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The Impact of Digital Transformation on the Electric Power Industry

An explorative study of the largest Norwegian distribution system operators

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Executive summary

The Norwegian electric power industry is currently facing major changes in terms of how business is conducted. New technology, increased competition and regulatory changes are just some of the drivers for the ongoing digital transformation of the industry. There is limited theory available on how to successfully handle a digital transformation, so the goal of this master thesis is therefore to understand how the Norwegian distribution system operators (DSO) meet and manage the current digital transformation.

This thesis addresses three areas that can help increase our understanding. First, we examine the actions and challenges the DSOs have encountered and reflect on their digital maturity. Second, we investigate how the DSOs organize their IT department and how they manage innovation and digitalization. Third, we examine how they handle leadership in this digital age with focus on the relatively new Chief Digital Officer (CDO) role. The data for our analysis were collected using semi-structured interviews with representatives from seven of the largest DSOs in Norway.

Our main finding is that the DSOs, as per today, have made well-founded plans for how to manage a digital transformation, and identified and initiated relevant actions. They agree about new technology, increased competition, regulatory changes and increased efficiency being drivers for the digital transformation, and they are concerned about the same challenges in regard to integration of new technology and systems, and how to change the culture in the organization. However, we discovered that all of them manage the transformation in different ways. All DSOs have restructured their IT department the last couple of years and we found three different approaches. Four of the DSOs have included innovation and digitalization in the IT department and two have separated it from the IT department. The last DSO have a separated innovation department, but no IT department. In addition, to get control and ensure digital development three of the DSOs have a CDO, three have a CDO in the parent company and only one has chosen not to establish this role.

One can argue for and against the different approaches, but we cannot justify to draw an indisputable conclusion on what is right and what is wrong. Which approach a DSO should choose will depend on company specific factors such as the size of the company, its organization and its corporate culture, but also on external factors such as new competitors, new technology and customer needs.

Preface

This master thesis is written as the final part of our master's degree in Economics and Business Administration at the Norwegian School of Economics. We wanted to write about a new and emerging topic, and found the concept of digital transformation to be interesting. We were initially very open about what industry to write about so our supervisor introduced us to the Norwegian electric power industry. We did not know much about this industry in advance, but we soon found out that this is a very complex and interesting industry that recently started going through a digital transformation. It has been very educational and exciting to immerse ourselves in this topic and industry.

We would like to take this opportunity to thank the people that made it possible for us to fully achieve this study. First, we are very thankful to the persons and companies that willingly and enthusiastically participated in our interviews. We really appreciate your honest and extensive answers to our questions. Your responses made the foundation for our research.

Further, we would like to express our greatest gratitude to our supervisor Ph.D. scholar Karen S. Osmundsen. Thank you for your great guidance and good advices throughout the whole semester, and for always being available. Your input and insight into the electric power industry have really elevated our thesis.

Finally, we would like to thank our family and friends for the help and support along the way.

Oslo, May 28th 2019

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Contents

List of tables and figures

Tables

Figures

1. Introduction

1.1 Background

Today's society is currently facing *the fourth industrial revolution*, stated to transform every industry and reshape the way we work, all driven by new technologies and digitalization (EY, 2018). Multiple industries have over the course of just a decade experienced tremendous change. The TV-and film industry, among some, have been altered to the unrecognizable and technical innovations have made CDs and DVDs redundant. In other words, organizations are evolving through digital transformations (Osmundsen, Iden, & Bygstad, 2018a). According to Powel (2018) one of the next industries to encounter modifications in terms of digital transformation is said to be the electric power industry[1].

The expected changes in the industry are argued to be based on a combination of technological innovations and a need for an upgrade of the existing electrical infrastructure in Norway. Electricity is being used for new purposes and products, and changes in production and consumption patterns could have implications for grid operations (Energy Facts Norway, 2019a). The industry will arguably change, and the possibilities presented by new technologies could affect the current business models of the grid companies, also referred to as distribution system operators (DSOs) (Energy Facts Norway, 2019a). Customers can in fact become self-sufficient or *prosumer homes,* where they both produce and consume energy (Zafar et al., 2018). Thus, the industry needs to adjust for future requirements and possibilities. According to The Norwegian Water Resources and Energy Directorate (NVE) the electric power industry as a whole is planning to invest NOK 140 billion in the electricity system over the next decade to meet the new demands and opportunities in the industry (Bakke & Paulsen, 2016). NOK 79 billion is expected to be invested in the DSOs' area of responsibility.

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[1] The electric power industry consists of production, transmission, distribution and trade (Energy Facts Norway, 2019b). The thesis will focus on the companies within the distribution function.

Another aspect the fourth industrial revolution introduces is how firms should develop new organizational structures to leverage on the power of digitalization. There are no clear guidance on the approach and strategy companies should take to foster digital transformation (Haffke, Kalgovas & Benalian, 2016). However, the penetration of digital innovations into practically every aspect of business has led many firms to create the role of a Chief Digital Officer (CDO) to administer the establishment of digital capabilities in the company (Haffke et al., 2016; Tumbas & Berente, 2018).

Due to the transformation the industry is experiencing, the need for an agile and effective management will be crucial for further success and progression for the affected companies in the Norwegian electric power industry. Many argue that the leadership challenges organizations will meet are not it terms of knowing when the next digital disruption is coming. Rather, the challenge will be how the firm embrace the impending changes (McKinsey & Company, 2016). Thus, the need for strong leadership and organizational adjustments will be highly present today and in the years to come to capitalize on a digital transformation.

1.2 Research question

This thesis focuses on how the DSOs adjust to the digital transformation the Norwegian electric power industry is experiencing. The main areas we will research are organizations' digital maturity, organization of the IT department and the CDO role.

Current research is placing great emphasis on how digital transformation is changing established business models and work routines. We seek to understand how Norwegian DSOs meet the need for digitalization, and how they manage their business in the digital age. Based on this we have formulated the following research question:

How do Norwegian distribution system operators (DSOs) meet and manage the digital transformation?

1.3 Scope

We wish to answer the research question by doing a qualitative study. Since there are limited quantitative and qualitative data on how the Norwegian DSOs manage a digital transformation, we will conduct semi-structured interviews in order to collect relevant data. The companies are still in the beginning of the digital transformation and the analysis will therefore be built up around their actions and experiences up to this point in time.

The electricity grid consists of three main levels, the transmission, distribution and regional grid. The transmission grid is operated by Statnett and the remaining grids are operated by 124 companies as of 31.12.2017 (Heien, Melvær, Nibstad, Sergieva, & Sliwinski, 2018). This paper will focus on the DSOs running the distribution and regional grids. The 10 largest DSOs (in terms of grid capital) accounted for 60 percent of the total grid capital in Norway in 2018 (Heien et al., 2018). Hence, in our study we aim to investigate the research question by analyzing the 10 largest DSOs.

A digital transformation can affect every aspect of a business, but in order to limit the magnitude of this thesis we have chosen to focus on three main areas; digital maturity, organization of the IT department and the CDO role. We will apply existing theory on these topics to analyze the research question.

1.4 Structure

The thesis consists of seven chapters. The following chapter is a presentation of the Norwegian electricity grid system. Structural set up and drivers that could affect and change the grid are discussed. Chapter three presents the theoretical foundation of digital maturity, organization of the IT department and the CDO role. Further, our methodology is presented in chapter four. Here we explain the chosen research design, how we located the interview participants and how we gathered and analyzed the data. Chapter five reports our findings and connect them to theory, while chapter six discuss the findings, further research and limitations. Last, in chapter seven we conclude on our findings of this study.

2. The Norwegian electricity grid system

2.1 The traditional structure

This section includes a brief overview of how the Norwegian electricity grid system is organized. The description is both from a technical and administrative view and are intended for non-expert readers to provide a general outline of the electric power supply value chain.

2.1.1 Technical structure

The electricity grid is an integral part of the electric power industry and enables electricity transport from producers to consumers. "*The electricity grid fulfils a core function in the electricity system, and constitutes key infrastructure in a modern society*" (Energy Facts Norway, 2019b). This emphasizes the importance of a well-functioning electricity grid and the significance of the DSOs' work.

The electricity grid in Norway consists of three main levels (*Figure 1*). However, as mentioned in the introduction the main focus of the thesis is the regional and distribution grid companies. Their operation areas are indicated by the blue outline in the figure below. On a general basis a grid company is a concessionaire who owns or operates a part of the national grid.
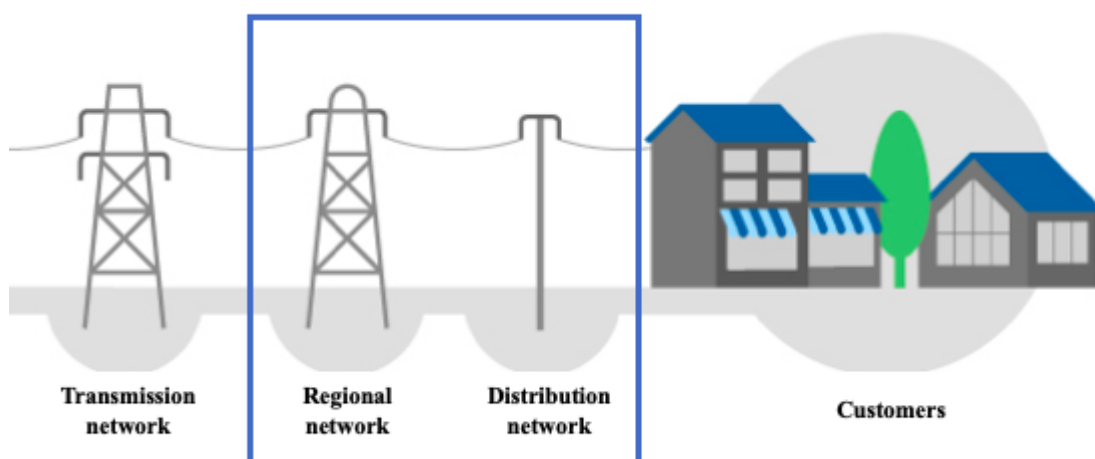

Figure 1: The Norwegian electricity grid (Hafslund Nett, 2018)

The transmission grid transfers high voltage usually around 300kV to 420 kV and is approximately 11.000 kilometers long (Energy Facts Norway, 2019b). High voltage levels are used to diminish grid losses, as this grid's main purpose is to carry electricity long-distance in a nationwide system (Energy Facts Norway, 2019b). Power intensive consumers, such as manufacturing companies and the petroleum industry are mainly connected to this grid.

The next level of the grid is the regional network with a total length of 19.000 kilometers. The voltage is gradually reduced to lower levels through transformer stations in the regional grid to 66kV to 132kV (BKK, 2019).

The final leg of the electricity supply occurs through the distribution network with a voltage of 22kV to 230kV which is adjusted to private consumption. This is the largest grid, stretching about 100.000 kilometers (Energy Facts Norway, 2019b). Small-scale consumers such as organizations and households are connected to the distribution grid.

2.1.2 Administrative structure

In Norway the grid companies are strictly regulated. This is due to the nature of electricity as a commodity. It is not socio-economically efficient to have more than one grid distributing the electricity to end-users in a specific geographical area. Consequently, the market can be described as a natural monopoly (Hafslund Nett, 2018). This implies that if the consumers are not satisfied with their DSOs services, they will not be able to change them.

The state-owned enterprise, Statnett, is the appointed Transmission System Operator (TSO). Statnett owns 94 percent of the transmission grid, the existing six percent is rented from other operators (Energy Facts Norway, 2019b). To ensure a cost-efficient and reliable electricity supply the TSO is assigned by the Norwegian regulator, NVE. The TSO has the responsibility to maintain instantaneous balance of power supply, frequency regulation and to develop market-based solutions that encourage efficient utilization and development of the electric power supply value chain. The transmission grid operated by Statnett is also Norway's connection to the international power grid. Thus, the TSO is accountable for extensive cooperation with foreign TSOs and regulators (Ottesen, 2017).

Further, the regional and distribution network is managed by a number of DSOs and they each run their entitled geographical area, also called concession areas. These are granted by NVE. As already mentioned there were 124 DSOs in 2017. However, by the end of 2018 this was expected to decrease to 120 (Heien et al., 2018). 103 of the DSOs has less than 10.000 customers, on the contrary the largest seven DSOs have more than 100.000 customers and supply electricity to 1,6 million users (Energi Norge, n.d.). Around 80 percent of the operators are owned by municipalities, county authorities or the state. The rest is under private ownership (Energy Facts Norway, 2019b).

Revenue cap regulation

NVE introduced a revenue cap regulation in 1997 for the grid companies in order to control the companies financially (NVE, 2016a). This cap sets an upper limit for what the companies can charge for the distribution of electrical power and ensures that the income do not exceeds the costs and a reasonable return (Rosvold, 2017). The purpose for this is to ensure that the grid is operated and developed in a socially rational and efficient way and to prevent unhealthy competition (NVE, 2016a). However, this does not mean that there is no competition, since the arrangement rewards the companies that operates most cost efficient with a higher cap than their costs would indicate (Heien et al., 2018).

When the revenue cap is determined, a cost basis must first be set. An element in the cost basis is KILE (quality-adjusted revenue cap for undelivered energy), which makes sure that the companies take into account the delivery reliability of the power grid. The KILE element represents the customers' cost of power outages. This is an adjustment of the revenue cap and the purpose is to give the companies incentive and motivation to allocate the resources in the best way possible (NVE, 2016b).

2.2 Future changes and the need for digitalization

In order to answer the research question, it is necessary to look further into digitalization and establish whether there is an actual *need* or not for digitalization of the electricity grid system. Digital transformation has already had its entry in a number of industries, but it is not until recently that focus has been aimed at the electric power industry.

Great changes are predicted to the electricity grid system during the next 10 to 15 years. Some of these are driven by the need for sustainable solutions, a decrease in centralized regulative production, more self-reliable consumers and new technologies (Haaland, 2014). These drivers can be identified as the attributes that influence and initiate the process of digital transformation (Morakanyane, Grace, & Reilly, 2017). In the following sections, the focus will be on the projected changes both from and organizational and technological view. Four drivers are presented and discussed.

