will-drive-success-in-2018/> - 5ec3cc84701a [Accessed 08.06.2018].
- AMAZONE 2018. Oculus Rift.
- ANDERSEN, I. 2017. Førerløse busser kan snart slippes ut i trafikken. Available: <https://www.tu.no/artikler/forerlose-busser-kan-snart-slippes-ut-i-trafikken/398496> [Accessed 07.06.2018].
- AUDIOPEDIA, T. 2017. What is DIGITAL TWIN? What does DIGITAL TWIN mean? DIGITAL TWIN meaning & explanation. YouTube.
- AVOYAN, H. 2018. Technology That Sees The World: Welcome To The Future Of Computer Vision. Available: <https://www.forbes.com/sites/forbestechcouncil/2018/04/26/technology-that-sees-the-world-welcome-to-the-future-of-computer-vision/2/> - d85940715a88 [Accessed 09.06.2018].
- BANG, K. E. 2018. *RE: Meetings about the thesis*.
- BASCUAS, K. 2014. Digital Maturity Explained. Available: https://www.asaecenter.org/resources/articles/an_magazine/2014/september-october/digital-maturity-explained [Accessed 11.06.2018].
- BERNTSEN, T. 2018. Digital endringsledelse. MarkedsPartner.
- BHARADWAJ, A., SAWY, O. A. E., PAVLOU, P. A. & VENKATRAMAN, N. V. 2013. Digital Business Strategy: Toward a Next Generation of Insights. *MIS Quarterly*, 37, 471-482.
- BLOCKGEEKS. 2018a. *What is blockchain technology?* [Online]. Available: <https://blockgeeks.com/guides/what-is-blockchain-technology/> [Accessed 03.05.2018].
- BLOCKGEEKS 2018b. What is blockchain?
- BLOOMBERG, J. 2018. Digitization, Digitalization, and Digital Transformation: Confuse Them At Your Peril. Available: <https://www.forbes.com/sites/jasonbloomberg/2018/04/29/digitization-digitalization-and-digital-transformation-confuse-them-at-your-peril/> - 61f9fc882f2c [Accessed 11.06.2018].
- BOYER, L. 2018. Digital Transformation: Start At The Beginning Keeping the End in Mind. Available: <https://www.linkedin.com/pulse/digital-transformation-start-beginning-keeping-end-mind-larry-boyer/> [Accessed 21.03.2018].
- BRYNJOLFSSON, E. & MCAFEE, A. 2014. *The second machine age*, W. W. Norton & Company, Inc.
- BURKETT, V. 2018. Pulling 5G: The Future Network.
- BURKHARDT, T. 2015. Why digital transformation has little to do with technology! | Tobias Burkhardt | TEDxIngolstadt. YouTube: TEDx Talks.
- BUSINESSDICTIONARY 2016. What is organizational structure? YouTube: WebFinance, Inc.

