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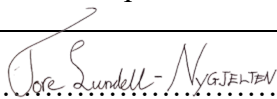
FACULTY OF SCIENCE AND TECHNOLOGY

MASTER'S THESIS

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Abstract

In today's accelerating environment, many industries have effectively used digitalization to attain control. However, digital best-practices and digital maturity vary within and across industries. After a period of financial turmoil, it has become evident that the oil and gas industry needs to undertake transformations. Utilizing digitalization, the industry has the opportunity to reshape and continue to provide value to its stakeholders.

The objective of this thesis is to investigate the current state of digitalization in the O&G sector, through a case study of Equinor, a grand Norwegian O&G company, to ultimately suggest efforts of improvements. The thesis identifies nine guidelines for effective digitalization implementation. The guidelines are presented with relevant theory, analysis, and recommendations, respectively. The thesis builds on the assumption that Equinor, and the industry at large, has great opportunities to unlock large values by improving their current digitalization strategy. To answer the objective of this thesis, two fundamental research questions were formulated:

RQ1: *What is Equinor's current digitalization strategy?*
RQ2: *What efforts can be made to improve Equinor's current digitalization strategy?*

This qualitative study answers the research questions by utilizing a semi-structured interview framework, measuring the state of the nine guidelines identified in the literature study. The findings are relatively unambiguous and indicate that Equinor is doing well compared to a lagging industry, but have growth opportunities both strategically and when it comes to administrative digitalization. Efforts to improve the current digitalization strategy were derived by analyzing the interview transcripts in relation to relevant literature. The analysis highlighted multiple root causes to Equinor's digitalization problems. Four, out of five, root causes originates from the current digitalization strategy and the analysis suggested these respective improvements:

Firstly, to tackle the current digitalization ambiguity, the meaning and impact of digitalization should be clearly stated. Secondly, insufficient collaboration can be solved by breaking up silos and creating circular collaborative ecosystems, with a focus on continuous and transparent data sharing. Thirdly, the developing digitalization governance can be accelerated by focusing on competencies like exploitativeness, project continuity, and transparency – to spread best-practice throughout the company. Finally, a clear and sustainable overarching digitalization strategy needs to be implemented, in coherence with Equinor's future digitalization objectives, combined with an emphasis to continuously manage it.

Preface

This master thesis is the concluding work of my Master of Science in Industrial Economics. This thesis was written during my final semester at the University of Stavanger, in the spring of 2019 for the Department of Safety, Economics, and Planning.
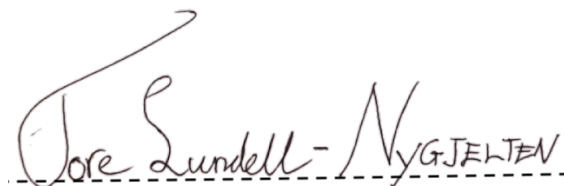
I would like to thank Tone Bruvoll for supervising this project and thesis, and assisting with enthusiasm as well as expertise. She has been a great support during plenty of meetings. I am sincerely grateful for the opportunity and your contributions!

I would also like to thank Robert Skaar, project manager at Equinor, particularly for industry context and valuable inside knowledge – I appreciate you taking the time and interest to make this thesis a reality.

Finally i would like to extend my gratifications to all the employees at Equinor who took the time to be interviewed and shared their insights.

For the readers convenience i would like to mention that that this thesis is written in LaTeX. Certain keywords are therefor possible to click on, to jump from where you are currently reading to a relevant section, figure, table, or concept description. The formatting of the PDF is also tailored to suit a book format; this is why the page numbers are on every other corner of the page, and the text is slightly shifted to one side or the other.

Stavanger, June 15, 2019

(Tore Lundell-Nygjelten)

"If we want things to stay the same, everything will have to change"

[Giuseppe Tomasi di Lampedusa,1958]

Table of Contents

List of Figures

Abbreviations and Concepts

List of Abbreviations

AI   Artificial Intelligence

CCE   Circular Collaborative Ecosystems

CEO   Chief Executive Officer

DCoE   Digital Center of Excellence

IIoT   Industrial Internet of Things

INSEAD   **Ins**titut **E**uropéen d'**Ad**ministration des Affaires

IoT   Internet of Things

ISO   International Organization for Standardization

MECE   Mutually Exclusive and Collectively Exhaustive

ML   Machine Learning

NDA   Non-Disclosure Agreement

ROV   Remotely Operated Vehicle

RPA   Robotic Process Automation

SIF   Serious Incident Frequency (measured in: million hours worked)

List of Concepts

Administrative Digitalization. The use of digital technologies to optimize administrative systems.

Center of Excellence An entity that provides best-practices, leadership, research, support and training on a subject of interest.

Digital maturity A measure of digitally transformed processes, talent engagement, and business models, in a organization.

Digital Transformation An developmental campaign a firm undertakes to increase their digital maturity.

Digitalization The use of digital technologies to change a business model and provide new revenue and value-producing opportunities.

Digitization The process of changing analog data into digital form.

Fourth Industrial Revolution(4IR) characterised by a range of new technologies that are fusing the physical, digital and biological worlds.

Virtual Coalface Where the actual digital work is done, in this paper referring to a digital change-agent's work.

Chapter 1

Introduction

Digitalization is emerging as a driver for sweeping transformation across the world. Connectivity and technology have proved its potential to empower millions of people, as well as provide unparalleled value-creating opportunities for businesses. [3]

Since the first industrial revolution, the Oil & Gas industry fuelled the economic transformation of the world. Today Equinor and the industry is facing falling crude prices and a greater demand for sustainable climate change accountability, together with a transition from the digital frontier to the whole industry lagging behind. For Equinor to redefine its boundaries, a number of challenges need to be addressed. [3]

Digitalization can act as an enabler to address these challenges and provide value to all stakeholders. However, as markets accelerate, a sea of false "best-practices" appear, making it difficult to navigate which digitalization adoption to invest in. To navigate this environment; progressively more agile business models need to be adopted; a transparent and exploitative culture needs to be cultivated; and collaboration needs to be emphasized. [12]

Digital strategy drives digital maturity. A successful digital transformation is dependent on a clear and sustainable overarching strategy. Like any strategy must the digital agenda be driven from the top. To drive a digital strategy, a leader should be competent with the latest technology and have the necessary soft-skills to drive the implementation. [13]

This thesis conducts a case study of Equinor ASA, an international energy company, with the purpose of identifying and illustrating factors that contribute to a sustainable overarching digitalization strategy for a grand oil & gas company. The thesis builds on the assumption that Equinor has great opportunities to improve the overarching strategy for digitalization.

1.1   Objectives and Limitations

The main objective of this thesis is to evaluate Equinor's current overarching strategy for digitalization and, thereafter, suggest potential improvements. Following, will the findings be investigated to see if they are applicable and can be generalized thought the oil and gas industry. This objective is based on the assumption that Equinor has great opportunities to unlock large values by improving their current digitalization strategy. Literature, public and internal documents will be examined and presented to reach this objective. Followed by a qualitative analysis, from semi-structured qualitative interviews, presented within the framework of nine guidelines.

In order to limit the scope of this thesis, two fundamental research questions will be answered:

RQ1: *What is Equinor's current digitalization strategy?*
RQ2: *What efforts can be made to improve Equinor's current digitalization strategy?*

These research questions will be answered with the use of a qualitative approach. Furthermore, will the analysis be based on semi-constructed key-personnel interviews. This methodology aims to take a snapshot of the current state at Equinor, analyze it, estimate the potential areas of improvements and ways to capitalize on them. The objective of the research is to present Equinor with potential areas of focus and growth. The author of this paper comes with an outside perspective and an interdisciplinary engineer/business degree, which will hopefully provide new valuable insights. This thesis intends to highlight areas of improvements at different levels of the organization and can be considered as a call to action.

1.2   Thesis Structure

The structure of this thesis is organized in a straightforward fashion to ensure a coherent reading. To begin with, a general introduction of the thesis, Equinor, and digitalization. Then, chapter 2 presents preliminary theory about the concepts discussed in the thesis. Next, chapter 3, presents the research- strategy, design, and method. Followed by chapter 4, that puts forward a string of relevant leadership guidelines. Each with relevant theory, analysis, and discussion, respectively, in order to lessen the scrolling between chapters and ease the reading. This framework is called thematic analysis and is favorable in qualitative research [14]. Followed by chapter 5, which discuss the quality and credibility of the thesis. Finally the conclusion chapter, chapter 6, is presented.

Introduction	Theory	Methodology	Analysis	Quality of Study	Conclusion
Chapter 1	Chapter 2	Chapter 3	Chapter 4	Chapter 5	Chapter 6

1.3   Background

To give a structured background for this thesis, are the following themes contextualized:

- Historical context

- Digitalization in Equinor

- Strategy in Equinor

Historical context

The Norwegian oil adventure started in 1969 with the discovery of Ekofisk. Equinor was founded two years later, under the name: Den Norske Stats Oljeslskap AS - Statoil, with the Norwegian state as the majority shareholder. Today, Equinor operates in over 30 countries internationally and is responsible for about 70 % of the oil and gas distribution domestically, making them the biggest company in the Nordic, in terms of revenue. [15]

In recent years, the oil and gas industry has been subject to financial turmoil. In 2013 the oil price was as high as $112, but Equinor still were subject to a negative cash flow [16]. Then in 2014, the oil price took a nosedive, to $50 at the beginning of 2015, then dipping below $30 in 2016. Nowadays, the price is

fluctuating around $70. The global market for oil and gas is notorious for having alternating market cycles. Statistically, this will not be the last downturn. Therefore, is it detrimental for the industry to capitalize on the lessons learned. [16]

Resulting from the financial turmoil was an increasing focus on cutting costs and optimizing processes. Digitalization has been favored as the solution to these problems. The O&G industry has been notorious for being state of the art in a broad spectrum of technical solutions. However, the industry is very conservative when it comes to digital solutions for administrative tasks, from now on called administrative digitalization. This conservative approach has historically been possible because of massive cash flows and hefty profit margins on projects, but this is a past luxury. [17]

Digitalization in Equinor

Digitalization has in the last years had an increasing role in Equinor, a big leap forward was the establishment of the Centre of Digital Excellence (DCoE) and the digital road map, in 2017. These initiatives made Equinor early adapters of digitalization within the industry. The center of digital excellence is supposed to act as a hub for all digitalization efforts within Equinor. The digital road map has outlined six programs that focus heavily on the operational side of the organization [18]. These initiatives will be discussed more in detail in section 4.2, where they are analyzed in relation to relevant measurables.