2.2.1 Legal and functional unbundling

To prepare for the challenges and possibilities lying a head, the Norwegian electric power industry is arguably forced to reorganize the structure of the electricity grid we know today (The Ministry of Petroleum and Energy, 2014). In 2014 a government report titled *A better organized electricity grid* was issued. A concern the report raised is the potential lack of execution capabilities and adoption of new technologies by the DSOs to meet new demands and tasks (The Ministry of Petroleum and Energy, 2014). Many of the smaller DSOs will probably be inefficient and lack financial capacity for renewal and expansions. However, there is not necessarily a connection between company size and their efficiency (The Ministry of Petroleum and Energy, 2014).

The process concerning organizational structure is already underway and in 2016 the Norwegian government decided to change the *Energy Act* concerning legal and functional unbundling (NVE, 2018). This is due to the fact that a lot of the DSOs are part of vertically integrated companies. By changing the law they hope to secure a more transparent distinction between market-based and monopoly activities, and to prepare the industry for the changing environment they will meet in the near future (NVE, 2018). Grid companies with more than

30.000 customers that also operate within production and/or trading are required to carry out these activities through separate firms, also referred to as legal unbundling. The second part to the new regulation is functional unbundling, demanding that people with managerial responsibilities in a grid company, will not be able to hold leading positions in associated firms handling production and/or trading activities (Aarseth, Andersen, & Bjelland, 2018).

Several studies substantiate that the structure in the market is changing. A report from 2018, *Key figures for DSOs*, show that the number of grid companies have had a negative trend for several years (Heien et al., 2018). In 1984 there were 291 companies while there were 127 in 2017, a 56 percent decrease. In addition, the report also documents that a number of acquisitions have been conducted in 2018 and that there are several planned acquisitions and mergers in 2019 (Heien et al., 2018). The result of this is a market with constantly fewer and bigger companies.

Osmundsen, Iden and Bygstad (2018a) identified regulative changes as a driver and objective for digital transformation. Based on the information provided above, one can argue that regulatory changes in the industry are contributing to the digital transformation agenda within the DSOs. The new *Energy Act* is forcing the companies to make structural changes to their business models and transform their organization.

2.2.2 Increased profitability

Several studies show that the possible gains, in terms of improved profitability, from digitalization is greater than what experts expected earlier (Booth, Morh, & Peters, 2016). The total boost in profitability throughout the whole value chain in the electric power industry is estimated to be 20 – 30 percent, including potential earnings in the distribution and retail part of the chain (where the DSOs operate). Increased efficiency, increased workforce productivity and improved decision making are some examples on how digitalization can lead to increased profitability (Booth et al., 2016). This in itself gives the DSOs incentive to focus on and to use resources on digital transformation.

2.2.3 New technology and potential new competition

A third important driver for digitalization could be increased competition due to technical innovations. External pressure from new market entrants with disruptive digital business models will increase the pressure of digitalization on established organizations (Haffke et al., 2016). Thus, the DSOs could arguably be forced to participate in an organizational transformation. Potential new competitors who utilize microgrids, local energy communities (LEC) and improving batteries and energy storage are highly relevant threats to the resource oriented monopoly the DSOs have had for decades (Powel, 2018).

> **Microgrids**: A microgrid is part of a system that can operate isolated from the main grid and has enough generation capacity to supply its loads, energy storage devices, telecommunication and management infrastructure (Azzopardi, 2017). This technology combined with increased urbanization will most likely impose strong changes at the distribution level (Di Silvestre, Favuzza, Riva Sanseverino, & Zizzo, 2018).

> **Local Energy Communities**: LEC are based on microgrids structure and can be described as a cooperation among the prosumers to use local energy sources in order to satisfy their communities' energy needs (Kotsalos, 2018). According to OMNETRIC Group (2017), a Siemens/Accenture joint venture, LEC could be one of the biggest disruptions to the energy system.

> **Batteries and Energy storage**: Batteries and energy storage capacity are constantly improving and this could possibly open up for other companies and challenge the well-established grid companies. Powerful companies from other industries, such as Tesla and Mercedes-Benz, have already developed different types of energy storage systems (Mercedes-Benz Energy, 2019). Tesla has created energy storage with different applications, for instance the Tesla Powerwall, a home battery that makes it possible to store excess energy and makes it available on demand to meet the electrical needs of a household. In addition, it makes the usage of renewable sources such as wind and

solar panels more flexible considering that you can use the stored energy from the solar panels when the weather is bad (Tesla, 2019).

2.2.4 Increased competition inside the market

In addition to the potential new competitors, another risk the grid companies will encounter is threats from inside the market. As of 1st of January 2019 all Norwegian household have installed new electrical meters as part of an advanced metering systems, also known as AMS (Energy Facts Norway, 2019a). The system allows the end users to monitor their consumption and makes it possible to adjust the consumption to prices and minimize the electricity bill. This is the first big digital change in the industry, and it is only the starting point in regards to what can be possible in the future (Sand, 2017). The DSOs that can make the most of the data that AMS provides can get valuable insight and possibly achieve competitive advantages (Roverso, 2017).

The market structure will most likely change because of AMS considering that the end users get more control over their own consumption. Many grid companies consider this as an alternative to network expansion. Instead of making new network investments in order to meet the maximum demand on peak days, they could make agreements with the end users to curtail energy use at peak demand time (Energy Networks Australia, n. d.). A market with more demand side participation is therefore expected in the future.

2.2.5 The future smart grid

Compared to Figure 1 in the previous chapter which illustrates how the power system works today, the future system will be more complex and include more features. A collective noun for the future power system is *smart grid*. The use of AMS, energy storages, renewable power sources, peak time management and new technology will all be important elements in the future smart grids. The future grid will be improved and ensure more flexibility (Smartgrid, n. d.). Figure 2 below illustrates what the future electricity grid system may look like.
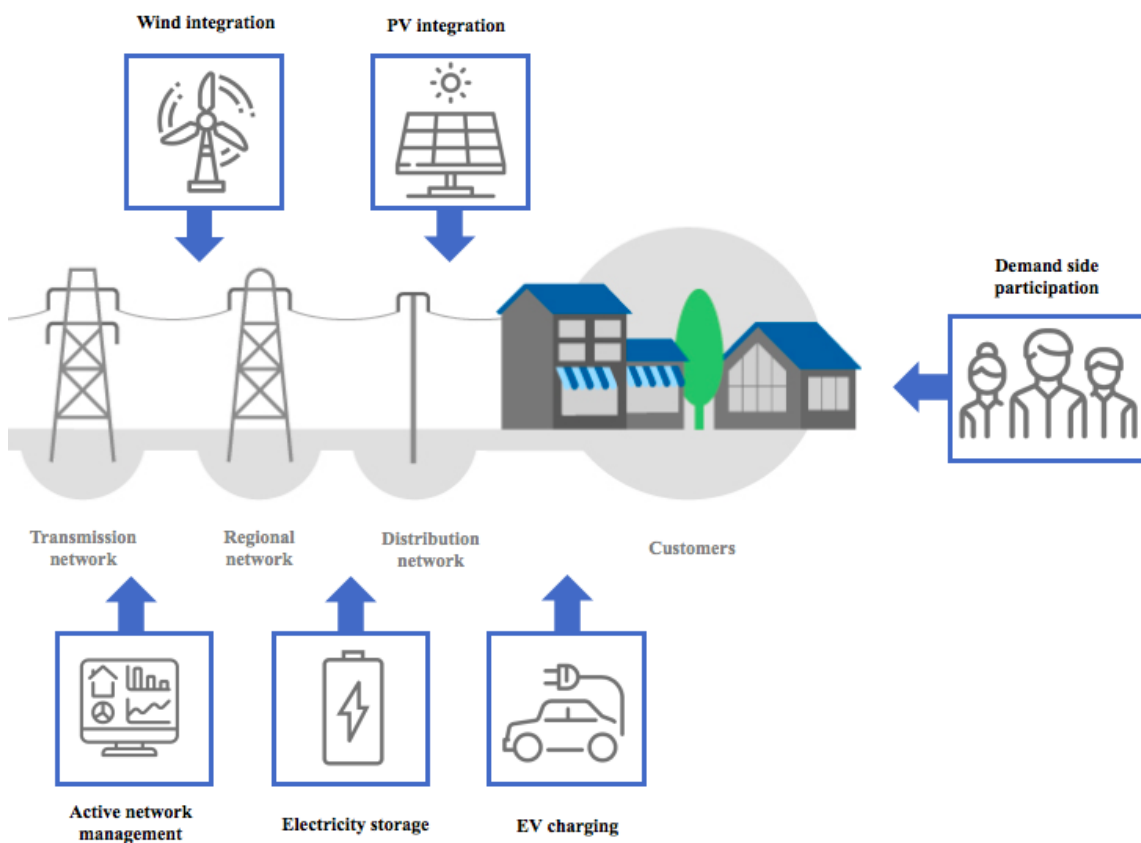
Figure 2: Illustration of a smartgrid (Smartgrid, n. d.).

Given all the changes that are about to influence the distribution part of the power system, it is clear that the DSOs will have to adjust and change in order to keep up. It is difficult to create and capture new value in a market that is changing and it imposes higher demand on the companies in terms of innovation (Lien, Knudsen, & Baardsen, 2016). Digitalization could therefore be an important factor to remain competitive and maintain pace with the changing market.

3. Theoretical foundation

This chapter presents theory, which provides the foundation needed to answer the research question. First, we introduce the concept of digitalization and other associated terminology. Digitalization is a widely used term in a variety of settings and as of now there is no cohesive perception of what the term actually entails (Osmundsen, Iden, & Bygstad, 2018b). Second, the ongoing discussion on how companies should structure their IT organization to align with changes introduced by digital transformation will be reviewed. Third, theory on leadership in the digital age is presented in line with the emerging role of the CDO.

3.1 Digitalization and associated terminology

At the same time as society and businesses are changing at a constantly higher speed in terms of new technology and innovations, a number of words and expressions have emerged. Words such as *digitalization*, *digitization*, *digital innovation* and *digital transformation* have become more and more familiar and are increasingly used in a more colloquially manner. However, the words lack clear and general definitions and are often used interchangeably (Osmundsen et al., 2018b). The purpose of this chapter is therefore to get a better understanding of these words in terms of definitions and to illuminate the important differences.

3.1.1 Digitization and digitalization

Osmundsen, Iden and Bygstad (2018b) conducted a literature review where they looked at the different definitions of digitalization in existing studies. They conducted a systematic literature review where they searched through 26 journals and 43 relevant conference papers from 2010 to 2017. One of their findings was that many authors based their definition of digitalization on the definition of Yoo et al. (2010). They defined digitalization *"[…] as the transformation of socio-technical structures that were previously mediated by non-digital artifacts or relationships into ones that are mediated by digitized artifacts and relationships" (Yoo et al., 2010).* Yoo et al. (2010) and many other authors also stress the fact that digitalization must not be mistaken for digitization, which is merely a technical term that describes the transition from analog to digital (Osmundsen et al., 2018b). Digitalization goes beyond this and implies, according to many of the definitions from the review, that also the social aspect regarding production, assessability, use and consumption changes (Osmundsen et al., 2018b). Based on

the existing definitions and in order to separate digitalization from digitization Osmundsen, Iden and Bygstad proposed the following definition for digitalization:

"The process of applying digital technology to alter one or several socio-technical structures."

Digital technology can be defined as new and emerging technologies (Morakanyane et al., 2017), while socio-technical structures is something that consists of two or more parts arranged together with both social (norms, humans interaction etc.) and technical (tasks, technology etc.) aspects such as processes, services or work arrangements.

3.1.2 Digital innovation

The official Norwegian definition of innovation is based on the definition constructed by economist Joseph A. Schumpeter: *"A new product, new service, new production process, application or organizational form launched in the market or used in production to create economic value"* (Nordbakken, 2019). Digital innovation is a subset of innovation that is becoming increasingly more relevant, and today we can observe a clear transition from "just" innovation to more and more digital innovation (Nambisan, Lyytinen, Majchrzak, & Song, 2017).

Nambisan et al. (2017) define digital innovation as the *"use of digital technology during the process of innovating"*. Like many authors, they look at digital innovation as a process. This is one of two main viewpoints in the existing literature about digital innovation (Osmundsen et al., 2018b). Many researches that share this point of view base their own conceptualizations on, or use the original definition constructed by Yoo et al. (2010), who defined digital innovation as *"the carrying out of new combinations of digital and physical components to produce novel products"*.

The other viewpoint understands digital innovation as an outcome rather than a process. The main source for this view is Fichman et al. (2014) who defined digital innovation as *"a product, process, or business model that is perceived as new, requires some significant changes on the part of adopters, and is embodied in or enabled by IT"*. Although many researchers agree with Fichman et al., Osmundsen et al. (2018b) argue that the definition should not include *process* or *business model* because these two concepts lean more towards digitalization and digital transformation.

Osmundsen et al. (2018b) found many commonalities between the existing definitions, such as digital innovation being perceived as something new that builds on digital technology. They also agree that innovation can be both an outcome and a process, but to get a clearer understanding of the concept they created two definitions for digital innovation based on both Yoo et al. (2010) and Fichman et al. (2014):

Digital innovation (outcome): *"A novel product or service that creates new value for adopters, developed by combining digital technology in new ways or with physical components."*

Digital innovation (process): "*Combining digital technology in new ways or with physical components, to develop a novel product or service that creates new value for adopters*."

3.1.3 Digital transformation

Emerging technologies such as big data analytics, internet of things, cloud technology and social media, are adopted by organizations to improve their daily operations. This has transformational impacts that change the way organizations conduct business (Morakanyane et al., 2017). Digital transformation is a term that is often used to describe these types of changes, but a clear and generally accepted definition is yet to be determined. Some authors claim that digital transformation is just another term for digitalization (Henriette, Feki, & Boughzala, 2015), but the more common view in existing studies is that digital transformation goes beyond this and needs its own definition (Morakanyane et al., 2017).