- CARSON, B. 2016. CHATBOTS EXPLAINED: Why the world's most powerful tech companies think they're the biggest thing since the iPhone. Available: <http://www.businessinsider.com/what-are-chatbots-and-who-is-building-them-2016-4?r=US&IR=T> [Accessed 09.06.2018].
- DALE, A. 2018. Disrupsjon og digitalisering - hva er egentlig spørsmålet? Available: <https://www.digi.no/artikler/kommentar-disrupsjon-og-digitalisering-hva-er-egentlig-sporsmalet/434005> [Accessed 31.05.2018].
- DATATILSYNET. 2018. *Hva blir nytt med forordningen?* [Online]. Available: <https://www.datatilsynet.no/regelverk-og-skjema/nye-personvernregler/hva-blir-nytt-med-forordningen/> [Accessed 21.05.2018].
- DAUGHERTY, P., BANERJEE, P., NEGM, W. & ALTER, A. E. 2015. Driving Unconventional Growth through the Industrial Internet of Things.
- DAVIES, A. 2018. The wired guide to self-driving cars. Available: <https://www.wired.com/story/guide-self-driving-cars/> [Accessed 07.06.2018].
- DELOITTE. 2018. *Digital Maturity* [Online]. Available: <https://eu.deloittedigital.com/en/content/digital-maturity> [Accessed 11.06.2018].
- DIFI 2017. Vurdering av digital modenhet. In: VURDERING_AV_DIGITAL_MODALHET-XLS.XLSX (ed.). Difi.no: Direktoratet for forvaltning og ikt.
- DITTRICH, R. 2017. The difficulty of digital transformation & how to make it happen | Rico Dittrich | TEDxUniPaderborn. YouTube: TEDx Talks.
- DÖRNER, K. & EDELMAN, D. 2015. What 'digital' really means. Available: <https://www.mckinsey.com/industries/high-tech/our-insights/what-digital-really-means> [Accessed 10.06.2018].
- DUCH-BROWN, N., GRYZBOWSKI, L., ROMAHN, A. & VERBOVEN, F. 2017. The impact of online sales on consumers and firms. Evidence from consumer electronics. *International Journal of Industrial Organizations*, 52, 30-62.
- DUDLEY, B., WEINELT, B., SPELMAN, M., GOMEZ, P., HEUSDEN, R. V., SIYAM, R., ASHRAF, M., COLLINS, J., KHAN, A., POPP, W., SHAH, A., AGRAWAL, P. & SHROFF, S. 2017. *Digital Transformation Initiative: Oil and Gas Industry*, World Economic Forum.
- DUDOVSKIY, J. 2018. Apple Value Chain Analysis.
- DUFFY, J. 2016. The internet of things | Jordan Duffy | TEDxSouthBank. YouTube: TEDx Talks.
- EIDEM, M. 2018. Norske bedrifter kan forsikre seg mot GDPR-bøter. *Dagens Næringsliv*.
- ESPEN ANDERSEN, R. S. 2018. Hva er digitalisering? Available: <https://www.magma.no/hva-er-digitalisering> [Accessed 05.03.2018].
- ESTEBAN, A. 2017. Computer Vision Technology Permeates Our Daily Lives. Available: <https://www.iotforall.com/computer-vision-applications-in-daily-life/> [Accessed 09.06.2018].
- EVERLEDGER. 2018. *Welcome to the digital vault of the future*. [Online]. Available: <https://www.everledger.io> [Accessed 05.06.2018].
- FLIXABOUT.COM 2016. Porters Value Chain. YouTube.
- FORUM, T. 2018a. *Find out how the TM Forum Digital Maturity Model works* [Online]. Available: <https://www.tmforum.org/digital-maturity-model-metrics/how-it-works/> [Accessed 14.04.2018].
- FORUM, W. E. 2016a. Digital Transformation of Industries - Logistics Industry. World Economic Forum.

- FORUM, W. E. 2016b. The digital transformation of logistics: Threat and opportunity. Available: <http://reports.weforum.org/digital-transformation/the-digital-transformation-of-logistics-threat-and-opportunity/> [Accessed 22.05.2018].
- FORUM, W. E. 2018b. Delivering change: digital transformation in logistics. Available: <http://reports.weforum.org/digital-transformation/delivering-change-digital-transformation-in-logistics/> [Accessed 25.05.2018].
- FOUNDATION, I. 2018a. Meet 'the Tangle'.
- FOUNDATION, I. 2018b. *What is IOTA?* [Online]. Available: <https://www.iota.org/get-started/what-is-iota> [Accessed 05.04.2018].
- GARTENSTEIN, D. 2018. Major Objectives of an Operations Department. Available: <http://smallbusiness.chron.com/major-objectives-operations-department-31500.html> [Accessed 11.06.2018].
- GEZGIN, E., HUANG, X., SAMAL, P. & SILVA, I. 2018. Digital transformation: Raising supply-chain performance to new levels. Available: <https://www.mckinsey.com/business-functions/operations/our-insights/digital-transformation-raising-supply-chain-performance-to-new-levels> [Accessed 28.05.2018].
- GLOBAL, I. 2018. What is Smart Technology. IGI Global.
- GRIMSON, E. 2017. 11. Introduction to Machine Learning. YouTube: MIT OpenCourseWare.
- HARALDSEN, A. 2018. Veien ut av den digitale tåkeheimen. Available: <https://www.digi.no/artikler/kommentar-veien-ut-av-den-digitale-takeheimen/438715> [Accessed 31.05.2018].
- HARIHARAN 2016. Big Data Analytics for beginners. YouTube.
- HEASLIP, R. 2015. The new digital business | Richard Heaslip | TEDxOxbridge. YouTube: TEDx Talks.
- HILL, J. B. 2017. Leading Through Digital Disruption. Gartner. Inc.
- I-SCOOP. 2017. Digital business: transformation, disruption, optimization, integration and humanization. Available: <https://www.i-scoop.eu/digital-business/> [Accessed 12.04.2018].
- I-SCOOP. 2018a. Artificial intelligence (AI) and cognitive computing: what, why and where. Available: <https://www.i-scoop.eu/artificial-intelligence-cognitive-computing/> [Accessed 09.06.2018].
- I-SCOOP. 2018b. Artificial intelligence in business: CIO challenges and recommendations. Available: <https://www.i-scoop.eu/artificial-intelligence-cognitive-computing/artificial-intelligence-business-ai-4-business-summit-belgium/> [Accessed 09.06.2018].
- I-SCOOP. 2018c. Big data in action: definition, value, evolutions, benefits and context. Available: <https://www.i-scoop.eu/big-data-action-value-context/> [Accessed 07.06.2018].
- I-SCOOP. 2018d. Cloud computing - from private, public and hybrid cloud to cloud services and cloud evolutions. Available: <https://www.i-scoop.eu/cloud-computing/-Platform-as-a-Service-PaaS-definition-and-usage-of-development-clouds> [Accessed 20.05.2018].
- I-SCOOP 2018e. Digital disruption.
- I-SCOOP. 2018f. Digital transformation: online guide to digital business transformation. Available: <https://www.i-scoop.eu/digital-transformation/> [Accessed 20.03.2018].