Equinor is ahead of a relatively lagging industry when it comes to digitalization. There plan is to maintain and advance there competitive advantage to promote their company strategy – always safe, high value, low carbon.
"At Equinor, we're investing to secure a global leadership position within digitalisation. Not because digitalisation and innovation are goals in themselves, but because digitalisation is a key enabler for our strategy." [18]

These digitalization efforts are directed towards the operational side of the organization. Equinor has historically been and is on the digital frontier when it comes to production digitalization and technical solutions offshore. However, as will be made clear throughout this thesis, Equinor is struggling when it comes to administrative digitalization. This was particularly highlighted during preliminary conversations with key personnel at Equinor. Suggesting a potential area of improvements for Equinor's digitalization strategy.

Strategy in Equinor

Equinor's grand strategy is – always safe, high value, low carbon [19]. Safety for offshore workers, the environment, and all other stakeholder are important to Equinor. It is essential for Equinor to create high value to both shareholders and stakeholder, through financial value and opportunities for society and communities. Equinor is an industry leader in carbon efficient O&G production and aims to thrive in the energy transition through growing into new energy solutions. Equinor's strategy builds upon its values *open, collaborative, courageous, and caring.* [19]

Equinor's strategic rapport identify technology innovation as critical to maintaining long-term growth through the ability to seize opportunities for digitalization. Equinor's performance would be impeded if digitalization lag behind the industry [19]. However, no clear digitalization strategy is outlined and what seems to be strategic actions (2.2) looks more like operational effectiveness than strategy (2.2).

Chapter 2

Theory

2.1 Digitalization

As illustrated in figure 2.1, the interest for digitalization has increased greatly the last decade, however as this thesis, and other studies [1, 3, 11, 12, 20, 21], reveal: the term is used inconsistently. Therefore, is it beneficial to start with a clear and proper definition of the term. In this thesis, Gartner's definition is used; they define digitalization as: "the use of digital technologies to change a business model and provide new revenue and value-producing opportunities" [22]. This definition is also adopted by Equinor [18].
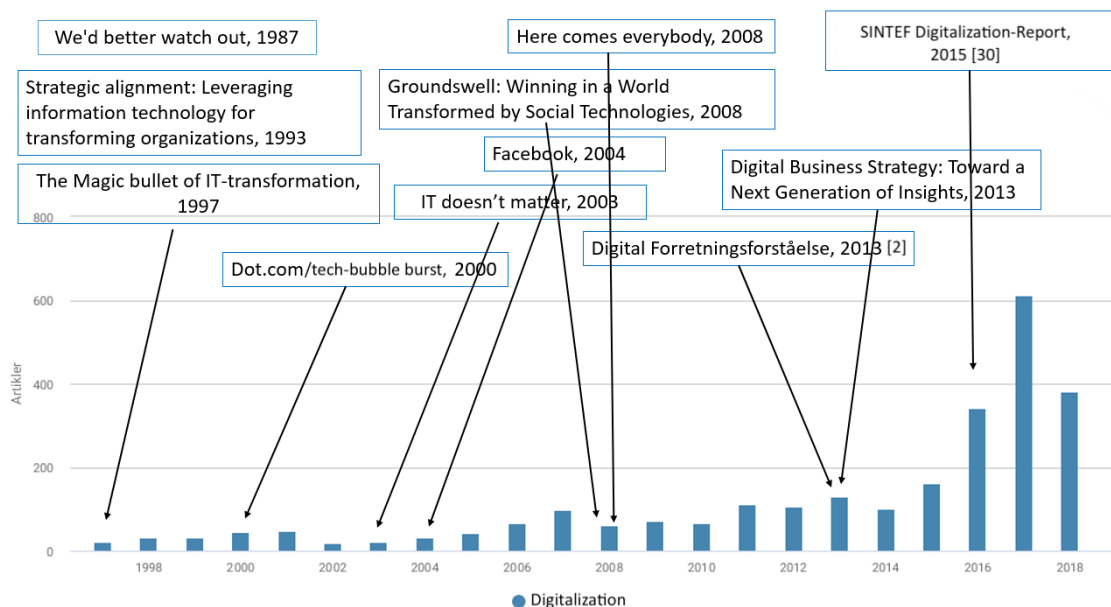
Figure 2.1: Interest of digitalization over the last decade [1].

Digitalization is allowing businesses to become increasingly more digital by both; applying technology to rethink and build new systems, processes, software and operating models; and by exploiting the convergence of things, business and people. Digitalization is increasing revenue, efficiency, and competitive advantage, by transforming business operations, and as a result: new product and service – opportunities emerge. To maintain these competitive advantages, rapid change adaptation and exploitation of novel opportunities, are paramount. Digitalization

and agility are both closely related and leading factors for competitiveness, thereby making them vital for the business and should be prioritized by executives. [23]

In order to understand why digitalization has become so important, this new systemic change is looked at in relation to prior revolutions. As mentioned in the introduction; can digitalization be defined in several ways. At the beginning of the Digital Revolution (see subsection 2.1.1) the term described the shift from mechanical and analog electronic technology to digital electronics and the adoption of computers around the 1960s. The term has also been more or less of a synonym with the concept of "digitization"; which is the process of converting information into a digital format and organized into computer-readable bits. Put in layman's terms: creating a digital version of a physical/analog thing, such as photographs, sounds, or paper documents. Our definition, however, builds on this prior thought and experience but it also looks at the implications of how advanced technologies affect today's business models. [24]

To elaborate further, is it beneficial to look at the digitalization in the context of the Fourth Industrial Revolution (4IR).

2.1.1 Fourth Industrial Revolution

The Forth Industrial Revolution was presented in the World Economic Forum Annual Meeting 2016 by Professor Klaus Schwab, founder and executive chairman of the World Economic Forum (WEF). Where: "Mastering the Fourth Industrial Revolution" was the theme of this renowned meeting, with 2,500 participants, 1,500 business leader from over 140 countries including 40 heads of state and government [25, 26].

Throughout human evolution, different abrupt and radical changes have occurred at different generations. Revolutions like these are often fueled by a new invention or a novel way of perceiving the world. Revolutions offer a profound shift in the way of living. The first industrial revolution arose from the invention of the steam engine. The second industrial revolution arose from the invention of electricity. The third industrial revolution started in the 1960s and catapulted us into the information society we live in today. This revolution is usually called the digital or computer revolution and was catalyzed by the development of semiconductors, mainframe computing (1960s), personal computing (1970-80s), and the internet (1990s). [24]
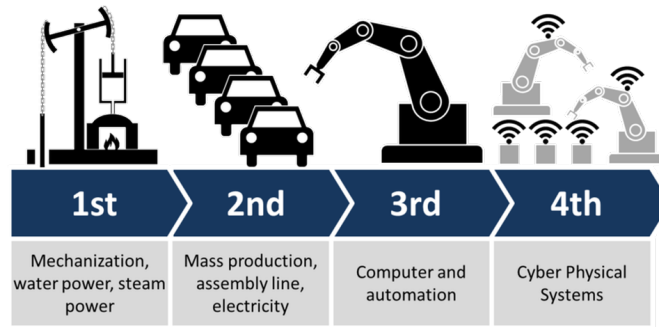
Figure 2.2: Illustration of the 4 Industrial Revolutions [1]

Building on the previously defined revolutions, many state that we, now, are at the beginning of the fourth industrial revolution. This revolution is characterized by new technologies, that melts together the physical, digital and biological into something described as *cyber-physical systems*. [1]

This conceptualization is not fundamentally new; others have tried to capture this new era in different terms. MIT Professors Erik Brynjolfsson and Andrew McAfee denoted this period as "the second machine age" in 2014 [27]. In 2011 at the Hannover Fair in Germany the term "Industry 4.0" was coined [28]. In Norway, this way of thinking is also present; it is present in the 2015 SINTEF-report titled: "Effekter av teknologiske endringer på norsk nærings- og arbeidsliv" [29]. This report discusses how humans, processes, intelligent IT-systems, and the surroundings will connect and interact in new ways.