Gregory Vial (2019) looked at 28 different definitions in his literature review, *Understanding digital transformation: A review and a research agenda,* and found 23 different interpretations. His criticism to the existing definitions is primarily about the use of unclear terms such as *digital technologies*, *circularity* and *conflation* between the concept and its impacts. He compiled a new suggestion which he based on recommended rules and guidelines for creation of conceptual definitions (Vial, 2019). His definition is listed in Table 1. Vial believes that his definition has three strengths compared to other definitions. First, he includes other forms of entities such as society and industries, not only organizations. Second, he emphasizes that improvement is not necessarily a guarantee, but an expected outcome. Third, he deliberately avoids the use of unclear terms.

Definition	Author(s)	Year
A process that aims to improve an entity by triggering significant changes to its properties through combinations of information, computing, communication, and connectivity technologies.	Vial	2019
An evolutionary process that leverages digital capabilities and technologies to enable business models, operational processes and customer experiences to create value.	Morakayane et al.	2017
When digitalization or digital innovation over time lead to significant changes to how business is conducted, leading to a major transformation of an organization or an entire industry.	Osmundsen et al.	2019

Table 1: Definitions – Digital Transformation

Morakanyane, Grace and O'Reilly (2017) conducted a similar literature review and developed a concept centric matrix[2] in order to construct a general definition of digital transformation. By looking at different definitions from different authors, they found a common pattern in the structure of digital transformation definitions. Based on this pattern, they proposed the following general structure of the definition:

"... something with certain characteristics; that is driven by something; to create certain impacts; on certain aspects of the organization"

Morakanyane et al. (2017) looked into the different parts of this general structure; *characteristics, drivers, impacts* and *transformed areas*, and found great inconsistencies in existing literature. After alternating different keywords and several iterations, Morakanyane et al. (2017) constructed a definition based on the general structure, see Table 1. Regarding characteristics, they argue that *an evolutionary process* is a more fitting term than other terms such as *radical change*, because digital transformation evolves with time.

Further, they identify digital technologies and capabilities as the two main drivers for digital transformation. Most authors agree that digital technology is the main driver (Osmundsen et al., 2018b), but Morakanyane et al. (2017) argue that digital capabilities is an equally valuable driver. They define digital capabilities as *"technology skills possessed or required by*

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[2] A literature review-method used to synthesize retrieved articles (Morakanyane et al., 2017)

employees, customers and other stakeholders in different areas that can enable the organization to thrive in a digital environment". Digital capabilities such as culture, strategy and digitally savvy human capital is necessary in order to benefit from new digital technology and enable a digital transformation (Morakanyane et al., 2017).

The impacts of digital transformation vary among the different understandings, but keywords that recur are operational efficiency, competitive advantage, improved relationships and value creation. Morakanyane et al. (2017) contend that the ultimate impact the organizations want to leverage on digital transformation is value creation, this variable is therefore included in their definition.

Last, Morakanyane et al. (2017) looked at which areas that are impacted by digital transformation. Some definitions focus on the organization and others on relationships, but Morakayane et al. (2017) argue that a digital transformation has an impact on both the organization and the customers. This is in line with Westerman et al. (2014) who suggest that digital transformation takes place in three key areas of the firm; customer experience, operational processes and business models. Morakayane et al. (2017) chose to build on these three key areas in their definition.

Osmundsen, Iden and Bygstad (2018b) also suggest a definition for digital transformation. They found that several researches have the same conceptual idea about digital transformation and that it implies a major organizational change that is driven by new technology and altering how business is conducted. Osmundsen et al. (2018b), like Morakanyane et al. (2017) , also address which areas that are impacted by digital transformation and they agree that a digital transformation affects more than just the organization itself. Osmundsen et al. (2018b) especially focus on the industry aspect, beside the organization, and include this in their definition.

Even though all three definitions vary in terms of some keywords and variables, they have several similarities and have the same conceptual idea of digital transformation. They agree that it is a process that happens over time and that leads to changes for the organization, customers and/or the entire industry. Since Osmundsen et al. (2018b) have created three general definitions for all the three terms discussed above, moving forward we will use their definitions regarding *digitalization*, *digital innovation* and *digital transformation*.

3.1.4 Conceptual model

Osmundsen, Iden and Bygstad (2018b) created a conceptual model that illustrates the differences and the linkages between digitalization, digital innovation and digital transformation. Figure 3 demonstrates how the different concepts are connected. Digitization is the technical component that is required in order to get digitalization *(a)* and digital innovation *(b)*. Further, digital innovation can lead to digitalization if individuals absorb the digital innovation *(c)*. Finally, digitalization and digital innovation can lead to digital transformation if it enables major changes to how business is conducted *(d & e)*.
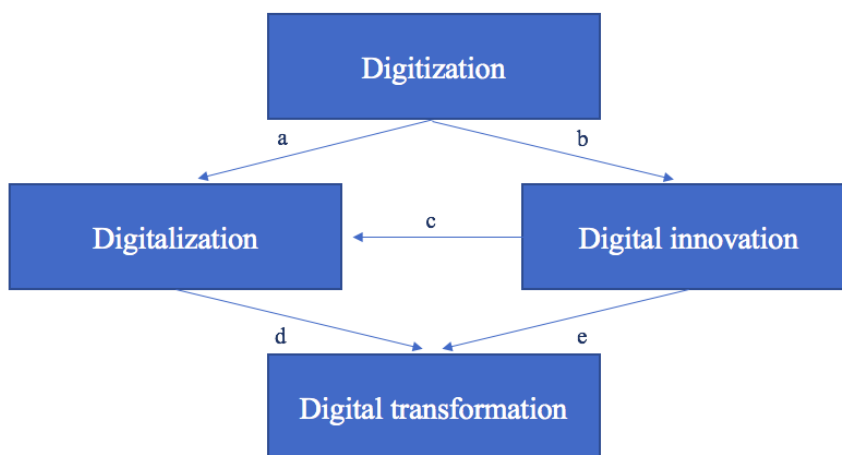
Figure 3: Conceptual Model (Osmundsen et al., 2018b)

3.2 Organizations and digital transformation

The following section examines the relationship between digital transformation and organizational structures. First, we discuss how organizations can be structured and possible drivers of organizational change. Second, a framework concerning digital maturity is presented and discussed. Last, research on Norwegian organizations and their level of digital maturity will be elaborated on.

3.2.1 Organizational structure

An organization can be structured in many ways. The structure is often concerned with the combination of activities a firm is involved in, and how they divide its labor into distinct tasks (Mintzberg, 1979) . Then, the activities and tasks are coordinated in the most suitable manner to achieve the overall business objective (Salaman, 2005). One can look at organizational maps and structures, but in complex organizations this will only provide a simplified overview of the organizational design. Organizational structures are usually described in an organic form, and as an intangible web of relationships between tasks and people (Cole, 2005). Organizational structures can be influenced by a number of factors such as technology, size, environmental changes, strategy and culture (Salaman, 2005). In organizations, senior management is often allocated the work of adapting and designing the structure to meet changing requirements (Cole, 2005). Thus, one can recognize that organizations are flexible and that internal and external factors influence the workings of an organization. Organizational change can be described as the process by which an organization redesigns its current structure and culture to achieve a desired future state, and hopefully increase effectiveness (Jones, 2013). Nonetheless, as they mature over time, companies often develop certain patterns of behavior also referred to as company culture (Salaman, 2005).

3.2.2 Organizations and digital maturity

Organizational change or restructuring could be a strategic choice, and one influencing factor to this choice could be digitalization. According to Kuusisto (2017) digitalization will be most effective when associated processes and working habits are changed. They need to align and accommodate possible efficiency gains enabled by digitalization. Furthermore, Kuusisto (2017) argues that simply shifting equivalent processes from paper-to-digital based does not mean the firm will become more efficient. Indicating that current business structures need to evolve to capitalize on a digital transformation.

According to a report by Fitzgerald, Kruschwitz, Bonnet and Welch (2014), responding quickly and effectively to new technologies is vital for business survival. They argue that effective management in a digital transformation process is already creating winners and losers in the business environment. Especially in terms of important measurements such as profits and market shares. To categorize organizations in terms of how far they have come on their digital journey, Capgemini and MIT Centre for Digital Business have developed a digital

maturity framework presented in Figure 4 (Fitzgerald et al., 2014). They identified four categories based on two variables; *transformation management* and *digital intensity*. Transformation management involves creating the leadership capabilities required to drive digital transformation in the company, while digital intensity is a firms investments in digital technologies and how far essential process have been digitalized (Capgemini, n.d.).
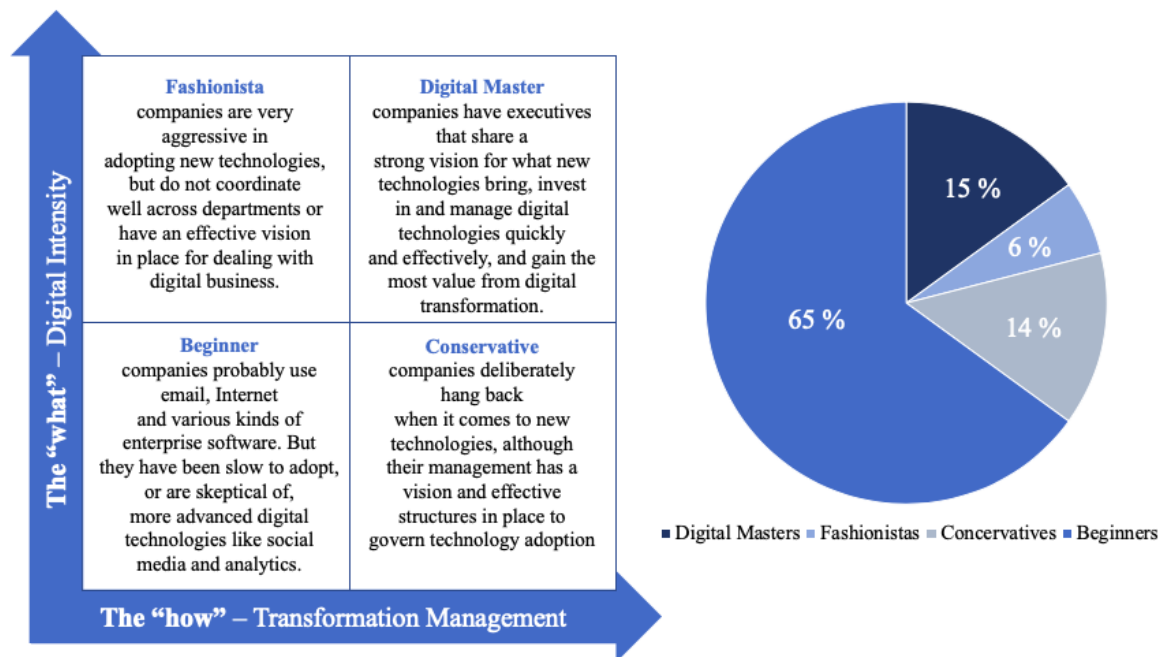
Figure 4: Digital maturity matrix (Fitzgerald et al., 2014)

Figure 4 indicates that 65 percent of the companies in Fitzgerald et al.'s (2014) research are beginners. The *beginners* are companies that have evolved from analog to digital technologies and have digitized part of their processes (Fitzgerald et al., 2014). However, they are slow to adopt more advanced digital technologies. *Conservative* companies are deliberately slow when it comes to using digital technologies, but have a vision and strategy in place to govern technology adoption (Fitzgerald et al., 2014). *Fashionistas* on the other hand are aggressive in using new technologies, but the effort is not coordinated on a managerial level. *Digital masters* have developed a strong vision and strategy and gain the most value possible from a digital transformation (Fitzgerald et al., 2014).

Even though this research was conducted in 2014, one can still argue that the results are applicable to 2019. According to Visma Digital Index 2018, Norwegian companies and leaders are not taking advantage of the possibilities digitalization presents (Austlid, 2018). This is further confirmed by a survey conducted by Sannes and Andersen (2017). They found that in

comparison to Asian and American organizations, Norwegian leaders spend much less time discussing digitalization, and they outsource the technology issue to the IT department (Sannes & Andersen, 2017). Further, Norwegian companies use their IT budgets to sustain old IT systems rather than developing new ones. Conversely, the majority of Norwegian companies believe that they are digital masters. The lack of self-knowledge and willingness to innovate in an increasingly global business environment are threatening Norwegian companies (Austlid, 2018).

3.3 The IT department and digital transformation

In this section we explore the role of the IT department and IT alignment in organizations. The relationship between the IT department and the rest of the business is interesting to look at in regard to a digital transformation. Some argue that this transformation process has increased the importance of IT, but also transformed the role and demands of the IT functions (Urbach et al., 2019). Firms arguably need to alter their IT department to best support a digital transformation, which can be done in different ways.

3.3.1 The IT department

Within established organizations, IT is generally understood as the technology and its management needed to maintain and employ Information Systems (IS) (Haffke et al., 2016) The IT department is usually led by a Chief Information Officer (CIO). In the 1970s the main use of IT was for accounting and number crunching purposes and the focus of the IT unit was maintenance (Langer, 2013). Moving into the 80s the Personal Computer (PC) was introduced, which evolved the role of the IT department (IBM, 2019a). According to Langer (2013) IT executives tended to discard the PC as a sustainable solution and did not see it as a business tool. However, moving into the 90s distributed computing[3] became the new normal. The new technologies allowed for a widespread expansion of IT throughout the organization. In the early 2000s the internet revolution changed the working environment for the IT department, and this has continued until today.

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[3] *"A distributed computer system consists of multiple software components that are on multiple computers, but run as a single system"* (IBM, 2019b).

IT outsourcing is also an established practice where organizations hand over various IT activities to a third party (Rajaeian, Cater-Steel, & Lane, 2017). The decision to outsource IT can be motivated by different factors such as cost reduction, access to external expertise and innovation and flexibility (Rajaeian et al., 2017). Organizations also need to consider what to outsource of their IT activities which entails management implications (Willcocks & Lacity, 2012).