- I-SCOOP. 2018g. Digitization, digitalization and digital transformation: the differences. Available: <https://www.i-scoop.eu/digitization-digitalization-digital-transformation-disruption/> [Accessed 10.06.2018].
- I-SCOOP. 2018h. Industry 4.0: the future industrial revolution - guide to Industrie 4.0. Available: <https://www.i-scoop.eu/industry-4-0/>.
- I-SCOOP. 2018i. Logistics 4.0 and smart supply chain management in Industry 4.0. Available: <https://www.i-scoop.eu/industry-4-0/supply-chain-management-scm-logistics/> [Accessed 04.05.2018].
- I-SCOOP 2018j. Six key steps to build a successful digital business according to Gartner - based Gartner press release.
- IBM. 2017. *Blockchain for supply chain* [Online]. IBM.com. Available: <https://www.ibm.com/blockchain/supply-chain/> [Accessed 05.06.2018].
- IBM. 2018. *What is cloud computing?* [Online]. Available: <https://www.ibm.com/cloud/learn/what-is-cloud-computing> [Accessed 09.06.2018].
- INNOVATION, U. C. 2018. UNITY Industry 4.0 Roadmap: Logistics.
- INSIGHT, F. 2017. The Internet of Things: From Theory to Reality - How Companies Are Leveraging the IoT to Move Their Businesses Forward.
- INVESTOPEDIA 2018a. Balanced Scorecard. Investopedia.
- INVESTOPEDIA 2018b. Organizational Structure.
- JANSEN, V. 2010. Dette er augmented reality. Available: https://www.tek.no/artikler/dette_er_augmented_reality/87659 [Accessed 09.06.2018].
- KAPLAN, R. S. & NORTON, D. P. 1996. *The balanced scorecard: translating strategy into action*, Harvard Business Press.
- KAUFFOLD, P. 2016. The Future of Virtual Reality | Phil Kauffold | TEDxSonomaCounty. YouTube: TEDx Talks.
- KAVANAGH, S. 2018. What is Network Slicing? Available: <https://5g.co.uk/guides/what-is-network-slicing/> [Accessed 08.06.2018].
- KIMBERLEE, L. 2018. Five Functions of Management & Leading. Available: <http://smallbusiness.chron.com/five-functions-management-leading-56418.html> [Accessed 11.06.2018].
- KNAPTON, S. 2017. AlphaGo Zero: Google DeepMind supercomputer learns 3000 years of human knowledge in 40 days. *The Telegraph*.
- LEBOEUF, K. 2016a. THE 5 VS OF BIG DATA: PREDICTIONS FOR 2016. Available: <https://www.excelacom.com/resources/blog/the-5-vs-of-big-data-predictions-for-2016>.
- LEBOEUF, K. 2016b. The Five Vs.
- LEONARD, N. 2018. Digitalization of asset management [What does that even mean?]. Available from: <https://www.viziya.com/resource/digitalization-asset-management/>.
- LEVY, S. 2017. The race for AR glasses starts now. Available: <https://www.wired.com/story/future-of-augmented-reality-2018/> [Accessed 09.06.2018].
- LINTON, I. 2018. Responsibilities of Marketing Department. Available: <http://smallbusiness.chron.com/responsibilities-marketing-department-69931.html> [Accessed 11.06.2018].