2.1.2 Digital Transformation

Digital transformation is not the same as digitizing a routine business task. It is not about mobile apps, online sales channels, nor social media campaigns. It is much larger than that; it is about re-imagining services and products as digitally enabled assets. Digital transformation entails generating undiscovered value from the interconnection of digital and physical assets through data, data management, and the creation of digital platforms. The outcome is a fundamental change in organizational activities, processes, and business models, enabling productivity growth. [30]

This fundamental change can affect ways of working, roles, and create new business offerings caused by technology adaptation. This fundamental change affects several operation environments, but we are going to focus on the organization level, not the process, society, or business domain level. The transformation of

the organization level offers new services and disregard obsolete practices and updates existing services in new ways. This fundamental change is happening right now. [31]

MIT Sloan and Deloitte's: Digital Business Global Executive Study and research project from 2015 surveyed more than 4800 business executives [2], and found that 92% believed that digital technologies would be important in three years and 60% believed that digitalization has the potential to fundamentally transform the way work is done. Furthermore, the study estimated how well a business adapted in a digital environment and measured it by *digital maturity*. The study defines digital maturity as: "a measure of digitally transformed: processes, talent engagement, and business models in an organization" [2].
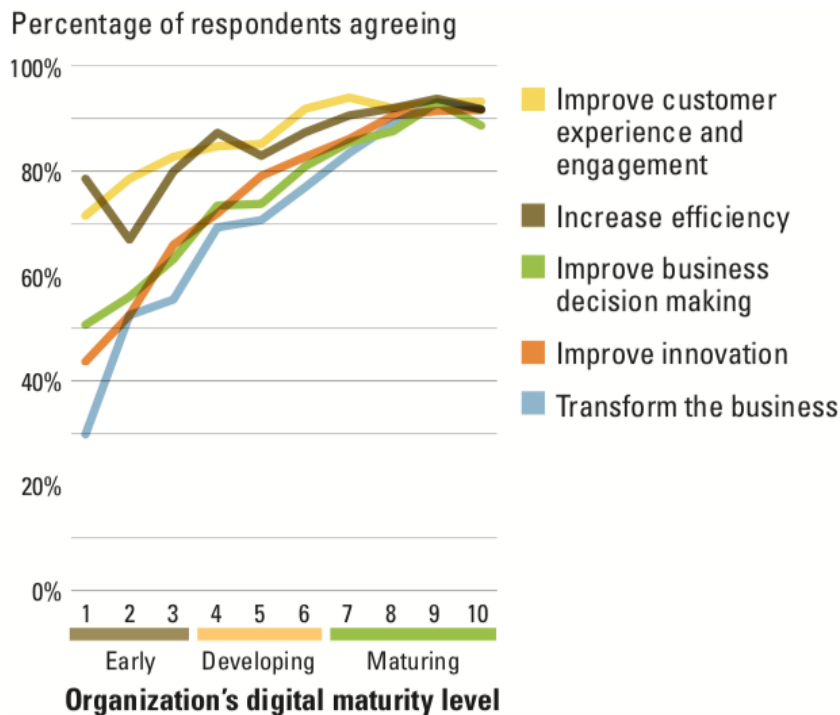
Figure 2.3: Organization objectives across digital maturity level. [2]

As seen from figure 2.3, are organizations across the board using digital to improve the customer experience and overall efficiency. However, high-maturity organizations differentiate themselves by applying digital to improve innovation and transform business, allowing for a competitive advantage. [2]

2.1.3   Digitalization in the Oil & Gas Industry

In the 1980s, the oil & gas industry was at the forefront of digital innovation and adaptation; boosting production potential; improving health and safety; and improving marginal operational efficiency around the world. However, for the last decade, the industry has missed opportunities and fallen of the digital frontier. They have been surpassed by other industries, failing to take advantage of data and optimally utilizing new technology. For example, a single oil rig can generate terabytes of data every day, but only a fraction is used for decision-making. (We can read in section 4.2 how Equinor is tackling this problem.) This situation emphasizes the opportunity for the oil & gas industry to leverage the transformational impact of digitalization. [3]

The WEF suggests that: the oil & gas industry's digital transformation, in comparison to other sectors, is expected to be evolutionary rather than revolutionary [3]. Even though the paper points out the immense potential for the developments in technologies like cloud computing, big data, and analytics. Cloud computing can boost business agility by dismantling silos of corporate business functions. By, sharing, computing, and solving problems in real time across business functions. Big data analytics is made possible by cheap sensors and widening connectivity, promoted by the Industrial Internet of Things (IIoT) (an application of IoT). Modern offshore platforms have about 80,000 sensors, and a single reservoir is predicted to produce more than 15 petabytes of data in its production-time [32]. Big data analytics will help companies navigate and utilize this vast amount of data.

Future Transformations and Digital Initiatives

Drawing on interviews with senior industry experts, executives, and academics have the WEF identified four digital themes that are expected to be immensely important in the oil & gas industry's digital transformation, the next decade.
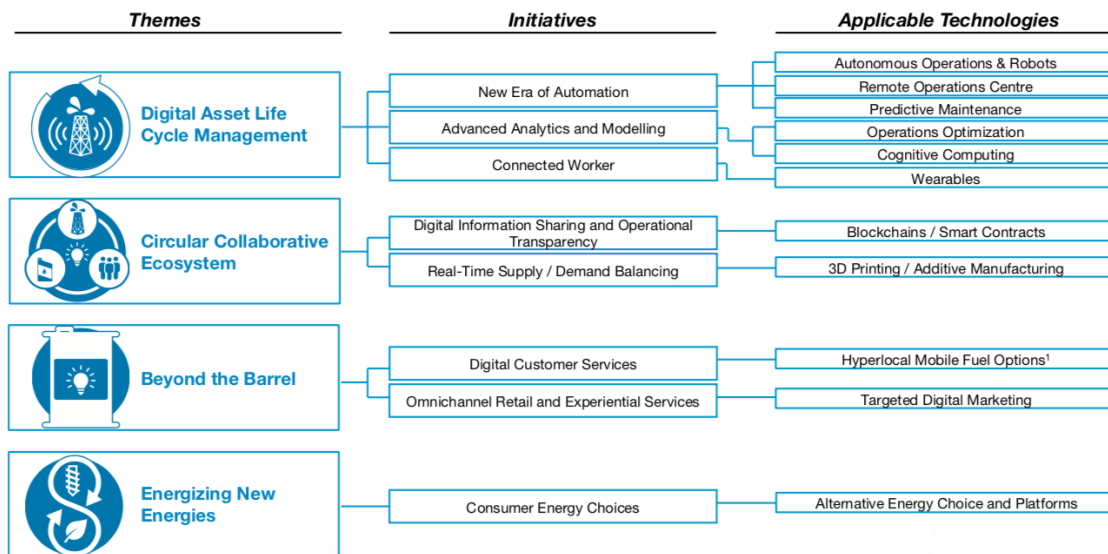
Figure 2.4: Digital initiatives in the oil & gas industry [3]

- **Digital asset life cycle management.** Data-driven insights combined with digital technologies can boost agility, strategic decision making, and transform operations, resulting in new operating models.

- **Circular collaborative ecosystems.** The use of integrated digital platforms has strengthened the collaboration among ecosystem participants, reducing costs, provide operational transparency, and help fast-track innovation.

- **Beyond the barrel.** Modern and innovative customer engagement schemes offer both flexible and personalized experienced, enabling new opportunities for operators and new services for customers.

- **Energizing new energies.** The industry cannot ignore the shift in consumer preferences, the tilt towards alternative and renewable energy sources present and growing. The oil and gas industry must, therefore, fully understand the impact of these changes, in order to change whit them.

As seen in figure 2.4, each theme is accompanied by initiatives – with respectively applicable technologies – excepted to have a significant impact on the industry's value chain, workforce, adjacent industries, the environment, and the wider society. The financial value of these technological impacts can be estimated in a value-at-stake analysis.

Value-at-stake

In this thesis, a value-at-stake analysis is defined as a framework for assessing the potential value of digital transformation initiatives on the industry, society, costumer, and the environment. It provides an understanding of where potential opportunities for value creation exists, and an evidence-based, differentiated understanding of the extent of the digital transformation's future impact. The value-at-stake analysis conducted by WEF in 2017 estimated that: a digital transformation in the oil & gas industry could unlock approximately $1.6 trillion of value for the industry, society, and its customers. The total estimated value can increase to $2.5 trillion if the influence of "futuristic" technologies, such as cognitive computing is considered (however, the evidence to make a definitive value assessment at this time is insufficient).

Barriers to digital transformation

To unlock the full value potential of digital transformation, the oil & gas industry has to contemplate a few key questions and hurdle a series of structural and historical barriers. In this thesis, three inhibitors – to realize the full value of the digital initiatives discussed above – have been researched more in depth.

1. **Lack of standardization**. Data standardization is one of the bigger challenges faced in the coming digital transformation. Just like ISO-standards for physical objects, should there be a convention or another ISO standard for data as well. This is discussed further in chapter 4.4, regarding culture.

2. **Ecosystems/platforms.** In order to unlock all the potential digitalization benefits, digital platforms must be fully integrated. Sensors and equipment from across the industry's value chain must be shared, together with best-practice. When this is accomplished; efficiency, productivity and health; and safety will be optimized. One solution for fully integrating and sharing data is via *smart contracts*, as discussed in section 4.5.

3. **Culture.** The WEF white paper [3] categorize oil & gas companies as very people-centric. This is mentioned in combination with the claim that chief executive officers (CEO) are skeptical about digital. Accordingly, are CEOs not prioritizing automation over manual labor. It is an industry-wide problem to use manual workarounds or disparate small systems to solve relatively easy automation problems. This, combined with a risk-averse nature, which inhibits the more experimental "fail-fast" approach – embraced by digitally mature companies [3] – makes for an industry lagging behind other industries when it comes to digitalization.

2.2   Strategy

Colloquially, strategy can be somewhat ambiguously defined. Therefore, is it beneficial to discuss the term. Some trace the origin of strategy back to the 6th century C.E. when it got introduced into Roman terminology. Where it is defined as: " A high-level plan to achieve one or more goals under conditions of uncertainty" [33]. Others trace the origin back to much earlier times, with the military definition of Sun Tzu in the *The Art of War* dated around 500 B.C.E. [34]. In this thesis strategy is defined in the context of organizational change. An action is strategic when it allows for a *sustained competitive advantage*. Thus, not all actions are strategic; some decisions are solely dedicated to maintaining the status quo [35].