The integration between the IT department and the rest of the organization is often considered ineffective (Langer, 2013; Yeow, Soh, & Hansen, 2018). This issue was already raised by Peppard and Ward in 1999. They argue that senior management are persistently dissatisfied with the perceived value the IT department should create, in comparison to the actual investment (Peppard & Ward, 1999). Further, they argue that the IT department's place in an organizational structure creates a gap between the IT department and the rest of the business. This creates information silos instead of a more agile and effective structure (Zeid, 2014).

Today, many argue that the IT department needs to make substantial changes in how they manage and deliver IT services in line with the new digital area we are living in (Horlach, Drews, & Schirmer, 2016). The traditional organization of the IT department today is procedurally and structurally unprepared to contribute in a significant way in a digital transformation (Urbach et al., 2019). As mentioned, the main focus and setup of traditional IT departments has been to act as pure service providers, with no devoted innovation skills. Subsequently, many CIOs or IT executives see their role as uncertain in today's changing digital environment, and are unsure of how they should approach a digital transformation (Urbach et al., 2019)

3.3.2 Organization of the IT department

Companies see the value and potential of using digital technologies to transform their business. However, executives are not certain of how to get results from such investments (Fitzgerald et al., 2014). Digitalization has increased the importance of IT, but also transformed the role and demands of the IT functions (Urbach et al., 2019). Companies see that they need to incorporate digital technologies in its business strategy, change work routines, structures and rethink their business models (Legner et al., 2017). Many discussions among professionals are evolving around how the IT department best can support and enable a digital transformation and deliver business value.

Bimodal IT

According to Haffke, Kalgovas and Benalian (2017) organizations demand more agility and innovation from the IT department in the digital business context. To meet these demands and get effective support from IT in a digitalization process the concept of bimodal IT has surfaced. Gartner defines bimodal IT in the following way: *"Bimodal IT is the practice of managing two separate but coherent styles of work – one focused on predictability (Mode 1) and the other on exploration (Mode 2)"* (Gartner, 2019).

BIMODAL IT

	Mode 1: Traditional IT	Mode 2: Digital IT
Goal	*Stability*	*Agility and speed*
Culture	*IT centric*	*Business-centric*
Customer proximity	*Remote from customer*	*Close to customer*
Trigger	*Performance and security improvement*	*Short term market trends*
Value	*Performance of services*	*Business moments, customer branding*
Focus of services	*Security and liability*	*Innovation*
Approach	*Waterfall development*	*Iterative, agile development*
Applications	*System of records*	*Systems of enegagement*
Speed of service delivery	*Slow*	*Fast*

Table 2: Mode 1 versus mode 2 (Horlach et al., 2016)

The IT department can arguably better support companies' ability to develop digital capabilities through bimodal IT (Horlach et al., 2016). Mode one is still focusing on traditional IT governance with emphasis on delivering safe and reliable IT solutions, whereas mode two is focusing on agility and innovation. Table 2 indicates the differences between the two modes in terms of their main objectives. The traditional mode uses a sequential or waterfall development approach towards IT projects which enables a risk-averse culture (Haffke et al., 2017). Mode two applies an explorative and iterative project management, which is intended to facilitate innovation.

The IT department needs to keep track of the IT function's traditional objectives while concurrently developing innovative capabilities. Even though the topic of bimodal IT was introduced by Gartner several years ago, and many companies have applied the concept, there are no consensus on how to best implement IT bimodality, and this area needs further research (Horlach et al., 2016).

There are conflicting views on bimodal IT, not only on how to implement it, but the concept itself. According to Boulton (2017) bimodal IT is already dead, and he argues that most CIOs

now see that all IT related functions need to work as mode two; fast. Bimodal IT is also described as destructive for firms, as they maintain the culture of organization silos. Simply adding an additional mode to the IT department only creates more silos, and hinders a digital transformation and alignment between IT and the rest of the business (Horlach et al., 2016). Another aspect of the critique is the possible rivalry between the two modes. This can cause non-cooperation and tension in the IT function (Bloomberg, 2015). Based on these factors, some researchers only see bimodal IT as a temporary solution for pursuing a digital transformation (Bloomberg, 2015).

Heavyweight IT and lightweight IT

The fast-changing technological environment and the change of traditional knowledge regimes are altering the IT function (Bygstad & Iden, 2017). Considering these shifts, Bygstad and Iden have introduced the concept of heavyweight IT and lightweight IT. Table 3 indicates the main differences between the two IT functions. Heavyweight IT is regarded as the traditional IT function and lightweight IT can be characterized by innovation and experimentation, and usually takes place outside of the IT department. This concept is driven by the consumerization of digital technologies and the increasing use and need of innovative IT services, such as phone apps (Bygstad & Iden, 2017).

	Heavyweight IT	Lightweight IT
Profile	*Back-end: Supporting documentation of work*	*Front-end: Supporting work processes*
Owner	*IT department*	*Users and vendors*
Systems	*Transaction systems*	*Process supports, apps, BI*
Technology	*PCs, servers, databases, integration technology*	*Tablets, electronic whiteboards, mobile phones*
IT architecture	*Fully integrates solutions, centralised or distributed*	*Non-invasive solutions, frequently meshworks*
Development culture	*Systematics, quality, security*	*Innovation, experimentation*
Problems	*Increasing compelxity, rising costs*	*Isolated gadgets, security*
Discourse	*Software engineerng*	*Business and practice innovation*

Table 3: Heavyweight IT versus Lightweight IT (Bygstad, 2017)

Successful lightweight IT projects is not only related to the IT department, but is something that evolves the whole organization and often third parties. Firms can avoid more silos, and see that innovation can take place across all departments. The backdrop of this solution is that it can be difficult to control and manage, and not become part of an organization's holistic digital strategy.

Bygstad and Iden (2017) have created a governance framework to manage lightweight IT. The framework has two central dimensions; *control* and *resources*. The control dimension involves efforts taken to govern lightweight IT, such as developing guidelines and standards. The resource dimension is to secure and facilitate resources for digitalization. While the measures within the two dimensions in practice can be implemented to varying degrees the framework is constructed with high versus low ideal types. This creates the matrix represented in Figure 5.

Figure 5: Governance framework (Bygstad & Iden, 2017)

Through Bygstad and Iden's (2017) work they identified four governance models. In the *central control* model lightweight IT is governed by the section for heavyweight IT. This management model is characterized by a high degree of control where lightweight IT initiatives are managed, evaluated and controlled according to the same principles as heavyweight IT. The *bimodal model* is the same in Bygstad and Idens's framework as the one described by Gartner previously in the thesis. Further, in the *laissesz-faire* model the development of lightweight IT is democratized and everyone in the firm can take part in the process. This strategy of managing lightweight IT involves both low control and resources. Last, the *platform model* includes a deliberate allocation of responsibilities and tasks between light- and heavyweight IT. The central IT department has the responsibility to stimulate and support initiatives within the lightweight IT responsibility. Heavyweight IT is used as a platform where third parties are given the opportunity to connect and offer lightweight IT solutions. This strategy is characterized by low control and high resource usage.

Based on the findings from Bygstad and Iden's (2017) case study of health institutions in Norway they present the consequences of applying the four governance models. They find that lightweight IT is too different to be part of the same governance and control as heavyweight IT. This principle is not catered to by the central control model with a high degree of control. This model provide secure and well-integrated solutions, but innovation is inhibited. This is unfortunate as innovation is the greatest attribution to lightweight IT according to Bygstad and Iden (2017). In the bimodal solution there is also a high degree of control, but with increased use of resources and a clear division of labor the disadvantages are minimized.

The two existing models with low control preserve innovation, but have their own challenges. With low control and resources the laissez-faire model has issues with maintaining quality and security standards of new developments. The platform model's advantages with high access to resources and third party solutions drive innovation. Nonetheless, the loose coupling and interaction with third parties makes it challenging to maintain data protection and security.

The framework provides organizations with a possible way to manage the relationship and interaction between heavyweight IT and lightweight IT. Bygstad and Iden (2017) recognize that the governance models are contingent. Organizations do not have to use the same governance model for all initiatives and the models can easily be combined (Bygstad & Iden, 2017).

3.4 Leadership in the digital age

To tackle the trials organizations are facing with information silos, IT alignment and other obstacles in a digital transformation process, the CDO role has emerged during recent years. The transformation of key business operations is challenging the established management concepts and firms need to create new practices to govern a complex digital transformation (Matt, Hess, & Benlian, 2015).

3.4.1 The CDO role

A digital transformation is as mentioned associated with immense challenges and a CEO or other chief-level (c-level) directors will have a hard time managing the process in addition to their original obligations (Singh & Hess, 2017). Thus, many companies have established a new managerial role called CDO. This title was introduced as a trendy new description a few

years ago and there are an increasing number of CDOs appearing in the global business environment (Folkestad, 2019). PwC's (2019) most recent *Chief Digital Officer Study* found that of the world's 2500 largest public companies 21 percent have a designated executive to manage a digital strategy. In 2015, the number was only six percent. According to a study conducted by PwC (2017) they found that only 10 percent of Norwegian organizations have hired a dedicated CDO. Further, they argue that the trend in Norway is to distribute the responsibility for digitalization across the whole firm.

Defining and understanding the scope of the CDO role is not straightforward. Research is conducted on the topic, but as businesses have different opinions of the role there is no clear consensus about the role and its function. However, one can observe similarities of how the role is referred to. According to Singh and Hess (2017) the CDO coordinates the digital transformation of the firm. This includes developing and executing a dedicated digital strategy in line with top management. Further, the CDO is responsible for cross-functional collaboration and has a wider role than the other c-level managers. This is to incorporate and mobilize the whole organization across hierarchy levels to engage in the digital transformation (Singh & Hess, 2017). The next section will explore the different roles of a CDO.

3.4.2 CDO: Role-types

Although the overall objective of a CDO may be to strategically transform an organization digitally, different businesses require different approaches and different types of CDOs (Curran et al., 2016). One size does not fit all. In order to succeed with the digital transformation a company must choose a CDO that best fits with the company's strategic goal and business model (Curran et al., 2016). Existing literature addresses different CDO role-types, but classification of various roles differs between studies.

Curran et al. (2016) from PwC's global team *Strategy&,* wrote a report about different types of CDOs based on their experience with different organizations and projects. As listed in Table 4, they found five main CDO archetypes. The intention with the archetypes is not to describe a specific CDO that any company should hire, the point is rather that each company should mix the right proportions in order to find an appropriate CDO for their company.

ARCHETYPES OF A CDO

Name		Characteristics	Suitable for
	The progressive thinker	Thinks imaginatively about how to transform the business through digitization. Typically focus on digital strategy and innovation.	*Industrial companies*
	The creative disrupter	Hands-on approach to the continuous development of new digital technologies and business models and solutions.	*Publishing, retail*
	The customer advocate	Focuses on the development of a convenient, engaging, and seamless customer experience using design thinking across all channels, digital and physical.	*Retail, banking, travel*
	The innovative technologist	Promotes the use of new digital technologies to transform the company's entire value chain. Works within industry boundaries.	*Manufacturing industries*
	The universalist	The mission is typically to manage all aspects, and all value- creation levers, of a complete digital transformation.	*All companies that have fallen behind in their efforts to adapt to the digital world.*

Table 4: Archetypes of a CDO (Curran et al., 2016)

Haffke, Kalgovas and Benlian (2016) also identify different roles for a CDO. They interviewed and investigated 19 companies about the CDO role and found four distinct CDO role-types. In order to identify these four roles, they looked at whether the CIO had a strong supply-side focus or demand-side focus. In addition, they also looked at the implications of digitization perceived by the organizations. The four roles identified are called the digital innovator, the digital evangelist, the digitization coordinator and the digital advocate (Haffke et al., 2016).

The digital innovator: This type of CDO works close with CIOs that typically have a supply-side focus and complement them with IT demand-side leadership. They run innovations labs and foster innovative mindsets. In addition, they follow the market trends closely and look out for new innovations that can be suitable for the business.

The digital evangelist: This CDO has focus on and highlights the possible opportunities and threats of digitization and educates the organization on digital topics. An important characteristic with this CDO role is to foster cultural change and prepare the corporation as a whole that a digital change is unavoidable.

The digitization coordinator: This CDO has a type of orchestration function and the main task is to coordinate and align digitization initiatives across the firm. It is also the CDO's task to ensure that a common digital vision is pursued by all divisions of the firm and to try to foster cross-functional collaboration.

The digital advocate: This CDO acts as a liaison between business functions and the CIO. This can be an advantage for the CIO because the CDO can act as an advocate for IT topics at the top management level. This CDO works closely with both business and IT to identify relevant digital needs and to ensure that the IT strategy aligns with the digital business strategy.

Another research conducted by Singh and Hess (2017) shows similar results as Haffke et al (2016). They identified three role-types. In accordance with Haffke et al (2016) they identified the digital evangelist and coordinator role, but they named the third role in their research *the entrepreneur role*. However, this role has many similarities with Haffke and colleagues' *digital innovator role*. According to Singh and Hess (2017) this CDO role explores innovations and helps the organization to innovate through the use of new digital technologies. The entrepreneur role also initiates changes and points the way in a fast-paced technological environment. Due to the many similarities between the mentioned theories, we have chosen to base the further analysis on Haffke et al.'s four CDO roles.

Which role the CDO should play in a specific business, depends on several factors (Singh & Hess, 2017). First, the digital transformation maturity of the company will have something to say, for example does the company quickly and efficiently manage new technologies or have they fallen behind in their effort to adapt? The digital mindset of the workforce and the size of the company will also affect which role the CDO must take on. Last, an important factor is the reporting relationship of the CDO and how much influence the CDO has within the company.

3.4.3 The need for a CDO

The emergence of the CDO role is fairly new. However, it appears to add traction in the global business environment. Nonetheless, does every enterprise need a CDO to orchestrate its digital transformation? Singh and Hess (2017) and Haffke et al. (2016) have considered multiple firms, and there are two clear factors they agree on when considering implementing a CDO.

First, the external pressure of digitalization is important to consider. New market entrants with disruptive business models, and changes in customer needs and behavior will pressure established companies. The intensity and speed of the external pressure decides the need for an exclusive role designed to drive digital innovation. Second, internal factors can affect the need for a CDO. Previous experiences with digitalization proposals, company size and culture, governance models and structures are aspects worth considering (Haffke et al., 2016). The complexity of coordinating an organization and its digital transformation process is therefore vital to analyze for organizations. Thus, one can argue that the benefit of a CDO is greater when the pressure from external and internal factors are present (Singh & Hess, 2017).