- LLOYD, M. 2016. Departments Every Startup Should Have. Available: https://mobe.com/departments-every-startup-should-have/?aff_id=1760 [Accessed 29.05.2018].
- MARQUIS, A. 2018. What Departments Are Needed to Run a Business? Available: <http://smallbusiness.chron.com/departments-needed-run-business-23223.html> [Accessed 29.03.2018].
- MARR, B. 2014. Big Data: The 5 Vs Everyone Must Know. Available: <https://www.linkedin.com/pulse/20140306073407-64875646-big-data-the-5-vs-everyone-must-know/> [Accessed 07.06.2018].
- MEDELYAN, A. 2016. 8 examples of Natural Language Processing you use every day without noticing. Available: <https://www.linkedin.com/pulse/8-examples-natural-language-processing-you-use-every-day-medelyan/> [Accessed 09.06.2018].
- MICROSOFT 2018. Microsoft HoloLens Development Edition.
- NIELSEN, J. 2017. The Analog Web.
- NORDMEYER, B. 2018. The High-Level Impact of Social Media. Available: <http://smallbusiness.chron.com/highlevel-business-impact-social-media-38816.html> [Accessed 07.06.2018].
- O'CONNOR, C. 2017. Introduction to Digital Twin: Simple, but detailed. IBM Watson Internet of Things.
- OED 2018a. digital, n. and adj. OED Online: Oxford University Press.
- OED 2018b. digitalization, n.2. OED Online: Oxford University Press.
- OED 2018c. digitizing, n. OED Online: Oxford University Press.
- OED 2018d. smart, n.2. OED Online: Oxford University Press.
- ØYDEGARD, P. 2017. *Digitalization of Offshore Wind Farm Systems*. Master, University of Stavanger.
- PCG. 2018. Key Functions of Your Accounting Department. Available: <http://www.pcg-services.com/key-roles-accounting-department/>.
- PORTER, M. E. 1998. *Competitive advantage : creating and sustaining superior performance : with a new introduction*, New York, Free Press.
- RAJPUT, H. 2018. How digital twin is transforming Internet of things (IoT)?
- RILEY, J. 2014. Organisation: Departments in a Business (GCSE). Available: <https://www.tutor2u.net/business/reference/organisation-departments-in-a-business> [Accessed 29.05.2018].
- ROGERS, D. L. 2016. *The digital transformation playbook: rethink your business for the digital age*, Columbia University Press.
- ROJAS, M. J., YUSTE, E., VAZQUEZ, J. A. & CELAYA, J. 2015. New business models in the digital age. CEDRO: Dosdoce.com.
- ROJEK, M. 2016. Digitalization Explained. Available: <https://www.linkedin.com/pulse/digitalization-explained-marcin-rojek/> [Accessed 10.06.2018].
- ROSIC, A. 2017. What is a Smart Contract? A Beginner's Guide. YouTube.
- ROSSI, B. 2017. Digital twinning explained. Available: <https://www.raconteur.net/business/digital-twinning-explained> [Accessed 09.06.2018].
- RUTH, M. 2018. Six Main Functions of a Human Resource Department. Available: <http://smallbusiness.chron.com/six-main-functions-human-resource-department-60693.html> [Accessed 11.06.2018].