When discussing what strategy is, *competitive position* is key. In order to enhance its competitive position, a company can either improve their current capabilities or expand into new territories. In order to implement this strengthening of competitive position, a process of strategy emergence is necessary. However, the optimal process of strategy emergence is disagreed upon by strategy academics. Some describe the process the optimal process as rational and deliberate (the Design school [35]), while others describe the process as evolutionary or emergent, which transpires from experimentation by trial and error (the Processual and Evolutionary schools). [35]

This thesis subscribes to a mixed model, of the two presented process of strategy emergence. Where the *intended strategy* is the strategy as conceived by the executive team. Even here, initially, the strategy is the result of the negotiation, bargaining, and compromise of several individuals and groups represented, within the organization. However, *realized strategy* – the actual strategy implemented – is influenced by multiple factors (see figure 2.5), more so than the intended strategy, as suggested by Mintezberg [35–37].
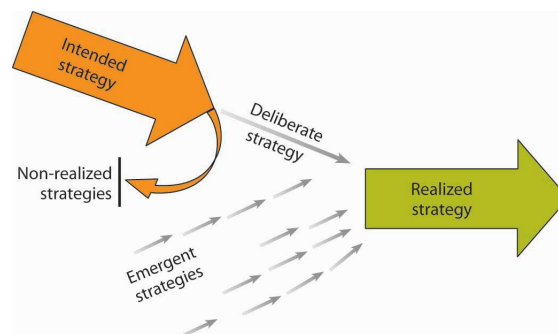
Figure 2.5: Strategy realization [4]

Where the primary determinant of realized strategy is *emergent strategy* – the result of managerial interpretation of the intended strategy and adapt it to ever-changing external conditions. Thus, making the realized strategy a consequence of the emergent and the *deliberate* factors. The deliberate strategy is only the realized intended strategy (see figure 2.5). [35–37]

The intended strategy is about gaining a sustained competitive advantage. The strategic action can, by this definition, be both grand or specific. Therefore is it crucial for a company to have a *Overarching Strategy*. The overarching strategy is a general framework that guides and prioritize strategic actions in a specific direction. The overarching strategy, like any strategy, must be driven from the top. Significant changes must be sponsored from the top, to have the most possible impact. This includes, presenting a clear vision, committing resources, and actively championing the change-effort (read more about it in section 2.2.2). [2, 3]

Operational Effectiveness vs Strategy

Operational effectiveness (OE) has been next to a mantra or dogma in the business world for the last 30 years (since the term LEAN manufacturing was coined in 1986). Undoubtedly, has this focus lead to major improvements in process optimization and effectiveness. However, the competitive advantage is diminishing. Because of the intense LEAN focus of the last decade, best-practices have become standard. Additionally, the OE drive has fuelled a merger and acquisition ideology that can only be explained by the drive towards increasingly more effective operations. However, some research point towards that this drive towards OE, has, in turn, made the industry turn a blind eye on the importance of strategy and strategic positioning and as a result prompted a wave of diminishing returns. [38]

Operational effectiveness harnesses the Japanese business model to optimize lean production. Operational effective, the Japanese model and lean production: all highlight the importance of maximizing the utility of its inputs. This is done by; reducing "waste," by focusing on what makes value and deprioritize everything else; even the workflow, by removing bottlenecks; and avoid unevenness in the supply chain, by utilizing planning tools like just-in-time systems. Michel Porter describes operational effectiveness as: "reducing defects in products or developing better products faster." [38], [39]

Another reason why OE is insufficient as a business model; is the lack of individualism; or "competitive convergence." This "decision-making by consensus" is another cultural characteristic that is predominant in Japanese business culture.

14

This kind of decision making; disbenefits innovation; tend not the invest in it when it occurs, and tend to diffuse the best-practices among competitors rapidly. More competitor-benchmarking leads do more identical companies, resulting in no differentiating factors prompting diminishing returns across the market. [38]

Strategic positioning, on the other hand, means performing different activities from competitors or performing similar activities in other ways. Strategy rests on unique ways of doing things. Strategy is the creation of a valuable and unique position in order to enhance competitive position. Positioning trade-offs purposefully limits the scope and deliverables of an organization. Thereby making them a specialist, who can offer specific deliverables at a specific price and quality level. Trade-offs also inhibit imitation and copying of market position, because imitators often undermine a more complex underlining strategy. Strategy is also about the combination of activities, also called *fit*. Fitting activities creates a value chain within the organization, where best-practices are transferable between the initiatives. Fitting also inhibits imitations because the value is dependent on all initiatives within the chain. [38]

The discussion above proves that strategy is much more than operational efficiency. If an organization is going to succeed in today's competitive market, both OE and strategy needs to be understood and capitalized on. Digitalization might be useful to combine OE with strategy, to efficiently drive competitive advantage. How Equinor is strategically utilizing digitalization will be discussed elaborately throughout chapter 4. Firstly, however, an understanding of the forces acting on the oil and gas industry is needed.

2.2.1 Michael Porter's five Forces Acting on the Oil & gas Industry

Already in 1979 did Michel E. Porter publish his " How competitive forces shape strategy," this was the young economist and associate professor's first Harvard Business Review (HBR) article. From this first article, a revolution in the strategy field began and still today is Porter's five forces the foundation of most strategic analysis [5]. This framework is a tool to analyze the competitive forces to a given business. Competition is arguably the biggest external factor in today's O&G market. Therefore, is it highly relevant to discuss these forces. Later, in section 4.1 will a deeper examination of the O&G's external environment, building on this section.

The Five Forces That Shape Industry Competition
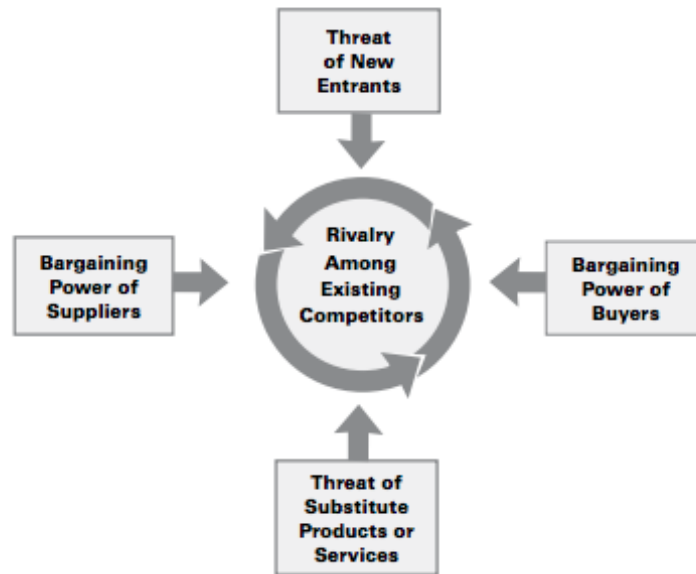
Figure 2.6: Michal Proter's Five Forces [5]

The oil and gas industry has a relatively small *threat of new entrants*, because of a high cost of entry into the market. This is particularly true for the offshore, subsea operations in Norway. Conversely, is the *threat of substitutes* growing exponentially over the last years. Figure 2.7a illustrates that renewable energy consumption has increased tenfold in the last 20 years. As seen in figure 2.7b has the share of renewables in power generation increased significantly, over the last 20 years. This growth is a substitute threat for oil and gas in the long run. Even though oil, gas, and coal make up about 85% [6] of today's energy consumption

does graphs 2.7b suggest that this could change in the long run.

The renewable substitute threat can, at least partly, be explained by the *bargaining power of buyers*. Consumer preference, more so in western culture, has shifted in favor of renewable energy, because of a population who are increasingly environmentally conscious. This greater demand for renewable energy is also a problem for the O&G industry in the long run.
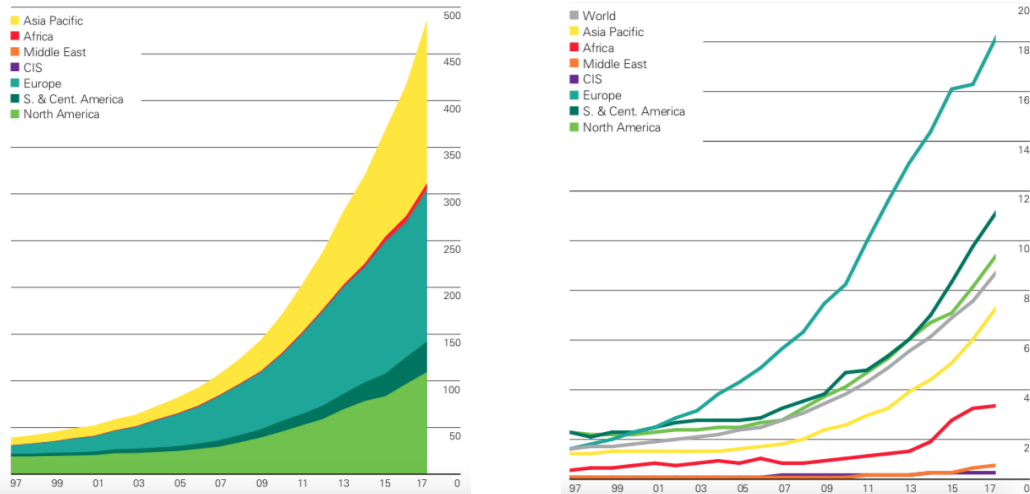
(a) Renewable energy consumption, measured in million tonnes oil equivalent [6].

(b) Renewable's share of power generation, measured in percentage [6].

Figure 2.7: Renewable energy (not including hydro) impact by region, over the last 20 years [6].

Large petroleum firms like Equinor have a complex network of suppliers and actors, which includes suppliers of material, equipment, engineering, etc. There are over 1100 suppliers in the Norwegian petroleum sector [40] alone. Since there are so many suppliers and Equinor has such a large market share, the *bargaining power of suppliers* is reversed in this context. Meaning that the suppliers unequally more depended on Equinor, causing the supplier industry to be at risk in harsh times.