4. Research method

This chapter presents the methods used to answer the research question. The first part addresses the chosen research approach and design, while the second and third part explains how the data was collected and analyzed.

4.1 Research design

The first step in formulating the research design is to choose between a quantitative, qualitative or mixed methods research design. The research design is an overall plan for the research project that contains information about which data to collect, how to collect it and how to analyse it. The main difference between quantitative and qualitative research is how the data is collected. Quantitative research is expressed through numeric data, while qualitative methods use non-numeric data. Qualitative research is an appropriate method when the objective is to make sense of a phenomenon based on subjective and socially constructed meanings (Saunders, Lewis, & Thornhill, 2016). Since our goal was to study how Norwegian grid companies meet and manage a digital transformation, it was most appropriate for us to collect non-numerical data. Thus, a qualitative research design was the best fit.

Our research has an inductive outlook, which means that we started off by collecting data and then constructed a theory or hypothesis based on what we found. In contrary, a deductive approach means that you design a research strategy to test a specific theory (Saunders et al., 2016). The process of using the two approaches is not mutually exclusive as both share some common elements, but the inductive approach focuses more on exploring existing theories. An inductive approach often gives the best insight combined with a qualitative design (Dudovskiy, n.d.).

A research project will either have an exploratory, descriptive, explanatory or evaluative purpose. An exploratory research is usually used when you study problems that are not clearly defined yet (Saunders et al., 2016). The goal of this kind of research is not necessarily to provide a final and conclusive answer, but rather to explore the research topic. Our study has an exploratory purpose since we sought to gain insight about a specific topic. One of the advantages with this type of research is that it is adaptable to change. When new data and insight appear it can be necessary to change the direction of the research (Saunders et al.,

2016). This was appropriate for us as we went further into the study and got a better understanding of the research concept.

4.2 Data collection

4.2.1 Interview as a research method

One of the most common methods of collecting data in a qualitative research is by conducting research interviews. The objective of doing interviews is to collect valuable and reliable data that can help answer the research question. The biggest advantage of using interview as a research method is that you, as the interviewer, can ask for detailed information and are able to control the flow of the process and clarify issues which at first seem unclear (Saunders et al., 2016). Since interviews were our main source of data, it was crucial that the quality and execution of the them were as good as possible.

There are several ways to conduct and design an interview. One option is to make the interview highly formalised and structured, while on the other hand it can be done completely unstructured. A semi-structured interview is something in between these two opposites and is normally characterized by key-questions and a list of themes to be covered. Unlike a structured interview you have more freedom to vary the order of questions and to encourage an open discussion in a semi-structured interview (Saunders et al., 2016). This kind of interview is particularly useful in qualitative and explorative research such as we conducted, because it is well suited to understand the relationship between variables and to get the interviewee's interpretation of the phenomenon that is being studied.

4.2.2 Interview preperations

Selection of interview objects

To answer the research question we contacted the 10 largest Norwegian DSOs. One of the reasons behind this exact number was as mentioned in section 1.3 that the 10 largest DSOs in Norway (in terms of grid capital) account for 60 percent of the total grid capital in Norway (Heien et al., 2018). However, only seven of the 10 largest DSOs could find the time to contribute to our study and will thus be included. From a methodological aspect conducting more than a certain number of interviews will not necessarily provide more insightful data and may only be repetitive (Johannessen, Tufte, & Christoffersen, 2016). There are different

opinions when it comes to the number of informants researchers should interview. Thomas and Polio believe that a suitable sample size for examining a phenomenon is between six and 12 persons (Gubrium, Holstein, Marvasti, & McKinney, 2012). Based on this, we consider that a sample size consisting of seven DSOs is sufficient to provide valuable insight on the topic.

More precisely we intended to interview central individuals in each of the selected companies, with a job description connected to digitalization or digital transformation. The reason we did not specify the exact role of the potential interviewees was due to the fact that we did not know if the DSOs would have a dedicated role to manage a digital transformation process. To find relevant interviewees we started off by conducting a Google search of each firm combined with the words *Chief Digital Officer*, *digitalization* or *digital transformation*. By doing this, we found relevant articles mentioning employees with a role in relation to these terms. In addition to this, we used LinkedIn to find individuals with a fitting job description.

After doing the preparatory search we contacted the potential interview objects either per e-mail or on LinkedIn, and gave a brief introduction of ourselves and our research. From an ethical stance, we wanted to assure that the participants were well informed before agreeing to contribute to our research. When the selected candidates responded they typically either agreed that they were the right point of contact, or directed us to a co-worker they thought had more insight on the topic. We believe that this sample size and selection of interview objects provided us with valuable and reliable information on the topic.

To protect the participants and their firms we chose to keep their information anonymous. All corporate names and personal names have been replaced with pseudonyms and is instead represented as company A to G, seen in Table 5, throughout the whole paper. However, to get an idea of the size of the firms, information about the number of customers and employees are provided. Table 5 presents the final list of all participants.

Company	Role	Customers	Employees
A	CIO	<100.000	<200
B	Head of IT and Security	100.000 - 200.000	200 - 300
C	CIO	100.000 - 200.000	<200
D	CIO	> 200.000	>300
E	Digital Advisor - System Operations	> 200.000	>300
F	Business ICT	<100.000	200 - 300
G	Department Manager Smart Grid	100.000 - 200.000	>300

Table 5: Interview objects

Interview guide

Before one can start executing the interviews, some preparations are necessary. The most important part is to construct a good and carefully thought out interview guide. An interview guide is a manuscript that structures the interview. For semi-structured interviews, the guide normally consists of some overall themes and key questions. An interview guide is important because it gives the interview direction and purpose (Saunders et al., 2016).

We chose to derive the themes for our interview guide from the literature and ended up with three main categories: digital maturity, organization of the IT department and the CDO role. Further, we developed some open questions related to each category that could be helpful in regard to answering the research question. We also thought about different follow-up questions that could be used to obtain greater understanding and more details. Lastly, we made sure that our questions were organized in a logical order so that the interview would feel more like a comfortable conservation rather than a strict interview and that the participants would feel encouraged to speak openly about each category. The interview guide can be viewed in its entirety in appendix 1.

Before each interview, we read any available information about the organization and about the person that was going to be interviewed. This could be anything from articles in newspapers to brief job descriptions. We did this because our level of knowledge could contribute to higher credibility and possibly encourage the participant to offer more detailed accounts of the different categories.

4.2.3 Interview execution

The interviews were conducted during March and April 2019, and lasted from 30 minutes to one hour. The interviewees were familiar with the thesis and the purpose of the interview prior to the process. Due to the widespread geographical locations of the DSOs we decided to do both face-to-face interviews and interviews via Skype. Face-to-face interviews might provide a more natural environment; however, we did not feel that the Skype interviews compromised the data from the informants.

We started each interview by asking for consent to record the audio and making sure that the interviewee understood that their participation was voluntary and that they had the right to withdraw their consent at any time. It was important to consider the ethical stance from the start of the interview (Saunders et al., 2016). All participants agreed to be recorded, and this contributed to a more natural and relaxed situation where we were able to listen and engage in the conversation. During the interview both of us asked question. We divided the questions between us prior to the interview to avoid confusion. The first half of the interview was directed by one researcher while the second half was managed by the other researcher. However, both researchers asked follow-up questions during the whole interview where this was necessary.

The interviews were initiated by asking the interviewee to describe their role, previous work experience and educational background. The next part of the interviews included questions related to the three main topics; digital maturity, organization of the IT department and the CDO role. Throughout the interviews, we asked open and non-leading follow-up questions. We also emphasised that we wanted a natural and dynamic conversation, rather than a static discussion. This to achieve the most natural answers and flow in the conversation. Finally, we asked if there were anything else they wanted to include. We experienced that our questions were answered and that the interviewees were very engaged in the topic.

4.3 Data analysis

Transcribing was chosen to process the collected data. Transcription of the interview records started immediately after each specific interview was conducted. This was done to avoid difficulties in remembering the context things were said and discussed. According to Kvale and Brinkmann (2009) there are multiple aspects one has to be aware of when transcribing,

such as difficulties with writing verbal language. By transcribing the interviews the same day we hoped to avoid this pitfall. To ensure that we did not affect the results with our preconceived opinions, we transcribed the whole interview and not just what we initially thought would be interesting to analyse.

After the transcription was finalized we started to analyse the data. We realised the need to use a systematic analytical method to process and secure credible interpretations of the collected data. Gioia, Coreley and Hamilton (2012) and other authors have over the past 20 years developed and refined an approach to conduct qualitative analysis and interpretation. Their method is based on initial data coding using informant-centric terms, referred to as 1st order analysis. Further, 2nd order analysis is done by using researcher-centric themes (Gioia et al., 2012). When the 1st order concepts and 2nd order themes are structured, they lay the basis for creating aggregate dimensions. Gioia et al (2012) have also developed a graphic representation of the data structure. They argue that this systematic approach, reporting both the informant's and researchers' voices, have proven useful to demonstrate thoroughness and to gain insight from qualitative data. We found that this methodology would be suitable for further analysis.

The 1st order analysis was done by coding the transcribed interviews. Both researchers coded one interview each and then discussed the initial surfaced codes. From this we compiled the codes and continued using these when coding the rest of the interviews. Our interpretations were similar, but where there were differences we went back and revisited the data to discuss the material until arriving at consensual interpretations. Based on the 1st order concepts we developed the 2nd order themes. This was done by identifying repetitive and similar codes which developed into the themes. From this we arrived at three aggregate dimensions. These three dimensions were the same as the interview categories which were anticipated. We used Excel to get a systematic overview of the data material. The 1st order concepts were categorised under each aggregate dimension and from this we created Pivot tables to keep track of the quotes and from what company they arrived from. A sample of the 1st order concepts, 2nd order themes and aggregate dimensions are graphically represented in a data structure disclosed in appendix 2.

4.3.1 Assessment of the data quality

Validity

Validity refers to the extent to which one can draw valid conclusions based on the results of the study (Saunders et al., 2016). In the assessment of the validity of the interviews we observed one main issue. This is related to us being first time interviewers. The lack of experience can compromise the quality of the data as we might not obtain the needed information to answer the research question. Further, problems related to misunderstandings between the interviewees and the interviewers could occur as questions can be misinterpreted. However, we felt that these weaknesses were minimized. We conducted a test interview using the finalized interview guide and made sure that the questions were understandable to outsiders. In addition to this, we asked follow-up questions to be assured that the interviewee correctly understood the questions.

Reliability

A key characteristic of a research with good quality is reliability. Reliability says something about the consistency of the study and whether the study can be replicated and achieve the same findings (Saunders et al., 2016). Internal reliability is about consistency during the research period and we felt that we achieved this to a great extent by being two researchers on the project. By being two persons, we were able to follow up on each other and to secure consistency during the interviews and the following analysis. External reliability refers to whether the techniques we used to collect data and analyse it would produce the same findings if they were replicated by other researches or repeated by us on a later occasion (Saunders et al., 2016).

Researcher error and bias are possible threats to both internal and external reliability, but we felt that we did everything to minimize these threats (Saunders et al., 2016). As mentioned earlier, we constructed the questions with caution and made sure that we did not lead the interviewee in a specific direction. We were also very aware of not to let our own subjective view come in the way during the interviews and in the later transcription and analysis.

Possible threats to our research project, that was harder for us to control, were participant error and bias. We cannot be absolutely sure that the interviewees answered completely honest on all questions. False response can even happen unconsciously because it is natural to want to represent yourself and the company in a better light (Saunders et al., 2016). However, we got

the impression that most of our participants spoke freely about both the ups and downs they had experienced, and that they had little reason to not be honest due to the monopoly situation and the high degree of cooperation among companies in this industry.

There is also a possibility that other representatives from the different companies would have answered the questions differently than what our interviewees did. Everyone has his own perception of the reality and can possibly emphasize different aspects of the themes and questions asked. Nonetheless, strong preparations and investigation made us confident that the selected interviewees were in the right position and had insight on the topics. Thus, they were able to provide good and informed answers on behalf of the company.

Transparency

Another important factor to consider is transparency. All findings should be transparent and the reader should be able to understand how the processing and analysis of the data led to the conclusions. According to Tjora (2012) a thesis needs to be embedded in relevant research. Interviews and other oral sources are less transparent than written sources. To secure the paper's transparency we have included the list of participants, the interview guide and information about which methods we used while collecting the data and in the analysis. In addition, the analysis is based on the theoretical foundation presented in section three. By doing this we can account for and justify the interpretations we have done.

5. Findings

Based on the interviews and the following analysis we have discovered interesting findings on how the DSOs meet and manage the digital transformation. The findings are presented in three chapters corresponding with the aggregate dimensions of the data structure; digital maturity, organization of the IT department and the CDO role. Furthermore, we found it appropriate to review and link the findings to the theory from chapter three in order to ensure a clear overview of the findings. We have also included illustrative quotations to substantiate the findings and to better explain the complex concepts we have encountered along the way.

5.1 Digital maturity

From the analysis we discovered three central aspects in regard to digital maturity which will be accentuated. The main aspects are presented under the headings; drivers, challenges and actions. This is to provide a clear overview of the many aspects discovered while analyzing the data material.

5.1.1 Drivers

The DSOs have been operating in a very stable environment with few changes for many years. Several comments have described the industry as old and sturdy. However, during the data collection and analysis, it became apparent that all informants agree that the industry has been, and still is, going through great changes.

> *During the last three to four years, more has happened in the electric power industry than in the previous 100 years, especially on the digital side […] It has been very stable in this industry and all of a sudden everything is changing – C*

> *The industry has changed a lot the last three years and especially the last two years. There has been a huge focus on digitalization, and on the fact that firms need to do something […] it is a maturity process. The whole industry will see that they need to do something – F*

Further explanation behind the reasoning of the shift in the industry was discussed. The DSOs highlighted different drivers or reasons to the recent changes. We see that the DSOs describe

a relative complex business environment where multiple drivers are affecting the traditional structure.