- SAS. 2018a. *Big Data Analytics - What it is and why it matters* [Online]. SAS Institute Inc. Available: https://www.sas.com/en_us/insights/analytics/big-data-analytics.html [Accessed 07.06.2018].
- SAS. 2018b. *Machine Learning - What it is and why it matters* [Online]. Available: https://www.sas.com/en_us/insights/analytics/machine-learning.html [Accessed 09.06.2018].
- SAS. 2018c. *Natural Language Processing - What it is and why it matter* [Online]. Available: https://www.sas.com/en_us/insights/analytics/what-is-natural-language-processing-nlp.html [Accessed 09.10.2018].
- SCHMIDT, M. 2018. Business Strategy, Model, Strategic Framework. Building the Business Case: Solution Matrix Limited.
- SEBASTIAN, L. 2014. What is "The Cloud" as Fast As Possible. YouTube: Techquickie.
- SEBASTIAN, L. 2015. RFID as Fast As Possible. YouTube: Techquickie.
- SEGAN, S. 2018. What Is 5G? Available: <http://uk.pcmag.com/cell-phone-service-providers-products/82400/feature/what-is-5g> [Accessed 08.06.2018].
- SHAFER, S. M., SMITH, H. J. & LINDER, J. C. 2005. The power of business models. *Business Horizons*, 48, 199-207.
- SHANE, T. 2018. IOTA - 100 Billion Reasons Why. YouTube: The bIOTAsphere.
- SIEMENS. 2018. *Driven by Data* [Online]. Available: <https://www.siemens.com/stories/cc/en/driven-by-data/> [Accessed 17.04.2018].
- SOLUTION, R. L. 2018. RFID Technology.
- STAMFORD, C. 2014. Gartner Identifies Six Key Steps to Build a Successful Digital Business.
- SZYMCZYK, M. 2016. Pokemon Go Is Driving Augmented Reality And Geolocation Adoption. Available: <https://zugara.com/pokemon-go-is-driving-augmented-reality-and-geolocation-adoption> [Accessed 09.06.2018].
- TAUQEER, M. A. 2018. *RE: Meetings about the thesis*.
- TEAM, C. A. 2017. *Migrating Enterprise to the Cloud: A Simple Explanation* [Online]. Available: <https://cloudacademy.com/blog/what-is-cloud-migration-a-simple-explanation/> [Accessed 09.06.2018].
- UNIVERSITY, C. 2013. *Porter's Value Chain* [Online]. Cambridge University: Institute for Manufacturing (IfM). Available: <https://www.ifm.eng.cam.ac.uk/research/dstools/value-chain/> [Accessed 01.06.2018].
- UNIVERSITY, T. O. 1999. *4 Organisational departments and functions* [Online]. OpenLearn: The Open University. Available: <http://www.open.edu/openlearn/money-management/organisations-and-management-accounting/content-section-4> [Accessed 04.04.2018].
- WONG, W. 2018. What's the Difference Between a Simulation and a Digital Twin? Available: http://www.electronicdesign.com/embedded-revolution/what-s-difference-between-simulation-and-digital-twin?adbsc=social_corporate_20180526_76216527&adbid=6405968155612712960&adbpl=li&adbpr=2697 [Accessed 30.05.2018].

9. Appendix

Appendix A:	Management scorecard
Appendix B:	Human resource scorecard
Appendix C:	Logistics scorecard
Appendix D:	Operations scorecard
Appendix E:	Accounting & finance scorecard
Appendix F:	Marketing scorecard

	Level 1	Level 2	Level 3	Level 4	Level 5	
Management						
Digital strategy	<input type="radio"/> Have no knowledge about digital tools (software).	<input type="radio"/> Are aware about basic digital tools (email, office, etc.).	<input type="radio"/> Has knowledge about widely used digital tools (ERP, 3D modeling, etc.).	<input type="radio"/> Has in-depth knowledge about digital tools, but reluctant to implement/adapt.	<input type="radio"/> Has in-depth knowledge about digital tools and has implemented it into the organization.	
Innovation	<input type="radio"/> Innovation is not seen as relevant.	<input type="radio"/> Innovation is welcome, but not prioritized.	<input type="radio"/> Innovation is of priority.	<input type="radio"/> Innovation is encouraged and of high priority.	<input type="radio"/> Innovation is a main focus.	
Technology	<input type="radio"/> New technologies are not considered.	<input type="radio"/> New technology is not seriously considered.	<input type="radio"/> New technology is looked at.	<input type="radio"/> New technology is considered at all times.	<input type="radio"/> Up to date on technology trends.	
Digital solutions	<input type="radio"/> Digital solutions are considered to be producing no value.	<input type="radio"/> It is looked into how digital solutions can generate value.	<input type="radio"/> Digital solutions is seen as future of value creation.	<input type="radio"/> Much of the value creation comes from digital solutions.	<input type="radio"/> Value creation is from digital solutions.	
Business model	<input type="radio"/> A conventional business model is in place.	<input type="radio"/> A digital business model is considered.	The benefits of having a digital business model is known and there is a clear intension of making one.	<input type="radio"/> A digital business model is being implemented.	<input type="radio"/> There is a digital business model.	
Decision-making	<input type="radio"/> Decision making is done by people.	<input type="radio"/> Decision making is done by people with help from some analytics.	<input type="radio"/> Decision making is done (Big Data).	<input type="radio"/> Decisions are made with the help of Big Data analytics.	<input type="radio"/> Decisions are made by artificial intelligence (AI) using Big Data analytics.	
	System calculated score:					0.00
<p>Some of the claims may not be relevant for your business/organization. Check off the ones you find relevant and neglect the claims that you do not find relevant. More than one assessments will give a more realistic review.</p>						