Globally, Equinor has a low *bargaining power of suppliers*, considering that Norway only produces about 2% of the total production in the world [6]. Other national oil companies such as Saudi Aramco (Saudi Arabia) and Petroleos de Venezuela (PDVSA) owns 16% and 18% of the total proved reserves, respectively. While intergovernmental organizations like OPEC owns 72% of the total proved reserves and controls 43% of today's production. This marginalizes Equinor's bargaining

power in the world market, because "bigger players" can affect the global oil price by either adding or cutting in production.

The threat of *rivalry among existing competitors* is significantly intensive. With 40 different actors operating on the Norwegian continental self [41]. Around half of these are big Norwegian companies, the rest are integrated international-, medium- and small- companies. Competition is significant and international. Equinor is competing with the biggest and best oil companies in the world. Thus, competition is severe and any competitive advantage is valuable, and increasingly so because of the scalability within the company. A technical solution or improvement in Norway it can be applied in the other thirty-plus countries, this is also true for any digital administrative solution.

2.2.2 Change Management

In today's dynamic marketplace, implementation and capitalization on change have never been more important. This section reflects on what competencies are important for a change-agent or a change-leader. Today's market calls for change more regularly than ever before [13]. A change agent benefits from being multi-talented. In a digitalization context, a change leader should be competent with the latest technology and have the necessary soft-skills to drive the implementation.

Weick & Quinn [42] suggest that change implementation can be brought forth in two ways. *Episodically*, in a revolutionary fashion, or *continuously*, in a developmental and iterative process. Episodic change follows the sequence unfreeze-transition- refreeze. While developmental change comes from a philosophy of continuous development. This approach utilized dynamic stability and manageable change to increase competitive advantages [43]. In other words, the organization believes that; incremental changes through constant optimization leads to an increased competitive advantage.

Assessing change leader effectiveness is a complex task [44]. Systematic models inhibit and limits depending on the context of the change. An emergent approach, however, to change seems to be most applicable. Emergent change is based on the assumption that change is continuous and unpredictable. Thus, one has to change with a changing environment [45].

Now that a general approach has been suggested, competencies for a change-agent and a change leader needs to be investigated. A change-agent is the person who

brings forward and suggests the change. A change-leader is leading the implementation of the change after it has been brought forward. A change-leader can also be the change-agent, but this is not always the case. The different change-roles demands somewhat different competencies.

Important competencies for a change agent are soft skills like: communication, enthusiasm, motivation [46], collaboration, influencing [47]. These are beneficial competencies for a change-leader as well, but Vera & Crossan [48] advocates that the best leaders display both transformational and transactional capabilities. Transactional leaders coordinate and monitor behaviors, while transformational leaders are more creative, more focused on innovation, mentoring, and broking. This combination highlights the need for modern change-agents to be multi-talented, in order to fulfill all the responsibilities and be able to communicate efficiently with a wide range of people [48].

Chapter 3

Methodology

Methodology is a theoretical and systematic analysis of the methods applied to the research. Conventionally, methodology is the general research strategy that outlines how the study is conducted. Methodology is not solely method, but rather a justification for using a particular method [49]. In this thesis the methodology is defined by looking at the overall research strategy(3.1), research design(3.2) and the research method (3.3). It is beneficial to start with a distinction between the three. The research strategy is the general orientation to the conduct of the study. The research design provides a framework for the collection and analysis of data. Lastly, the research method is simply the technique for collecting data [50].

3.1 Research Strategy

3.1.1 Research Process

The research process is illustrated in figure 3.1. In order to investigate the needs of digitalization in Equinor, the very first preliminary literature was suggested by the supervisors at Equinor, consisting of internal and industry relevant, external documents. In order to get-up-to-speed in the business environment, pain-points, and root causes of their digitalization difficulties. After analyzing the literature received, combined with a broader literature review (presented subsection 3.1.2), the research questions were defined. After considering the literature and Equinor's state of digitalization, the leadership guidelines were defined (4), in collaboration with Equinor. The leadership guidelines chapter is the cornerstone that this thesis is built around, so each guideline was further divided into a theory, analysis, and a sub-conclusion part, in order to ease readability. Following, were the research design and method developed in order to initiate the interview process. The interview guide was constructed in order to interview the right employees. After, were the interviews conducted and transcribed. The transcripts were then analyzed, resulting in 21 observations that correlated with the leadership guidelines. The findings were then discussed in order to identify pain points, root causes, effects, and suggestions for the respective observation. Finally, was the analysis utilized to used to answer the research questions.

1 — Literature Review

Conducted Literature Review

In order to get up to date on relevant literature a preliminary literature review was made. Presented in 3.1.2

2 — Research Questions

Research Questions Defined

Based on the literature review and initial meetings with Equinor research questions were defined. Presented in 1.1

3 — Leadership Guidelines

Leadership Guidelines Established

Considering the literature review and Equinor's current state of digitalization leadership guidelines where put forward, in collaboration with Equinor. Presented in 4.

4 — Research Design

Research Design Developed

A case study of key-personnel from different departments in Equinor was selected as the optimal research deign. Presented in 3.2

5 — Interview Guide

Interview Guide Created

A semi-constructed interview guide was created in order to match the research design. Presented in 3.3.2 and Appendix A.

6 — Interviews Conducted

Semi-Structured Interviews Conducted

6 interviews with key-personnel were conducted and transcribed. Presented in 3.3.2

7 — Analysis

Analysis of the Interviews

The interview transcripts were coded into statements and organized into a relational model. Presented in 4.

8 — Discussion

Discussion of Analysis in Relation to Theory

The observations were discussed, with relevant theory, to identify causes, effects, suggestions and insights. Presented in chapter 4.1- 4.9

9 — Conclusion

Conclusion of the Research Questions

A conclusion to the Research Question was presented, based on all the material throughout the thesis. Presented in 6.

Figure 3.1: The research process illustrated, step-by-step, chronologically.

3.1.2 Selection of Literature

The preliminary literature review, combined with the expertise from supervisors identified which literature topics were relevant and nudged the author towards the relevant leadership guidelines. The literature were collected from the scientific databases: Google Scholar [51] and ScieneceDirect [52], both made available by the University of Stavanger Library [53]. Most of the preliminary literature was white papers, and annual rapports, to get familiar and understand the current challenges. The selection of the databases was mainly based on their high integrity and there high quality of interdisciplinary content. The databases provided content that was both business- and technologically -auspicious. When literature was unfamiliar and complex, the information was double-checked with multiple sources. The information cited is consistently based on the highest integrity source.

Selection of Research Method

The research method is a scientific method for acquiring knowledge, generally referred to as data collection of relevant information. This data can either be measured in sizable, numerical values or not, giving the distinction between the two principal research methods: quantitative and qualitative, respectively. The quantitative research method utilizes the process of measurement to provide a connection between empirical observations and mathematical operations. Since quantitative data is numerical, statistical analysis is possible and, if the results are unbiased, can even be used to generalize to some larger population. The qualitative research method, on the other hand, collects data that are non-numerical, subjective meanings and experiences, emphasizing on words rather than numbers during the analysis of the data. [54]

Since it is hard to quantify the degree of digitalization within an organization, a qualitative research method was chosen for this thesis, by utilizing semi-constructed interviews as the main way to collect data.

Philosophically, it is important to denote that the author chose a constructivist ontological and a interpretivist epistemological stance in this qualitative study. Epistemology asks the question of what should be regarded as acceptable knowledge in a discipline. This is a particularly important question in the social sciences, were information often less tangible. In quantitative research, *positivism* is the epistemological norm; it advocates the application of the method of the natural sciences in the social reality and beyond. *Interpretivism* is an alternative that proposes that social actions are more subjective, rather than the objective positivism view. Ontology is the study of reality and what it is. *Constructivism*, simply put, takes

the position that things and meanings do not exist independently, rather than human begins have *constructed* meanings to things dependent on social actors, and these meanings are in a constant state of revision. [50]

These philosophical considerations prompted the wish for interview objects in separate departments, since constructivism implies that social interactions within a group promote a more uniform opinion. The interpretivist stance promote the interviewer to interpret the meaning, rather then the absolute grammatical truth, of the interview statements and treat them as perceived truths rather than absolute facts. [50]

3.2 Research Design

The major unit of analysis in this thesis is the employees of Equinor with knowledge about Equinor's digitalization strategy, specifically, in relation to the presented leadership guidelines.

The thesis can be considered a case study. A "case" associates a study with a location, such as an organization or community, whereby an intensive examination of the setting is emphasized. The case study design often favors the qualitative methods, such as semi-structured interviewing, since these methods offer a detailed examination of the case. [50]

The interviews conducted were completely anonymous; the name, role, or any sensitive information obtained in the interview was not used in this thesis. This was done to create a safe atmosphere, where the interviewees could say their honest and subjective options, without their opinion being directly traced back to them. The interview subjects were given a randomized number, in order to easily and distinctively separate their statements and given a vague role description in order to provide context to the analysis. An overview of the interviewees is shown in table 3.1. The interviewees are indexed for anonymity. These indices are applied throughout the analysis chapter (chapter 4), using curly brackets. "{2}" indicates that the respective statement is from interviewee number 2 in table 3.1. This table allows the reader to link statements to the information in the table. These efforts are made to preserve anonymity and facilitate for verifiability.