First, one of the drivers is governmental regulations, such as legal and functional unbundling. As discussed previously in the thesis, there has been a substantial decline in the number of operating DSOs in Norway. This seems to be an ongoing trend in the industry based on information given by the interviewees. Two out of the seven DSOs interviewed are currently in the process of finalizing a merger process. Other DSOs also indicated that there are possibilities of other mergers taking place in the near future.

> *In relation to these structural changes, that the companies need to legally and functionally unbundle, it will be quite hard for the smaller companies to stand alone and to keep costs down at a competitive level – E*

> *A lot of changes are happening now and it is very important that the industry is paying attention, but the authorities also need to keep up to create and provide good conditions from the regulator* [NVE] *– G*

Second, another driver mentioned by the DSOs is increased competition. This can be new market entrants providing energy storage solutions and other technologies such as solar power. However, according to the informants this seems to be something that will affect the industry in the long term. They point out that due to Norway's weather conditions with rough winters, technology such as solar power is not advanced enough yet to be a replacement of traditional electricity supply.

> *With the competition that is taking place now, yes, it is important that the DSOs are aware that changes are happening. We need to adapt and pay attention to the occurring changes so we stay relevant for the future. But we just have to be part of the change.* [The changes] *may come as they come – G*

When asked specifically about competition such as microgrids and battery storage solutions and their potential disruption on the industry the DSOs seem to be aware of these trends.

> *Yes, I think so in the long term. But it is not going to happen quickly. However, in the long term it will probably hit the Norwegian market, there is no doubt about it - B*

Third, increased profitability and efficiency are drivers mentioned by the DSOs. They see that investments and efforts towards digital solutions and processes can provide economic benefits. Many of the DSOs have experienced increased operating costs. Even though they are monopolists they are being measured on efficiency and have incentives to become more efficient. The DSOs compare their industry with the banking industry, which the informants argue is much more digitally driven and has been able to cut operating costs due to that.

> *The whole industry sees the need to do something. You can compare it to the banking industry, they experienced increasing operating costs, and needed more and more people to complete their work tasks and that is not sustainable – F*

> [The main driver] *is that we see that this can give us great economic advantages […] we see that this can increase our efficiency and also, in the long term, reduce the customers network tariff - C*

Fourth, new technology such as the AMS meters is described as a driver towards the shift the industry is experiencing. Our analysis finds that the DSOs have had different approaches towards the implementation of AMS. Many of the DSOs saw the opportunity to alter or change their current systems to fully take advantage of the possibilities the AMS data can provide. Whereas others of the DSOs admitted that at this point in time they are not ready to use the AMS data to the full extent. The following quotes point out some of the differences between the DSOs approaches.

> *The data has very, very high value for optimization of the company. That is why we built the platform and consolidate all data there at any time. I see that other DSOs have chosen to enter into alliances, opted to get third party companies to handle AMS data on their behalf, which in practice ensures that the consumption data ends up in the Elhub[4], but they will miss control of important data. It is not the tools that are so important, but it is the control and access to the data that is critical – D*

> *When it comes to using data from the AMS meters, I will say that we are not very early. It has more to do with the general IT architecture and how it has been built previously.*

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[4] Elhub is a neutral data hub that handles data and market processes in the Norwegian power market (Elhub, 2019).

We need to structure the IT architecture before we start to create too many new integrations – G

Q: Has something specific been done to take advantage of the AMS data?
A: No, not yet. […] but we are working on it – B

5.1.2 Challenges

Any industry facing a digital transformation will arguably experience challenges and this seems to be the situation for the Norwegian DSOs as well. The interviewees emphasised two main challenges in regard to what we presented and defined as digital transformation.

The first challenge the DSOs accentuate is the integration of old IT infrastructure and architecture with new technological solutions. They provided multiple examples of how and why this is time consuming and acts as a hinder for a digital transformation. However, in this context some of the DSOs pointed out that the technology itself is not the issue. A bigger problem is to have the right skills and competencies, and have the ability to act on the changes.

The old core systems that cannot be integrated are one of the biggest challenges. There are a lot of stand-alone silo solutions where some integrations are possible, but not to the full extent. You do not reach the end goal and end up with a halfway solution – F

Further, the DSOs highlight different reasons to why the integration has become an issue. There is not one single cause to the problem. Some mention the structure and culture of the industry, where others point out issues with standardization and suppliers.

The company has been showing signs of previously having good access to money, I've said it since I started here. You could always find a budget to expense your investment need. So we have ended up with three to four systems which more or less do the same – B

There is little standardization when it comes to the integration section. So every time a system from one supplier meets a system from a second supplier they have different interfaces and the systems have been set up differently […] We should be done spending time on these issues and rather use our time to create value instead – A

Second, cultural issues and management of change were something several of the companies described as challenging. Changing an organization's culture is often described as one of the most difficult leadership challenges and the DSOs seem to agree to this statement (Jahanian & Salehi, 2013). Several of the informants spent quite some time discussing this challenge.

> *Technology is quite kind. It follows rules, does as you say, and behaves pretty well. People on the other hand are more complex. That's just how it is […] It's the building of culture that takes a shockingly long time. I thought we should have reached our goal much earlier, it just takes a lot of time – D*

> *The biggest challenge with the transformation we are experiencing […] everything is really evolving around people ultimately – E*

> *One of the challenges is the tendency of silo thinking in the company and the "we work the way we always have done"- mentality – C*

DSO A argued that due to their size and structure they did not struggle with this challenge.

> *We are fewer employees than some of the other companies. It takes longer to change the big organizations. We are more dynamic and flexible – A*

5.1.3 Actions

The DSOs are certainly aware of their changing business environment and they have conducted different actions to meet the digital transformation. Three main actions have been identified; collaboration, organizational adjustments and strategic choices. There are undoubtedly more specific efforts put in by the DSOs to meet a digital transformation. However, due to the scope of this thesis we decided to focus on these three main actions.

First, the nature of the DSOs being monopolists and not direct competitors foster an atmosphere of collaboration which the DSOs pointed out.

> *We are not competitors in a sense, other than the fact that we are measured on efficiency […] collaboration in the industry will be central – E*

There are several research and development (R&D) projects taking place and all of the seven DSOs are part of one or more R&D projects. The interviewees experience the industry as open and willing to share when it comes to the use of new technologies.

There is a lot of collaboration across the grid companies. If one company has created a good solution or done something clever, they are often willing to share that [...]The industry is generally very open and generous, at least that's my experience – F

The DSOs mention several different R&D projects focusing on different aspects such as the use of drones for maintenance. However, three out of the seven DSOs emphasize the importance of a standardized digital data platform. Again, they compare the electric power industry to the banking and financial industry which has developed a shared platform. According to the DSOs the banks are 10 years ahead when it comes to digital solutions.

Today, every company works too much on their own projects and use their resources on that. So we don't manage to build a common platform for the industry. If we look at the banking and financial industry they have managed to create a common platform to a much greater extent. The banks use the same system and share a common IT infrastructure. It says something about the maturity – A

However, some informants point out that this is something the industry is just starting to collaborate on.

Second, the DSOs are making organizational adjustments to meet the digital transformation the industry is experiencing. We find that the firms are making changes to their organizations, but they seem to be in a transition period and it is hard to say if the changes made will be successful in the long term. Especially the IT departments in the DSOs have been restructured which will purposely be presented in section 5.2.2.

What we are building up now is how we want to structure the effort to work more digitally. There is a huge focus on business management and we are building portfolios which will concern different things [...] Things will change already this summer, but the organizational chart will change to some extent continuously in regard to changes and our strategy – E

Third, our analysis looks at how the DSOs incorporate digitalization into their business strategy or if they have a separate digital strategy. Only one of the seven DSOs have a separate digital strategy. However, this DSO is currently working on incorporating this into the overall business strategy. We can therefore say that none of them will have this in the near future. The

DSOs say that the digital focus needs to be incorporated into all aspects of the organization and it is therefore part of the overall strategy.

It is part of the business strategy. So we don't have a separate digital strategy or IT strategy, we never had that. It is embedded in the business strategy – B

We have a business strategy, which involves us being digital and that is a very important part of it. But it's not a separate strategy. We believe that the digital aspect should be invoked in everything – D

I think having a separate digital strategy is a "trend" thing. This was something you did a year or two ago. Today, the digital part should be part of the overall strategy, a part of the corporation – E

5.1.4 Digital maturity of the DSOs

This section reviews and outlines the most compelling findings and presents the DSOs digital maturity level using Capgemini and MIT's digital maturity model.

Our main finding concerning the digital maturity of the DSOs is that most of the DSOs are in an early stage of a transition period and are trying to find the best approach to capitalize on a digital transformation. There are many actions taking place to try to transform the industry, such as R&D projects. There seem to be a lot of initiatives which are positive, but the DSOs report that these have not been coordinated and it seems to be somewhat random what is being initiated. Further, this might be a result of how the energy industry as a whole operated previously when they had wider and more flexible budgets. One DSO described previous times in the energy industry as having a "try and fail" mentality of buying and testing new technology without being very critical. According to Capgemini and MIT's model this description fits well with the fashionista role where firms are very aggressive in adopting new technology, but it is not well coordinated.

The electric power industry seems to have evolved from this strategy even though some DSOs point out the need to coordinate R&D efforts more systematically. Several DSOs report the need to take a step backwards to work with a fundamental standardized data platform similar to the one in the banking and financial industry. The banking and financial industry has worked on a collective IT platform and experienced a digital boost (Alt, Beck, & Smits, 2018). This

will give a lift for every single DSO and will possibly be a stepping stone for further development of the industry.

We have attempted to place the individual DSOs in Capgemini and MIT's maturity matrix (Figure 6). The placement is based on the information given by the informants during the interviews. We asked direct and indirect questions related to strategic choices (transformation management) and how quick they consider themselves to implement new technology (digital intensity). Our analysis of the companies reflections on drivers, challenges and what actions they have in place lay the foundation for the placement of the DSOs. According to Capgemini (n.d.) the utility industry is placed in the conservative box in their matrix. The conservative role is characterized as an organization where the administration has an image and effective structures in place to govern technology adoption, but the firm is deliberately slow to adopt new technology. Based on our analysis we would place the majority of the DSOs in the same box. The DSOs are positively trying to prepare and change their organizational structure to take advantage of new digital technologies. Some of the DSOs are quick to adopt new technology, where others mention that they are not in a position or willing to be the leading DSO in the industry when it comes to using new technologies. Even though the DSOs have different approaches to tackle the changing circumstances in the industry we see that their maturity levels are comparable. The small variances in categorization are based on the overall analysis of the information gathered on the companies.
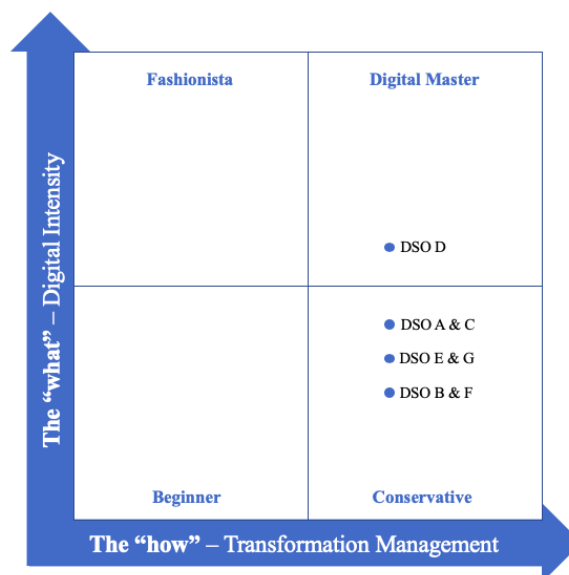

Figure 6: Digital maturity of the DSOs

DSO D that stands out, and we consider this company to be a digital master (see Figure 6). DSO D has a digital mindset and have organized themselves in a progressive way to meet the digital transformation. Managerial decisions were taken at an early stage to be able to take advantage of the potential a digital transformation brings. They have also focused on digitalizing essential and core processes which will make it easier to implement new technology at a later stage.

> *We* [the IT department] *have gone against our established business structure and that was challenging, but needed [...]Luckily, the CEO backed this a 100 percent, if not, we would never have been able to make the changes – D*

Further, DSO D has made substantial investments to alter their IT infrastructure to take advantage of the AMS data and other new technologies. This was a decision that the whole organization saw as necessary, not just the IT department.

> *Ensuring interaction between development and technology is quite obviously a very important task. It's interdisciplinary teams that should drive innovation. So if we put technologists together with very forward looking engineers, something magical happens. That's where we really try to create innovation. It's a shared responsibility, an interdisciplinary responsibility – D*

The innovation responsibility lies within every department of company D. However, it seems to be well managed by the CIO. DSO D's IT department is not focusing on traditional IT, but acts as a business driven department supporting innovation throughout the company.

5.2 Organization of the IT department

This second section addresses the findings about how the DSOs organize their IT department. It also includes an overview on how the organization of the IT departments has developed over time and the results related to IT's main tasks and responsibilities are presented. Last, we review the findings in the light of the theory about bimodal IT and heavyweight/lightweight IT.

5.2.1 Structure of the IT department

As presented in the theory chapter there are many ways to organize an IT department. During a digital transformation one could argue that the role of the IT department gets bigger and more important, so we wanted to find out how the DSOs solve this issue. As the theory suggested we found that the DSOs organize their IT department in different ways, but we were able to extract some similarities among the companies.

Every DSO has some IT people in their organization, but an important finding is that the size of the IT department tends to be quite small. Out of the seven DSOs, four said that the IT department consists of two to four persons. One reason for this seems to be that a lot of them rely on the support from a bigger IT department in the parent company.

> *We buy a good deal of IT services from the parent company - E*

> *We do not have a large IT department in our company, but we rely heavily on the competence of the parent company – C*

> *Yes, we are only two who work in the IT department, but there are many other resources in company A that work with IT and IT projects, but then from the business areas - A*

> *Yes, you look at him now. I am our IT department – C*

Another reason for the small IT departments is that every DSO outsources a majority of the traditional IT operations. Some of them even outsource tasks related to development and innovation.