	Level 1	Level 2	Level 3	Level 4	Level 5
Recruitment	<input type="radio"/> Recruitment is done fully by people.	<input type="radio"/> Job advertisement posted online, but is processed by people.	<input type="radio"/> First phase of recruitment is done online.	<input type="radio"/> The first rounds of recruitment selections is done by chatbots and artificial intelligence (AI).	<input type="radio"/> Recruitment of new employees is done fully by chatbots (AI).
Social media	<input type="radio"/> Social media is not part of the organization.	<input type="radio"/> Social media is used for posting job ads.	<input type="radio"/> Social media is used for communication.	<input type="radio"/> Social media is used for profiling the organization.	<input type="radio"/> Social media is highly integrated in the organization.
Communication	<input type="radio"/> Communication between coworkers is done face to face.	<input type="radio"/> Communication between coworkers is done by telephone.	<input type="radio"/> Communication between coworkers is done by e-mail.	<input type="radio"/> Communication between coworkers is done by internal chat.	<input type="radio"/> Communication between coworkers is done by digital tools such as online video calls etc.
Workplace	<input type="radio"/> The work is only possible from the office.	<input type="radio"/> Employees can only be doing few things outside of office.	<input type="radio"/> Employees can be doing some work outside of the office.	<input type="radio"/> Employees can be doing most of the work outside of office.	<input type="radio"/> Employees have the possibility to work from anywhere connected to internet.
Follow-up	<input type="radio"/> Staff follow-up is done by personal meetings.	<input type="radio"/> Staff follow-up is mostly face-to-face but is also occasionally done by e-mail.	<input type="radio"/> The value from online staff follow-up is known, and is in some use.	<input type="radio"/> Much of staff follow-up is done online.	<input type="radio"/> Staff follow-up is done by digital surveys and online forms.
Performance	<input type="radio"/> Performance evaluations are reported through paper notices.	<input type="radio"/> Performance evaluations are reported through online forms.	<input type="radio"/> Performance evaluations are reported through online forms, but automated solutions are looked into.	<input type="radio"/> Performance evaluations are reported through online forms and some are automated.	<input type="radio"/> Performance evaluations are fully automated and reported real-time.
System calculated score: 0.00					
<p>Some of the claims may not be relevant for your business/organization. Check off the ones you find relevant and neglect the claims that you do not find relevant. More than one assessments will give a more realistic review.</p>					