Interviewee Number	Location and Date	Relevance (Job Title)	Duration [min]	Number of Words Transcribed
1	Stavanger, Equinor Headquarters 06.05.2019	Project Leader of Digitalization Initiativ	54	1739
2	Skype from Stavanger Equinor HQ to Equinor Oslo 09.05.2019	Project Member of Pilot Digitalization Team	51	2046
3	Skype to Equinor Employee based at Digitalization Partner 07.06.2019	Project Leader of Digitalization Initiativ	37	1624
4	Stavanger, Equinor Headquarters 14.05.2019	VP & Project Leader of Digitalization Initiativ	41	1937
5	Stavanger, Equinor Headquarters 12.04.2019	Manager Development and Production	55	3847
6	Stavanger, Equinor Headquarters 25.04.2019	Manager on Digitalization Initiativ	67	4987

Table 3.1: Overview of the sampled interview subjects

3.3 Research Method

3.3.1 Selection of Interview Objects

In collaboration with the supervisor, a purposive sampling of interview subjects was conducted. A purposive sampling was done to interview relevant subjects, thus achieving the most accurate results. A probability sampling that randomly picks subjects would have been unfavorable since a narrow set of employees have valuable insights on the state of Equinor's digital transformation. The purposive sampling approach, conversely, strategically chooses subjects that differ in key characteristics, but are united in their relevance to the research questions [50]. All

the interview subject had key insights, because of their hands-on work with current digitalization initiatives, but they were from different departments, projects, and hierarchical positions. Because of time and resource constraints, the sampling was subject to some convenience as well, which is natural. A convenience sample chooses the most relevant subjects that are available to the researcher [50]. However, the author is exceedingly happy and grateful for the broad range of distinguished interview subjects that took the time and interest to be a part of this study.

3.3.2 Data Collection

The primary source of data and information in this thesis have been semi-structured interviews. Complementary to the interviews, information from internal documents and public information, such as Equinor's 2018 Annual Report, have supplemented the data collection.

The Semi-Structured Interview

A semi-structured interview approach favors fewer questions, with a longer discussion around each question. In order to get the interview subject to tell a more consistent story. This kind of interview also favors a more open and honest discussion, rather than a rigid questioner, prompting short answers. This sort of approach has a higher likelihood of getting more subjective, honest, and detailed answers [50].

A semi-structured interview approach also favors open, vaguer questions, followed by follow-up-questions to guide the interviewee into the era of interest, if necessary. This is highlighted in the interview guide (see appendix A) with broad questions and then follow-up questions in italic, to guide the participant into the right era if needed [50].

A semi-structured interview also favors longer questions in order to paint the narrative of the story around the questions. It is favorable if the interviewee to respond with a story. This increases the length of the answers given, which gives more data to analyze, and can get the interview to present something completely unknown to the interviewer, pin-pointing complementary areas of research [50].

Other sources of information

Complementary to the semi-structured interviews, documentary information from a joint venture standardization project and a data-pooling project were used to

support certain topics of the analysis. These internal documents were in the form of presentation slides and illustrations, from project leaders of the respective initiatives. These documents provided a deeper understanding of the current digitalization initiatives and their obstacles. However. these documents were deemed sensitive and are therefore subject of a confidentiality agreement and will thus not be included in this thesis. Public information from Equinor, such as annual reports and web pages, have also provided useful information and context.

3.3.3 Data Analysis

To process the extensive amount of data, a variation of *thematic coding* was utilized as the primary analytic technique. Coding is commonly used in qualitative analysis and is a part of the inductive research methodology called grounded theory. Thematic coding, or simply coding, identify passages of text, statements, in this case, linking them by a common theme, making a framework of categories and subcategories [14, 50, 55]. During the data collection, a comprehensive interview guide A was utilized to the fullest. With the main questions outlined in bold and support questions in cursive, to further explain the context of the question or help the interviewee back on track. Thematic coding is a beneficial way to sort the data and prevent from being swamped at the end of the data collection stage. The transcription of the interviews was done immediately after the interviews ended, to best recall the nuances and the emphasize. It is crucial to stay objective during the interview process. However, body-language, wording, and tone can give valuable information as well.

The transcripts were coded to relevant statements, and from these statements; observations were made. Neither the statements nor the observations are in the standard single word coding format, rather short descriptive sentences, instead. The statements were cross-checked with all the transcripts, then refined repeatedly, as recommended by Bryman [50]. The refinement process entailed; finding overarching statements by combining statements and refining these on the basis of relevance and number of times expressed. The first iteration gave over 60 observations; this was filtered down through five iterations into the 21 observations utilized.

Chapter 4

Analysis

Leadership Guidelines for the Digital Age

This chapter will present and analyze nine leadership guidelines for the digital age and compare them with Equinor's current digitalization strategy. The nine Leadership guidelines are drawn from insights in INSEAD's reports: "The Real Impact of Digital" [20] and "Directing Digitalisation" [12], published in 2016 and 2017 respectively. These reports build on a survey of 1160 managers, board members, and executives in a broad range of organizations, working in the "virtual coalface". In other words, insights drawn from people working on the front line of digital transformation and digitalization.

INSEAD is an international graduate business school that is consistently ranked among the top business school in the world [56] [57]. The school has over 2000 cases-studies used in over 100 business schools [58].

In 2016, the authors Liri Andersson, founder of *this fluid world* a marketing consultancy, and Ludo Van der Heyden, Chaired Professor of Corporate Governance & Professor of Technology at INSEAD, conducted a quantitative and qualitative investigation of the 1160 working in the virtual coalface. The survey reached a broad range of organizations and industries in different regions, to uncover the "impact of digital" through looking at:

- How the business community sees digital

- What organizations expect from digital

- The success rate of digital initiatives

- The nature of digital strategies

- Levels of engagement in key areas of digital transformation

After conducting this investigation, eleven key insights and ten recommendations were made to the business community in general. One year later, the same authors published a follow-up report, this time directed at helping top management. This report puts forward a framework of strategic implications and recommendations in order to step into the new digital age.

Analysis Visualization

The analysis will present insights from these two reports, internal documents, public information, and findings from personal interviews with key personnel in Equinor will be presented in nine guidelines, within three categories. The guidelines are, respectively, broken down into three subsections: theory, analysis, and insights. The theory section builds on the themes discussed in the preliminary theory chapter, chapter 2, combined with additional, in-depth theory relevant to each specific guideline. This is done in order to ease the reading and reduce scrolling. In the analysis subsection of each guideline, the relevant observations are stated and explained, before the causes, effects, and suggestions are discussed. Finally, respective insights conclude each guideline.

Figure 4 illustrate the state of digitalization in Equinor.

- The nine leadership guidelines

- The measurable of each guideline

- The observations from the interviews

- The root causes for the negative observations

- Additional relevant theory for each guideline

Figure 4 is color coded in accordance to category, to represent the impact area of the digitalization efforts, and to increase readability. The categories are: *the business environment* (green), *the organization* (blue) and *strategy* (red). Some causes apply to multiple observations and are therefore cross-referenced accordingly. Figure 4 illustrates a snapshot of the current digitalization efforts in Equinor. Thus working as a visualization of the answer to (RQ1).

Leadership Guideline	Mesurable	Observation	Root Causes	Relevant Topic
G1: Digitalization requires an unbiased understanding of the external environment.	G1.1 External Influences	G1.1.1: Equinor are subject to the same external forces as the industry.	Industry Interdependence [G1.1.1, G1.1.2]	Section: 2.1.1, 2.1.3, 2.2.1, 4.1
	G1.2 Competitive Position	G1.2.1: Equinor is doing well, relative to a lagging industry.		
G2: The meaning and impact of digitalization to the firm must be clearly stated.	G.2.1 Personal definition of digitalization	G2.1.1: The definition of digitalization varies significantly within Equinor.	Digitalization Ambiguity [G2.1.1, G2.2.1, G3.1.1, G3.2.1, G4.2.1, G6.1.1]	Section: 2.1, 2.1.1, 2.1.2, 4.2, 4.3, 4.6
	G.2.2: Equinor-wide definition consistency	G2.2.1: The perceived organization-wide definition, have to do with: the use of digital tools.		
G3: Digital understanding and capabilities are required across the firm.	G3.1: Digital Transformation Progress	G3.1.1: Ahead when it comes to production technology, lagging when it comes to administrative digitalization.		
	G3.2: Digital competency of executives	G3.2.1: Engagement and willingness to invest is present, but the technical competence is under development.		
	G3.3: Hierarchical position of digital change-agents	G3.3.1: Key-personnel is driving the digital change efforts, dependent on personal interest, not hierarchical position.		
G4: Digitalization must be supported by the firm's corporate culture.	G4.1: Description of culture	G4.1.1: The culture is not transparent nor exploitative enough and too people-centric.	Insufficient Collaboration [G.3.3.1, G5.1.1, G5.2.1]	Section: 2.1.3, 2.2.1, 4.5, 4,6
	G4.2 Digitalization-enabling culture traits	G4.2.1: Historically good at technology R&D, but still fundamentally conservative.		
G5: Digitalization demands a greater level of collaboration.	G5.1: Cross-functional collaboration	G5.1.1: Internal collaboration can seem somewhat random and subject to silo-structures.		
	G5.2: Collaboration with suppliers	G5.2.1: Digitalization incentives differ significantly across the supply chain, nonetheless developments are being made.		
G6: Business strategy in the digital age becomes a continuous process.	G6.1: Time frame for digitalization	G6.1.1: Equinor's time frame for digitalization is regarded as long-term, with increasing uncertainty.	Developing Digitalization Governance [G4.1.1, G6.2.1, G7.3.1, G9.2.1]	Section: 2.1.3, 2.2.2, 4.2, 4.3, 4.6, 4.7, 4.9
	G6.2: Level of project follow-up	G6.2.1: Project continuity, follow-ups, and spread of best practice are now being prioritized.		
G7: Decision-making in the digital age is increasingly data-driven.	G7.1: Grounds for decision-making	G7.1.1: Business cases are used for decision making throughout the company, most are content with it, some say it's not optimal for innovative work.		
	G7.2: Data collection & processing	G7.2.1: A large amount of data is collected, so big data analytics can advance.		
	G7.3: Data utilization & translation	G7.3.1: Data is not always processed and translated in the best way.		
G8: Digitalization requires firms to enter uncharted territories.	G8.1: Commitment to innovation and implementation	G8.1.1: Committed to innovation, but the time and certain competencies are limiting implementation.	No Overarching Digitalization Strategy [G8.1.1, G9.1.1, G9.3.1]	Section: 2.1.3, 2.2, 2.2.2, 4.8, 4.9
	G8.2: Willingness to take on risk	G8.2.1: The enthusiasm and willingness to take on R&D risk is there and the capabilities are growing.		
G9: Digitalization is about continuous management of change.	G9.1: State of digital project management	G9.1.1: Good individual initiatives, lack of coordination and spreading of best practice.		
	G9.2: Degree of executive engagement	G9.2.1: Executives and management are engaged and enthusiastic and technical capabilities are increasing.		
	G9.3: Agility of overall digitalization strategy	G9.3.1: No predominant overall digitalization strategy.		