> *The philosophy of company C is that we should use the market – C*

> *IT operations are outsourced. So we have a framework agreement with a company that operates the IT systems - G*

> *When we insourced, we did not insource IT operations that run networks and servers and computers and phones and such things, we do not have these people here, we buy this out in the market – D*

> *Developer resources are also among the services we outsource – B*

DSO E reports that they do not have an IT department, but the parent company does. However, DSO E has IT employees who are located in different divisions of the company.

> *No, we don't have our own IT department, but we do have IT people – E*

In addition to an IT department, five out of seven of the DSOs have a second department or division that works directly towards innovation and digitalization. These departments have different names such as *smart grid*, *analysis department* and *division for development*, but the content seems to be quite similar. The workforce in these departments consists of many people with IT background.

> *We have a separate unit, Division for development. In that department we have data scientists, we have BI people, we have the expertise that can use the data – E*
>
> *The Analysis department is a separate division, it is not under IT – C*
>
> *We have a separate unit called Business development - G*

Based on our findings and the similarities, we have created an outline (Figure 7) that show how IT is built up and represented in most of the DSOs.
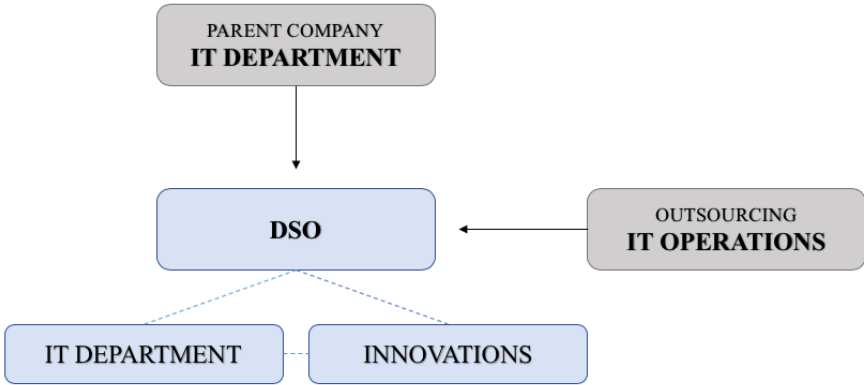

Figure 7: Outline of the organization of the IT department

5.2.2 Restructuring

During the interviews and work with the analysis we discovered that several DSOs have restructured their IT department the last couple of years. The biggest change is, as mentioned in the last section, that most of the DSOs have created a separate department, or a division under the IT department that focuses on innovation and digitalization. There are strategic reasons for why some of the DSOs have created these separate departments and not included them in the IT department. The main reason among the companies is that they would like these departments to be business driven, not IT driven.

We created a separate section for analysis just over 1.5 years ago – C

We do not think that our IT department should do what IT was doing before, they should not spend time on operations, infrastructure, servers and such things, so we simply outsourced it – D

It was a strategic choice to create the Strategy and Analysis department as a separate department, in order to be able to work across all departments and not necessarily be so strongly related to IT - C

In connection with the establishment of these departments, the DSOs have employed new people with new and more modern IT expertise such as data scientists, developers and machine learning experts.

There has been a change. We have brought in more people with IT expertise into our company – G

In the grid company we have in a way rigged ourselves into getting these IT people who can use the data, then I think of business intelligence, data scientists etc, it is quite new - E

What we also have done is that we have just employed a data scientist – C

5.2.3 Role: IT department

After discussing the organization of the IT department with the DSOs, a natural subject became what they think of the department's role in a digital transformation. Everyone agreed that the IT department's role is evolving. Previously, IT has been seen as an individual section with no or little direct connection to the rest of the organization. Today, the DSOs argue that the IT department needs to be business driven.

> *I think that the IT department is not an IT department. It is a business development unit. A very close advisor to the business on how to use new technology and its limitation – D*

> *We think that IT needs to support the most important business processes – A*

DSO B also highlighted that they have assigned a strategic role to the IT department. The department needs to be a strategic partner to the rest of the business during the digital transformation.

> *We made a decision were we said that IT is and will be a strategic tool to achieve the goals the company has set for itself - B*

As mentioned in the previous finding sections concerning the IT department, the attitudes and structure of the DSOs IT departments are changing and evolving. The DSOs all agree that the role of the IT department is changing.

5.2.4 IT approaches

The analysis of the IT departments and how the DSOs have organized themselves to meet a digital transformation has revealed three approaches; Bimodal approach, IT department and a separate innovation department, and no IT department, but a separate innovation department (see Table 6).

Company	IT and innovation structure
A	Bimodal approach
B	Bimodal approach
C	IT department and separate innovation deparment
D	Bimodal approach
E	No IT departement - separate innovation department
F	Bimodal approach
G	IT department and separate innovation department

Table 6: IT and innovation structure

The first group of DSOs (A, B, D, F) which have organized their innovation work under the IT department can be seen in relation to Gartner's (2019) bimodal structure presented in chapter three. When discussing this approach with the DSOs they did not necessarily call it bimodal IT, but agreed that their method was similar to the bimodal definition. Thus, we see that the IT department needs to keep track of the IT function's traditional objectives while concurrently developing innovative capabilities. Bimodal IT is seen as a temporary solution by some researchers and participate to upheld the issues with silos. However, as mode one focusing on traditional IT is outsourced to a great extent in the DSOs, their IT resources' main focus is mode two, innovation and agility. Given the size of the DSOs it is understandable that they have chosen to organize their innovation work this way. Further, even though the DSOs are organized this way they are very aware of the need to be business driven and not simply IT driven. They explain that the innovation responsibility lies with the whole organization and that their role is to play a supportive and initiating role.

Bygstad and Iden (2017) are also skeptical of the bimodal method as they argue that innovation initiatives should ideally be organized outside of the IT department. However, during the work with their governance models they recognized that bimodality can be successful and purposeful as there is a division of labor between lightweight IT and heavyweight IT.

The remaining DSOs (C, E, G) have managed their innovation efforts (lightweight IT/mode two) as a separate department, disconnected from the IT department (if any). This is more in line with Bygstad and Iden's platform governance model. Where the bimodal model assumes that lightweight IT is subordinate to the heavyweight regime, the platform model makes it possible to have looser connections. The design principle of having loose organizational links will hopefully make innovation thrive (Bygstad, 2017). However, both the bimodal model and

the platform model fulfill Bygstad and Iden's ideal structure as there is a division of labor between heavyweight IT and lightweight IT.

The bimodal approach might make it easier for the DSOs to control lightweight IT initiatives/innovation. This can be purposeful in the early stage of transformation, and in light of the many issues of integration of old and new technology the DSOs are currently facing. Simply developing new lightweight IT solutions can be problematic without close communication with the heavyweight IT section. On the other hand, a looser organizational link between heavyweight IT and lightweight IT divisions might make innovation initiatives move at a faster pace.

5.3 The CDO role

The third and last aggregated dimension from the data structure was the CDO role. The following section presents the main findings related to this role in the Norwegian DSOs and compares the findings to Haffke et al.'s (2016) theory about different CDO roles and PwC's CDO study from 2019.

5.3.1 Do the DSOs have a CDO?

One of the most central issues related to the research question was whether the DSOs have established a CDO role in their company. What we found was that the answer to this issue was not as straightforward as first anticipated. Our main finding regarding this was that the CDO role has different meanings and definitions in the different companies, and none of them have organized the CDO role in the exact same way. However, based on the interviews and organizational charts we were able to identify three ways the DSOs mainly organize the CDO role.

None of the interviewed companies had a role that was titled CDO directly, but three of them had a person in charge of handling a digital transformation and with duties equivalent to what a CDO would have. The official titles for the persons interviewed from company A, D and F that we argue in practice also act as CDOs, are respectively CIOs and Business-ICT[5].

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[5] Business – Information and Communications Technology (ICT)

I have a combined role. I started with digitalization and was the leader for that department, I didn't have that title Chief Digital Officer, but I was the head of digitalization. Now I am the leader of IT, but I still have the same responsibility for digitalization – A

I am probably more of a CDO than a CIO if you look at the role description – D

We do not call it a CDO, we call it business ICT. We started with this before the CDO role was all hyped up – F

A different strategy used by three of the companies is that they have employed a CDO in the parent company. Beside this person's responsibility for all the subsidiaries' digital development, the DSOs themselves also have a responsibility to ensure progress with digitalization. All three companies in this group said that this responsibility is split between different people and departments within the company. On the question of who is responsible for the digital transformation, the companies answered the following:

I think that in relation to the digital transformation, it is a collaboration between the two divisions, Development and System Operations – E

It lies a certain responsibility on me [CIO] *and not least on the department leader for the department Network Strategy and Analysis – C*

The last DSO (G) did not have a CDO or a specific person that clearly had the overall responsibility for a digital transformation. However, it should be mentioned that this company has different roles and departments that work directly towards digitalization and innovation. The interviewee stated that the reason for why they do not have a CDO is that the responsibility should not be put on just one person.

The responsibility lies in the organization, not on a single person – G

Everyone in the company is responsible for ensuring that we have the most efficient tools – G

As mentioned in the theory chapter, PwC (2017) found when they examined the CDO role in Norwegian companies that there is a trend in Norway that the responsibility for handling a

digital transformation is distributed through the whole company. It was therefore slightly surprising that we in our analysis found this to be true for just one of the DSOs.

Singh and Hess' (2017) theory about the need for CDOs could possible explain why we see that most of the DSOs have established a CDO role in their company or have a CDO in the parent company. The DSOs themselves explained that the culture in the organization poses a challenge and neither do they have much experience with handling a digital transformation. Both of these factors are what Singh and Hess call internal pressure. In addition, as mentioned in chapter two the industry is facing increased external pressure from new competitors and more demand side participation. One can argue that the DSOs are exposed to so much internal and external pressure, that they believe a CDO is necessary.

Company	CDO approach
A	CDO in DSO
B	CDO in parent company
C	CDO in parent company
D	CDO in DSO
E	CDO in parent company
F	CDO in DSO
G	No CDO

Table 7: CDO approaches

5.3.2 What role does the CDO have?

Another important aspect of the interview was to map out how the CDOs work, figure out what their main responsibilities are and their position in the organization. Since there were three companies with a CDO-role the main focus will be on them, but we also take notice on how the CDO in the parent companies and the people with digitalization responsibility work in the other companies.

The first important finding in this category is that the CDOs in the companies and the parent companies have as main task to ensure collaboration and coordinate all departments in their work with digitalization and the digital transformation. When asked about the main responsibility of the CDO, the following topics were brought to light:

Ensuring collaboration in the company around development and technology, it is quite obvious an important task, a very defined task – D

Having the overall overview over the business and all business processes, from bottom-up and top-down. That's the job – F

Second, many of the interviewees mentioned that the CDO and other people responsible for handling a digital transformation is included in the management group of the company and/or the parenting company.

I am in the top management group. This is an important step in getting what we are working on right into the top management level – D

When I was employed five years ago, it was the first time the company employed an IT manager who was a member of the management group of the grid company – B

When we look closer at the CDO's tasks and responsibilities we find many similarities that can be linked to Haffke et al.'s (2016) theory about CDO roles. Haffke et al (2016) identified four different CDO roles; the evangelist, the innovator, the coordinator and the advocate. We recognized many components from Haffke et al.'s different roles when interviewing the DSOs. However, it was nearly impossible to categorize each CDO strictly within one of the four roles. Every CDO has some mix of capabilities from the different roles.

The two roles that were best represented among our interviewees were the coordinator role and the advocate role. On the question related to the CDO's main responsibility, the most common answer was to have the overall overview and to ensure digital progress throughout the whole company. In addition they talked a lot about cross-functional collaboration which also is a characteristic for the coordinator role.

Regarding the advocate role, since all of the three CDOs are part of the top management group of the company, they can work as a liaison between IT, business functions and the management. Several DSOs mentioned this as an intentional strategic choice to ensure IT involvement at the highest managerial level. The CDOs in the parent companies also play this role since they can argue for the needs of the subsidiaries in the top management group of the parent company.

The CDOs also mentioned that they have a certain responsibility when it comes to innovation and to be updated on the newest technology that can be suitable for the business. However, many of them emphasized that this responsibility lies on everyone in the organization. The innovator component is therefore not the most important capability for the CDOs in the DSOs. Some of the CDOs also described elements that fit well with the evangelist role. Their focus on cultural changes and preparing the organization for a digital transformation are main characteristics for this role.

To which extent each role is represented in the CDOs varies from CDO to CDO. However, we see the same main features among most of the CDOs we have interviewed. They are first and foremost a coordinator and an advocate, but with a certain responsibility for tasks connected to the innovator and evangelist.

5.3.3 Educational background

Since the CDO role is a relatively new role we were interested in finding out what kind of education and background the DSOs think that a CDO should have. This was a question answered with great consensus among our interviewees. They all emphasized the importance of a strategical background and abilities, and many of them believed that technical skills are not necessarily required.

> *The point is that you have to win the support and trust of the people in the organization and you have to be able to sell the solutions. It is a much greater requirement than that you are good at technology. You must be able to explain technology to those who are not so good at it – F*

> *You don't have to be technological at all, I think it's almost a strength not to be, because then you focus more on the other things that I think are more difficult – D*

However, most of them agreed that an interest in technology and the ability to see opportunities is an advantage in this role.

> *Not everyone is interested in doing something new. So it is clear you must also have enough technological background to be able to challenge those who struggle to see the benefits – C*

> *You cannot be entirely devoid of technology expertise - B*

DSO A agreed that strategical abilities are important, but was also very concerned that technology competence is important in a complex industry like the utility industry.

> *I have a very technical background and see lots of benefits from it. I think it is important. To know what is required to develop IT systems and to have an understanding of how to make the right decisions is very important - A*

We also asked the three CDOs in the grid companies about whether their background was technological or non-technological, and the result is presented in the following table:

Company	Educational background - CDO
A	Technological
D	Non - technological
F	Non - technological

Table 8: Educational background - CDO

Our findings are in line with what PwC found in their CDO study from 2019 about CDO roles, that the majority of CDOs have non-technological background (Strategy&, 2019). In 2018 the share of CDOs with non-technological background were 60 percent[6]. However, they also found that the number of CDOs with technological background has started to increase from 14 percent in 2014 to 40 percent in 2018. PwC argue that the digital transformation has moved beyond the starting point and become a central part of the core business, and that this causes the need for new skill sets among the CDOs (Strategy&, 2019).