Logistics					
	Level 1	Level 2	Level 3	Level 4	Level 5
Planning	<input type="radio"/> Manual planning of supply chain.	<input type="radio"/> Data driven planning of supply chain.	<input type="radio"/> Real-time planning (tracking) through connected -vehicles and -warehouses.	<input type="radio"/> Planning is based on data from external sources as well (Road condition, weather, etc.).	<input type="radio"/> Autonomous just-in-time planning.
Inventory	<input type="radio"/> Inventory list are paper based.	<input type="radio"/> Inventory list are digitized but only stored on local drive.	<input type="radio"/> Inventory lists are digitized and can be accessed from local network.	<input type="radio"/> Inventory lists are online and can be accessed from anywhere.	<input type="radio"/> Inventory lists are in the cloud and can be accessed from anywhere and updated real-time.
Records	<input type="radio"/> There is no digital records, only paper based.	<input type="radio"/> Most of the records are paper based, but some is digital.	<input type="radio"/> The records are even distributed between paper based and digital.	<input type="radio"/> Most of the records are digital, but there are still some paper based.	<input type="radio"/> All records are digital.
Inventory management	<input type="radio"/> Push delivery process.	<input type="radio"/> Pull delivery process.	<input type="radio"/> Vendor managed inventory.	<input type="radio"/> Autonomous inventory management.	<input type="radio"/> Predictive inbound logistic management (Big Data).
Shared logistics	<input type="radio"/> No shared logistics.	<input type="radio"/> Sharing logistics is looked into.	<input type="radio"/> Advantages from shared logistics is found and development is underlying.	<input type="radio"/> Shared logistics is developed.	<input type="radio"/> Cross border platform.
Automation	<input type="radio"/> No automation.	<input type="radio"/> Automatic warehouse system.	<input type="radio"/> Automatic warehouse network.	<input type="radio"/> Supply chain warehouse network.	<input type="radio"/> No warehouse in the supply chain.
System calculated score:		0.00			

Some of the claims may not be relevant for your business/organization. Check off the ones you find relevant and neglect the claims that you do not find relevant. More than one assessments will give a more realistic review.

Operations					
Level 1	Level 2	Level 3	Level 4	Level 5	
<input type="radio"/> No dedicated IT-support.	<input type="radio"/> General IT-support.	<input type="radio"/> The IT-support is a valued part of operations.	<input type="radio"/> IT-support is a big part of operations.	<input type="radio"/> IT is central for the operations optimization.	IT-Support
<input type="radio"/> Connected or communicating devices/equipment is not relevant for operation.	<input type="radio"/> IoT is known and looked into.	<input type="radio"/> IoT is seen as a strategic asset to business.	<input type="radio"/> Look to deploy IoT solutions.	<input type="radio"/> Have launched IoT solutions in all aspects of operation.	IoT
<input type="radio"/> Large data sets are not stored. Digital data is discarded.	<input type="radio"/> Small data sets are stored (email documents, etc.).	<input type="radio"/> Data sets from equipment are stored.	<input type="radio"/> Raw data from all aspects of operation is also stored.	<input type="radio"/> Data is also collected and stored from competitors, social media, etc.	Big Data
<input type="radio"/> Documents and files are paper based.	<input type="radio"/> Documents and files are in the process of being digitized.	<input type="radio"/> All documents and files are digitized.	<input type="radio"/> All documents and files can be accessed from local network.	<input type="radio"/> All documents and files are stored in the cloud.	Documents and files
<input type="radio"/> Meetings are usually face-to-face.	<input type="radio"/> Meetings can be arranged through internet, but are usually face-to-face.	<input type="radio"/> Video conferences are as usual as face-to-face meetings.	<input type="radio"/> Most of meetings are online, occasionally there are face-to-face meetings.	<input type="radio"/> All meetings are arranged online.	Meetings
<input type="radio"/> Production is based on manual labor.	<input type="radio"/> Automation of production is looked into.	<input type="radio"/> The advantages of automated production is well known and the process of getting there have started.	<input type="radio"/> The production is on its way of getting fully automated.	<input type="radio"/> Production is fully automated.	Automation
<input type="radio"/> Business operators use human decisions.	<input type="radio"/> Artificial intelligence (AI) tools are used to assist scheduling, automatic replies.	<input type="radio"/> AI is used in planning operators tasks and activities.	<input type="radio"/> AI is an integrated part of operations and used to support decisions.	<input type="radio"/> Autonomous operators. AI is used in all type of decision making and future planning.	AI
<input type="radio"/> There are no simulations of operations.	<input type="radio"/> Simple simulations of operations are done.	<input type="radio"/> Simulations of workflow.	<input type="radio"/> Full simulations of operations, without a 3D model.	<input type="radio"/> A 3D digital twin is in place for all operators with the ability for using augmented reality (AR).	Simulations
System calculated score: 0.00					
<p style="text-align: center;">Some of the claims may not be relevant for your business/organization. Check off the ones you find relevant and neglect the claims that you do not find relevant. More than one assessments will give a more realistic review.</p>					