The Business Environment

4.1 Digitalization Requires an Unbiased Understanding of the External Environment.

In order to successfully operate in today's increasingly digital market, is it essential to investigate and generate an unbiased understanding of the external environment. It is important to cultivate awareness of relevant threats and opportunities in the external market. In this digital age, a precise understanding of innovation and digital technologies, are a necessity, in order to update business models and strategy, accordingly. [12]

Theory

In order to examine the external environment, the lessons learned and discussed from Micheal Porter's five forces framework, in section 2.2.1, will be utilized. As this framework is a tool for analyzing the competitive forces on a given business. Competition is arguably the biggest external factor in today's O&G market. Since profitability, feasibility, and the final go-ahead decision rests heavily on the oil price. In today's globalized O&G market, every actor in the market is affected and connected. The oil price set by the biggest actors (OPEC and OECD [6]) is essentially the oil price for the whole market. The competitive forces are presented and discussed elaborately in section 2.2.1. The industry trends, such as supply and demand, will be discussed in more detail here.

Figure 4.1 shows that multiple supply and demand forces are shaping the O&G industry, along with the broader energy value chain. Supply forces include: "The rise of new hydrocarbon sources," such as shale oil and shale gas [6]. Advances in technologies, such as horizontal drilling and hydraulic fracturing, are unlocking the shale resources. Thereby creating an oversupply and a persistently low price for crude oil [3]. Demand patterns are shifting, and the overall demand is estimated to be reduced because of increased adoption of renewables and the rise of electric vehicles [3]. These industry trends, combined with the competitive forces discussed in section 2.2.1, makes digitalization potentially disruptive. The future digital leaders have the potential to increase their competitive advantage drastically [59].
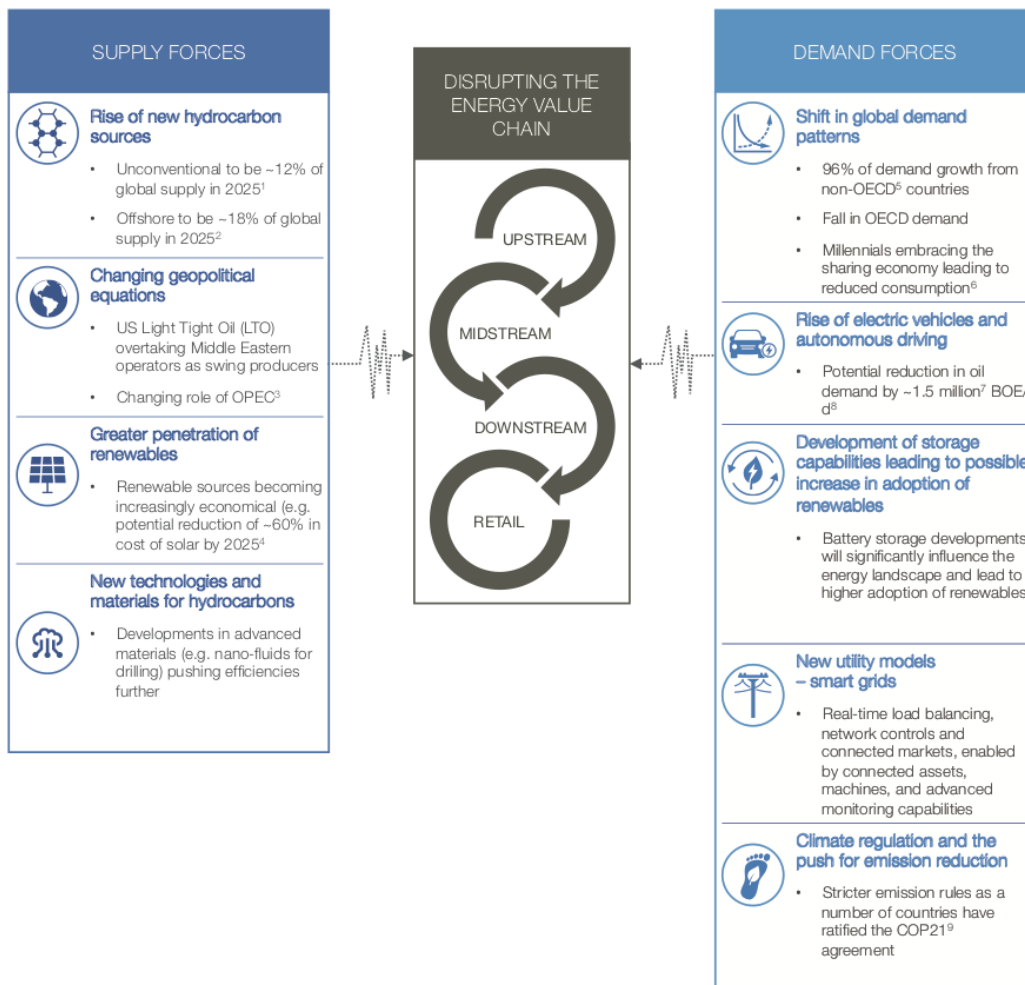
Figure 4.1: Supply and demand forces that are reshaping the oil & gas industry [3]

Analysis

Achieving an *unbiased understating of the external environment* is crucial in order to improve the current digitalization strategy (RQ2). Firstly, must the current state of the environment be understood (RQ1). The external environment was investigated through interviews, questioning the external influences and competitive position.

G1.1 EXTERNAL INFLUENCES

To understand the external environment, is it critical to understand the external influences or forces acting on Equinor. This measurable was established to

investigate which external forces were acting on Equinor. Competition is arguably the biggest force acting in the O&G industry (2.2.1, para.6).

G1.1.1: Equinor are subject to the same external forces as the industry.

EXPLANATION:
The O&G industry's operations and revenue are inherently dependent on the global market. Thereby making competition the biggest external force acting in the Equinor (2.2.1, para.6). In relation to this interview-observation, was it mentioned that the starting point for the industry's digital transformation came from the 2016 annual WEF meeting. Where: "Mastering the Fourth Industrial Revolution" was the theme of this renowned meeting [25, 26]. The fourth industrial revolution is explained in depth in section 2.1.1 and highlights the utilization of cyber-physical systems.

CAUSES:
The industry, as a whole, is lagging behind substantially compared to other sectors (2.1.3, para.1). This lagging is a product of multiple things; the rigidity of large organizations; and the prior comfort of pleasant financial times. Because of a high oil price, for a relatively long time before the recession in 2014, the whole industry could afford not to upgrade (1.3, para.2). Another cause for the dependency, is the inter-connectivity of today's globalized O&G market (4.1, para.1). The oil companies are dependent on each other, through a shared publicly traded oil price.

EFFECTS:
The effects of this inter-dependency are increased trade but also increased volatility and dependency. The inter-connectivity has also lessened Equinor's impact on the oil price, because of major actors like OPEC and OECD. The effects of the digital underdevelopment in well-off financial times resulted in the need for severe cost-cots in the 2014 recession (1.3, para.2).

SUGGESTIONS:
The inter-dependency comes with the negative effects of discussed. However, it also provides the potential for a bigger competitive advantage for Equinor, by becoming a front-runner with best digital practice. If Equinor optimizes its operations through digitalization, they can reap the benefits from companies who have not invested as much in their digital transformation. By cutting costs through digitalization, they can a lower break-even than competing companies.

G1.2 COMPETITIVE POSITION

By now it has been established that the industry is lagging as a whole and Equinor are subject to the same forces, however, now the competitive position of Equinor relative to the industry, needs to be established.

G1.2.1: Equinor is doing well, relative to a lagging industry.

EXPLANATION:
Some interviewees suggested that Equinor was a front runner when it comes to digitalization. All interviewees were positive that Equinor was above average within the industry. They pointed towards the establishment of the DCoE and the digital road-map (4.2, para.2).

CAUSES & EFFECTS:
The interviewees pointed towards the early admission of lagging, as an explanation for why they are ahead now. This sparked the enthusiasm around digitalization and resulted in tangible efforts like the DCoE and the digital road map, described in section 4.2.

SUGGESTIONS:
To preserve the competitive advantage, its important to sustain this head-start. In order to increase this advantage, digitalization needs to be brought in fully as a driver of the business model, in order to provide new value and revenue- producing opportunities 2.1.3.

Guideline 1 Insights:

Having an unbiased understanding of the external environment is key for advancing digitalization efforts. In order to direct the current digitalization strategy and to determine an optimal future strategy. To understand the environment, the analysis measured the external forces acting on Equinor (G1.1) and Equinor's competitive position within the industry (G1.2). The analysis uncovered that Equinor is subject to the same forces as the industry (G1.1.1) and that Equinor is doing well relevant to the lagging industry (G1.2.1) Equinor's early admission of digital lagging, resulted in resource allocation towards the DCoE and the digital road-map, giving them headway within the industry. The consequent inter-dependency from a globalized market can also improve Equinor's competitive advantage. By leading digitalization and digital development, capitalization on best-practice is possible.