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[6] The numbers are based on the global top 2,500 listed companies by market cap as of March 31st 2018 (Strategy&, 2019).

6. Discussion

After seven interviews and a thorough analysis of the data, we are left with many impressions and new thoughts about the electric power industry's digital transformation. It is well known that handling a digital transformation is a complex and difficult task, and one can argue that it can be solved using various methods. Our study of the Norwegian DSOs has really enlightened this aspect and showed us different approaches on how to tackle the great changes they are facing these days.

The digital maturity of the DSOs has surprised us in some ways. We originally thought that many of the DSOs were falling behind in their effort to adapt to the fast changing environment and the theory suggested that the utilities industry as a whole has a conservative approach when it comes to digital transformation. However, when we look at the different measures the DSOs have initiated we see that they may be at an early stage on the way of becoming digital masters.

The world is changing from day to day and businesses must constantly adapt. The business and governance models that work best today may not be the best choice tomorrow. It was just a couple of years ago that having a digital strategy was key, while we now see that digitalization should be incorporated in every aspect of the business and be a central part of the overall business strategy (Liferay, 2019). An interesting finding was therefore to see that all seven DSOs already have integrated the strategy in their business strategy or were in the process of doing so. The DSOs have developed a digital mindset, meaning that digitalization is on their agenda and affects the whole business. However, even though they have established managerial capabilities to tackle the digital transformation, their IT infrastructure is difficult to integrate with new technological innovations. This hinders the digital intensity and makes it difficult to implement new technical solutions immediately.

When it comes to the DSOs' organization of the IT department and innovation department it is difficult to say what is right and wrong. Some argue that the innovation departments are experiencing the same trend as the digital strategy. Some years ago the right thing to do was to establish a separate innovation department, while the new trend is to incorporate innovation in all departments (Tesseras, 2017). The supporters of the *new way* argue that by separating the innovation department you can in fact get creation of great innovations, but they will not get implemented because they are not aligned with the company's business model. They

further argue that everyone in the organization should be involved in innovation (Viki, 2016). We have observed that the DSOs solve this issue in different ways. Four of the DSOs have adopted a bimodal approach, but emphasize that innovation is the whole organization's responsibility. The remaining DSOs have a separate innovation/digitalization department. This might be expedient due to the size of the organizations and their maturity level. As we argue that the maturity level is conservative for the DSOs they could possibly need a leader fully devoted to lead the digital transformation. The leader of the innovation department (CDO) can be completely focused on creating understanding of digitalization and the possibilities of technology, to get units to work together and to bridge the gap between business and IT.

The CDO role could also be an indication on the DSOs digital maturity. PwC found that about 10 percent of Norwegian companies had a CDO in 2015, while we found this number to be over 70 percent for the DSOs we interviewed. It is natural that this number has gone up since 2015 due to the increased interest in and the need for CDOs, but it is also possible that we get this high number because of our small and carefully chosen selection of DSOs. Nonetheless, we think it is fair to conclude that some of the largest DSOs in Norway are ahead of average Norwegian companies when it comes to establishing a CDO role.

Despite these findings we are still left with a big question about the CDO role. Is a CDO necessary in order to successfully handle a digital transformation? Since the CDO role is a fairly new phenomenon and the grid companies are in the beginning of a digital transformation it is impossible to draw a definite conclusion. For large and complex organizations, a CDO could be a necessity in order to take control and coordinate the digitalization projects throughout all divisions and departments in the organization. For mid-size and smaller companies on the other hand, an additional c-role can possibly add more confusion and conflict with already existing roles. For instance if the CIO has a broad remit it can be difficult to allocate tasks and responsibility between the CIO and CDO. A solution for this can be a combined CIO and CDO role such as some DSOs already have established. Some smaller companies may not even need a CDO at all. As one DSO mentioned, it may be better to focus on driving digitalization across the entire company and not put the responsibility on one person.

The latest news related to the CDO role that is gaining foothold among several experts and business people, is that the CDO has reached its peak. PwC did a CDO study in 2019 and found that the growth in the number of CDOs is decreasing (Strategy&, 2019). They argue that the need for a CDO is getting reduced in line with digitalization becoming a more natural part of the organization (Strategy&, 2019). Even though we cannot conclude whether a CDO is necessary or not, we can argue that there are many ways to achieve a successful transformation. If this way includes a CDO, a combined CIO/CDO or not a CDO at all, depends on factors within the organization such as size, corporate culture and experience with digitalization, but also on external pressure from new competitors and customers.

6.1 Further research

We have conducted an exploratory study of how seven of the 10 largest DSOs in Norway meet and manage the digital transformation their industry is currently experiencing. Due to the scope of the thesis we decided to only focus on the largest DSOs. However, it would be interesting to see how the more than hundred other DSOs are handling the changes a digital transformation brings. By only researching the largest DSOs we have deliberately left out smaller organizations with fewer resources. It would be intriguing to see if they are putting any effort into meeting the digital transformation or expect that they sooner or later will merge with other DSOs.

Our informants specified that the transformation of a very steady industry mainly began around two-three years ago. Since the changes are fairly new, it would be interesting to compare our findings with an equivalent review in a few years. Future research can potentially uncover whether the measures taken at the time of the study have been successful and how they have further evolved.

The CDO role is something we found particularly interesting. Due to the scope of the thesis we did not manage to fully cover this role and explore the effects of the role to the full extent. Further research on the topic in relation to the electric power industry, but also in general would provide a deeper understanding of the role.

6.2 Limitations

The thesis is based on seven interviews with the largest DSOs in Norway. We believe that the information given by the informants has given us a solid basis to say how the DSOs meet and manage the digital transformation. However, we acknowledge that our study has limitations. Our sample size is carefully selected and we observe two main issues in relation to this. First, only interviewing the largest DSOs leaves out the smaller firms and we cannot say that our results are applicable to these firms as well. Second, by interviewing employees directly involved with digitalization and innovation projects their opinion could possibly provide biased answers. If we had chosen to interview other employees not directly working with the topic, we could have been left with another impression, especially in relation to the digital maturity of the organizations. Nonetheless, as the companies are monopolists and not direct competitors we feel that the informants provided us with nuanced and honest answers they might not have shared if they were more direct competitors.

Concerns are raised about the generalisability of findings from qualitative research (Saunders et al., 2016). We see that the transferability of our findings to other settings and their applicability to other contexts could be problematic. The grid companies are unique in regards to ownership structure, regulations and that they operate in a natural monopoly. This can make it difficult to directly transfer the findings to other industries. However, the grid companies as other established firms, face a number of the same challenges with a digital transformation. Thus, other established firms and industries can still benefit from insight this thesis provide. Further, the research approach itself can be transferred to others who wish to study how other companies/industries meet and manage a digital transformation.

Since the DSOs are at an early stage of their digital transformation journey we cannot conclude what will be the best way, or if they will make even greater adjustments at a later stage. However, our findings correspond with previous and current research on the topic. Examination on both IT organization and the CDO role provide no current consensus on how to best meet a digital transformation. Thus, we argue that is it not unlikely to find similar results elsewhere.

7. Conclusion

The purpose of this master thesis was to get a better understanding of how Norwegian DSOs handle the current digital transformation the electric power industry is going through. Since the digital transformation is a relatively new and unexplored phenomenon for the companies in this industry, we wanted to contribute and increase the knowledge in this area. Hence, we wanted to answer the following research question:

How do Norwegian distribution system operators (DSOs) meet and manage the digital transformation?

We found it appropriate to divide the study into three parts in order to answer the research question. These main parts were digital maturity, organization of the IT department and the CDO role. When we examined the digital maturity of the DSOs we found that they agree about the drivers for the digital transformation being new technology such as AMS meters, increased competition from microgrids and energy storage, government regulations that cause changes in the market and the desire to increase efficiency. All DSOs have initiated different actions such as R&D projects and collaborations, and all of them have incorporated the digital strategy in their overall business strategy. However, many of the DSOs have a tendency to be conservative and do not necessarily seek to be the front runner when it comes to new technology and digitalization. Only DSO D stands out and can be categorized as a digital master because of their digital mindset and focus on core processes to make integration of new technology and systems easier.

Many of the DSOs have restructured their IT department as a reaction to the digital transformation. Four DSOs have established a bimodal department where lightweight IT and heavyweight IT is managed separately, but within the IT department. The other three have separated innovation and digitalization into an exclusive department of the organization. Both approaches, according to theory, give room for innovation and are arguably smart strategical choices.

One of the main findings related to the CDO role was that the DSOs organize this role in three different ways. Three DSOs have a CDO or a person in charge for handling the digital transformation, three have employed a CDO in the parent company and only one has chosen to not establish this role and rather distributed the responsibility through the whole company.

It was also interesting to see that two of the persons acting as CDOs in the DSOs actual titles were CIO. A CDO can take different roles, but we found that the most common among our DSOs was a CDO with coordination responsibility mixed with an advocate role. As discussed earlier there are many viewpoints and opinions on how to organize the CDO role and whether this is a necessary role or not.

The purpose of this master thesis was to identify how the DSOs meet and manage a digital transformation, not necessarily to provide a recipe for how to handle it successfully. To conclude, we can say that the Norwegian DSOs are taking many direct actions in order to manage the digital transformation, including restructuring of the IT department and by establishing a CDO role. This indicates that many of the DSOs are heading towards becoming digital masters in the future. However, the road ahead is unclear and difficult to foresee so it will be interesting to see what actions and managerial decisions in the electric power industry that eventually will lead to a successful handling of the digital transformation.

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Appendix 1: Interview guide

<u>Practical information:</u>

- Ask for consent to record the interview.
- Ensure that the interviewee understands that it is voluntary to participate in the study and that they may withdraw their consent at any time.
- Briefly describe the purpose of the thesis to the interviewee.
  (same description they received on mail prior to the interview)

<u>Introduction questions:</u>

- What is your job position?
- How long have you worked in the company and in your current position?
- Can you briefly say something about your educational background and previous work experience?

<u>Category 1: Digital Maturity</u>

- What do you see as the main challenges for the grid companies in regards to a digital transformation? (Digital technologies, customers, competition, culture, expertise)
    - o What are the biggest challenges for you as a company?

- What kind of actions have you taken to address these challenges?
    - o Do you have any examples?
    - o Have you encountered any challenges along the way?

- Have you developed a digital strategy for the grid company?
  If "yes": What is the main focus in this strategy?

    Is the leader group involved in the preparation of the digital strategy?

  If "no": Is the digital strategy incorporated in the overall business strategy?

- Would you say that you as a company are quick to adopt new technologies? (e.g. the use of drones in maintenance work, the use of data from AMS etc)

<u>Category 2: Organization of the IT department</u>

- Do you (the grid company) have an IT department?
    - o How is the IT department organized?

- Have the organization of the IT department developed or changed in recent years?
    - Have you encountered any challenges related to restructuring?

- What do think about the role of the IT department in a digital transformation?

- Have you heard about the term "bimodal IT" ?
  If "no" – Briefly explain what it is

    - Is this something you recognize in the organization of your IT department?
    - Is this something you have considered using?
    - Do you see any challenges by using this "model" ?

Category 3: The CDO role

- Who is responsible for digitalization in your company? Do you have a CDO or a role similar to a *Chief Digital Officer* in the grid company?

If "yes":

- Where in the organizational chart is the CDO found?
    - Who does the CDO report to?

- How is the CDO role organized? Does he/she have a team?

- What is the CDO's role and main responsibilities?
    - Do you have any examples of projects?

- How is the cooperation between the CDO and the CIO/IT-department?
-
- How is the interaction between the CDO and the other departments in the company?

- What kind of educational background do you think a CDO should have?
    - Technological or non-technological?

If "no":

- Why have you not established this role?

- Have you considered establishing this role?

- Who has the responsibility for the digital strategy/digital development?

Appendix 2: Data structure

1st order concepts	2nd order themes	Aggregate dimensions
• A lot of changes are happening now and it is very important that the sector is paying attention, but the authorities also need to keep up to create and provide good conditions from the regulator • With the competition that is taking place now, yes, it its important that the DSOs are aware that changes are happening • The change is that we have the new AMS meters, sensor technology etc. and this is much cheaper now	Drivers	Digital Maturity
• The biggest challenge is the integration of legacy systems with new and more flexible technological solutions • The biggest challenge with the transformation we are experiencing is that it really involves people and culture	Challenges	
• There is a lot of collaboration across the grid companies. • What we are building up now is how we want to structure the effort to work more digitally • It is part of the business strategy. So we don't have a separate digital strategy or IT strategy, we never had that. It is embedded in the business strategy	Actions	
• We do not have a large IT department in our company, but we support us heavily on the competence of the parent company • Yes, we are only two who work in the IT department, but there are many other resources in company A that work with IT and IT projects, but then from the business areas	Structure	Organization of the IT department
• We do not think that our IT department should do what IT was doing before, they should not spend time on operations, infrastructure, servers and such things, so we simply outsourced it • We created a separate section for analysis just over 1.5 years ago	Restructuring	
• I think that the IT department is not an IT department. It is a business development unit. A very close advisor to the business on how to use new technology and its limitation	ITs Role	
• I am probably more of a CDO than a CIO if you look at the role description • I have a combined role. I started with digitalization and was the leader for that division, I didn't have that title Chief Digital Officer, but I was the head of digitalization. Now I am the leader of IT, but I still have the same responsibility for digitalization	CDO or not?	The CDO
• Having the overall overview over the business and all business processes, from bottom-up and top-down. That's the job • I am in the top management group. This is an important step in getting what we are working on right into the top management level	CDO role	
• You don't have to be technologically at all, I think it's almost a strength not to be, because then you focus more on the other things that I think are more difficult • You cannot be entirely devoid of technology expertise	CDO background	