Accounting & Finance

Level 1	Level 2	Level 3	Level 4	Level 5
<input type="radio"/> Financial records are paper based.	<input type="radio"/> Financial records are being digitized.	<input type="radio"/> All financial records are digitized.	<input type="radio"/> Financial records are stored on local drive and can be accessed from local network.	<input type="radio"/> Financial records are stored in the cloud and can be accessed from everywhere.
<input type="radio"/> Financial reports are paper based.	<input type="radio"/> Financial reports are being digitized.	<input type="radio"/> Digital solutions for financial reporting are implemented.	<input type="radio"/> Financial reporting is done by digital solutions.	<input type="radio"/> High-speed database that enables real-time financial reporting.
<input type="radio"/> Distributed Ledger Technology (DLT) is not considered for the business. (Blockchain).	<input type="radio"/> DLT is something that is looked into.	<input type="radio"/> The benefits from using DLT is well known and implementation is looked into.	<input type="radio"/> The implementation of DLT into the business has started.	<input type="radio"/> DLT is highly integrated in the business.
<input type="radio"/> Applications are local.	<input type="radio"/> Applications are connected to local network.	<input type="radio"/> Applications are connected to the Internet.	<input type="radio"/> Applications are connected to the Internet and some data is moved to the cloud.	<input type="radio"/> Most of the applications are transferred to the cloud (Cloud computing).
<input type="radio"/> Bookkeeping and data entry is done manually.	<input type="radio"/> Paper invoices received and sent to clients.	<input type="radio"/> Human approval of bookkeeping with the use of e-invoicing, automatic payments and bookkeeping.	<input type="radio"/> Artificial Intelligence (AI) based approval and rising invoices.	<input type="radio"/> Auditing is also done by software (AI).
System calculated score: 0.00				

Some of the claims may not be relevant for your business/organization. Check off the ones you find relevant and neglect the claims that you do not find relevant. More than one assessments will give a more realistic review.

Financial records
Financial reports
DLT
Applications
Clerical accounts

Appendix F

Marketing

	Level 1	Level 2	Level 3	Level 4	Level 5
Research	<input type="radio"/> Research is done by personal conversations and paper based surveys.	<input type="radio"/> Research is done by digitized surveys.	<input type="radio"/> Research is done by online surveys.	<input type="radio"/> Research is done by online surveys and use of software in order to process the data is looked into.	<input type="radio"/> Research is done by online surveys and Big Data analytics.
Market strategy	<input type="radio"/> There is no digital market strategy.	<input type="radio"/> A digital market strategy is looked into.	<input type="radio"/> The advantages of a digital market strategy are known and under development.	<input type="radio"/> A digital market strategy is being implemented into the organization.	<input type="radio"/> The organization has a clear digital market strategy.
Social media	<input type="radio"/> No focus on social media.	<input type="radio"/> Social media is looked into for use in marketing.	<input type="radio"/> Can see benefits from using social media in marketing.	<input type="radio"/> See large benefits from use of social media in marketing.	<input type="radio"/> Social media is one of the main areas in marketing.
Customer service	<input type="radio"/> Customer service is based on physical appearance.	<input type="radio"/> Customer service is being moved from physical appearance towards online functions.	<input type="radio"/> Customer service has online functions as well as personnel.	<input type="radio"/> Customer service has some chatbots as well as personnel.	<input type="radio"/> Customer service is fully run by chat bots.
AI	<input type="radio"/> Batch marketing using artificial intelligence (AI).	<input type="radio"/> Creating marketing groups with AI.	<input type="radio"/> Market segmentation using AI.	<input type="radio"/> Smaller market segments with the use of AI.	<input type="radio"/> Individualized marketing (profiling) using AI, AI-to-Market.
Customer understanding	<input type="radio"/> Customer understanding comes from historical experience.	<input type="radio"/> Customer understanding through Big Data is looked into, but not in use.	<input type="radio"/> The use of Big Data in order to understand the customer is seen as beneficial and in development.	<input type="radio"/> Big Data analytics is started to be in use for understanding the customer.	<input type="radio"/> Understanding the customer through Big Data analytics is a strategic asset.

System calculated score:

0.00

Some of the claims may not be relevant for your business/organization. Check off the ones you find relevant and neglect the claims that you do not find relevant. More than one assessments will give a more realistic review.