The Organization

4.2 The Meaning and Impact of Digitalization to the Firm Must be Clearly Stated.

Digital currently defies definition [20]. This is demonstrated by the vast and varied ways business opportunities are addressed by digitalization. How a firm perceives and defines digitalization depends on a number of factors specific to the firm and its context. Still, too often, companies are looking for the standard "one-size-fits-all" approach to digitalization. Rather than searching for a blueprint to reveal the way, a unique digitalization strategy needs to be formed, possibly in the form of a digital road-map. [12, 20]

Theory

Equinor has made clear their importance of being a digital company. They have made several efforts to accelerate their digital transformation. The two most significant efforts are the establishment of the Digital Centre of Excellence and the launching of a digital road map. These two efforts predominantly focus on the operational side. The main scope of these efforts was to; significantly increase the handling and utilization of data, in order to run sophisticated analytics; and implement automated robotics. The intended impact and meaning of this digitalization were to: improve safety, increase profitability, and reduce carbon footprint. [60]

More than 26 petabytes (PB) of data is stored in Equinor's data centers. For comparison: the current used (paired) space of the Internet Archive is 48 PB [61]. The Internet Archive is an archive of almost all of the Internet's web pages, with daily snapshots from as far back as 1996 [62]. This comparison is supposed to illustrate the vast amount of data Equinor has at its disposal. Furthermore, the data is speculated to double every other year, in the years to come. The Chief Digital Officer speculate that the Equinor's operations will have generated about 2500 PB by 2030. To make optimal decisions with this vast amount of data, it needs to be analyzed, organized, and labeled; professionally called data warehousing.

To handle this data and other digitalization efforts, the Digital Center of Excellence (DCoE) got established in mid-2017 [60]. The Digital Center of Excellence was created to coordinate and manage Equinor's digitalization efforts across the organization and to collaborate with external specialist communities. The DCoE allows Equinor to collaborate with the companies on the digital frontier efficiently; in data analytics, machine learning, and artificial intelligence. Equinor wants to

gain in-house expertise as well and is currently recruiting to do so [60].

Equinor has been utilizing digital technology for decades to automate and simplify processes. However, the implementation of digitalization can support these processes. With this next scale of data creation, Big Data analysis could examine overall workflow, find pain-points in the value chain, and improve on these. The cost of sensor technology has decreased at the same time as the technology has developed, enabling large scale data collection. The data from these sensors can, for instance, help predict the need for maintenance on equipment and rigs. Relatively new cloud solutions enable data sharing to be possible internally and with external partners. Lastly, the increase in processing capabilities and advancements in Artificial Intelligence (AI) allows for the accelerated development of Equinor's Machine Learning (ML) and AI endeavors [18].

Equinor has developed a digital road map, in collaboration with Capgemini, which includes six specific programs:

1. Digital safety, security, and sustainability
2. Subsurface analytics
3. Next generation well delivery
4. Field of the future
5. Data-driven operations
6. Process digitalization and insight

The common denominator for all these programs is that they focus on the operational side of the business. All six programs are directly angled to improve the safety, efficiency, technology, and work processes on the operational platforms. None of these programs focuses on the administrative side of the organization. [63]

Analysis

For an organization to improve its digitalization efforts, they first have to agree on the definition, because digitalization is defined in several ways (2.1, para.1). Thus, an adamant organization-wide definition is fundamental for an overarching digitalization strategy, so everybody agrees on the fundamental scope. The meaning and impact of digitalization were measured, through interviews, by asking for a personal definition(G2.1). Followed by the perceived general definition in the company, in order to measure term definition-consistency(G2.2).

G2.1 Personal definition of digitalization

G2.1.1: The definition of digitalization varies significantly within Equinor.

Explanation:
Even within the sample group, all the participants had a somewhat different definition of the term, from: "a tool for effectivization," til: "major changes of process and relational business models." Considering that the interview subjects are either; a manager or a member of a large digitalization initiative {1,2,3,4,5,6}, this was unexpected.

Causes:
A significant and driving cause is the fact that digitalization is an ambiguous word and it is often perceived differently (2.1, para.1). Within Equinor, the term-variation can be traced back till before the pivotal WEF 2016 meeting, when digitalization was set on an industry scale agenda (2.1.1, para.1). Prior to this industry focus shift, digitalization was solely viewed as an expense in the budget {2,3,4}. One interview subject described prior digitalization initiatives as specialized, one purpose, IT-tools {4}. Therefore, when digitalization was put on the agenda, some drivers still treated it as before, instead of as the revolutionary new business model enabler, that the WEF is calling for (2.1.1, para.2).

Effects:
Equinor's definition of digitalization can be ambiguous by itself . It is therefore imperative to ensure that everyone involved in digitalization efforts is agreeing and in alignment to what the term means, in order to work towards a common goal. The effects of definition variations are that the company cannot set a course or even have a discussion about digitalization whiteout agreeing on a precise definition. One can imagine the difficulties of planning when everyone has a different understating of what is discussed.

Suggestions:
A suggestion to solve this problem is to enforce a unanimous definition organization-wide. Perhaps enforce the current Equinor definition: " the use of digital technologies to change a business model and provide new revenue and value-producing opportunities " (2.1, para.1). Alternatively, revisit what digitalization means for the company's future and create a new definition in coherence with this.

G2.2: Equinor-wide definition consistency

G2.2.1: The perceived organization-wide definition, have to do with: the use of digital tools.

Explanation:
This general and vague statement represents the widespread option of what the general definition of digitalization is in Equinor. When questioning the interviewees for their perceived generalized definition, they almost unanimously (4) said that it had to do with the utilization of digital tools. Within the sample group, the definition varied form, simply the use of IT-tools as software, to the use of digital tools to optimize processes.

The causes, effects, and suggestions are inherently alike and explained in the statement above (G2.1.1).

Guideline 2 Insights

A clear definition and meaning of digitalization are needed for guiding the firm and its employees through a digital transformation. The analysis tried to measure the definition-consistency by checking the coherence of the interviewee's personal definition (G2.1) with there perceived organization-wide definition(G2.2). As shown by the analysis, there is no agreed upon definition of digitalization (G2.1.1), suggesting that there is room for improvements defining the meaning of digitalization for Equinor. When questioning the interviewees for their perceived generalized definition of digitalization in Equinor, they approximated it as: "something to with digital tools" (G2.2.1). The leading causes for this lack of definition-consistency are an overall ambiguity and an outdated view on digitalization. Enforcing a unanimous definition organization-wide would solve these problems. Either enforcing the current definition or a thoroughly revised definition, that matches Equinor's future digitalization strategy.

The recent digitalization efforts have tried to address these issues faced. However, from the DCoE and the digital road map, it can appear that Equinor's digital meaning and impact are limited to the operational side of the business. Thereby, disregarding the administration side, that is lagging more (G3.1). Nonetheless, the efforts mentioned signals to the firm and their surroundings that digitalization is prioritized. This is crucial for a successful digital transformation. It is important to make people, management, and culture the main drivers of digital [20].

4.3 Digital Understanding and Capabilities are Required Across the Firm.

Building on what is discussed in section 2.2.2 about, the importance of a change agent to initiate the effort for a digitalization initiative to take place. This person is usually an expert who is passionate about the project, and preferably have some leadership capabilities. After the initiation of the project, it is important to condition a positive culture for the change, in order for it to persist. This digital-positive culture is important for any digital transformation to be possible. Demanding a culture to arise does not work, the change agent has to generate genuine excitement and commitment around the change. This excitement has to be present throughout the organization, from junior contributors all the way up to the board of directors. This is especially true in the digital age because today's junior contributors are digital and tech-savvy from growing up with digital technology. The combination of vigorousness from millennials and the experience and wisdom from senior personnel is very potent [12].n

Theory

Both the interviews and the literature highlights a common problem; organizations are not driven by the desire to fundamentally transform into digital, rather use digital as a tool to achieve specific business objectives [20], {1,3,4}. Suggesting that the digital understating is not quite there yet. An example of this, and a fundamental barrier to digitalization, is Equinor's approach to information management.

A common problem with grand organizations like Equinor is managing information flow. How to provide relevant information and the right amount of information to the right people in a seamless way. If too little information is given, the full picture of the situation may not become clear, but if too much information is given its detrimental as well. Firstly, the receiver can be swamped in information, unable to tell the important from the insignificant. Secondly, information can be sensitive, demanding authorization to be evaluated constantly. [64]

Data management is an immense problem at Equinor. Many employees are stuck spending much time manually transferring data from one system to another. If some information is going into multiple IT-systems, then the employee is stuck manually transferring the same information into multiple systems. This type of manual labor is strictly the product of bad information management, and other industries have solved this problem a long time ago [3]. On the upside, this creates a great area for improvements, where cost-cuts could be significant. Some coun-

termeasures are being tested. Robotic Process Automation (RPA), for example, is one way to solve the problem. RPA's can automatically manage the data, by, for example, transferring the data between the systems automatically. However, some interview subjects argued that RPAs were not sustainable and can be compared to "putting a band-aid on a bullet wound" {1,3}. These problems point towards a root communication problem, that only a total transformation of how information is stored and transferred, can solve.

Today, the information flow in Equinor is severely outdated. Equinor is heavily dependent on data coming from their suppliers. Normally, this data is sent in a PDF format, making it difficult to transfer and analyze the data effectively. Internally, the information is then transferred in multiple copies, one for each relevant division. Each division has its own set of programs tailored to their specific needs, with its own set of formats and data standards. A problem then occurs when data needs to be transferred from one program to another, or information is compiled from multiple programs. The individual data formats and standards make it difficult to transfer data across departments and programs. The problem is even more substantial than this. Because of department silos (discussed in section 4.5), the different departments do not have insights into each other's data, unaware of the data even exciting. This intel was collected from interviews with key personnel {1,4}, working on a solution to this problem. This novel solution is called Fusion and is illustrated in the figure under.
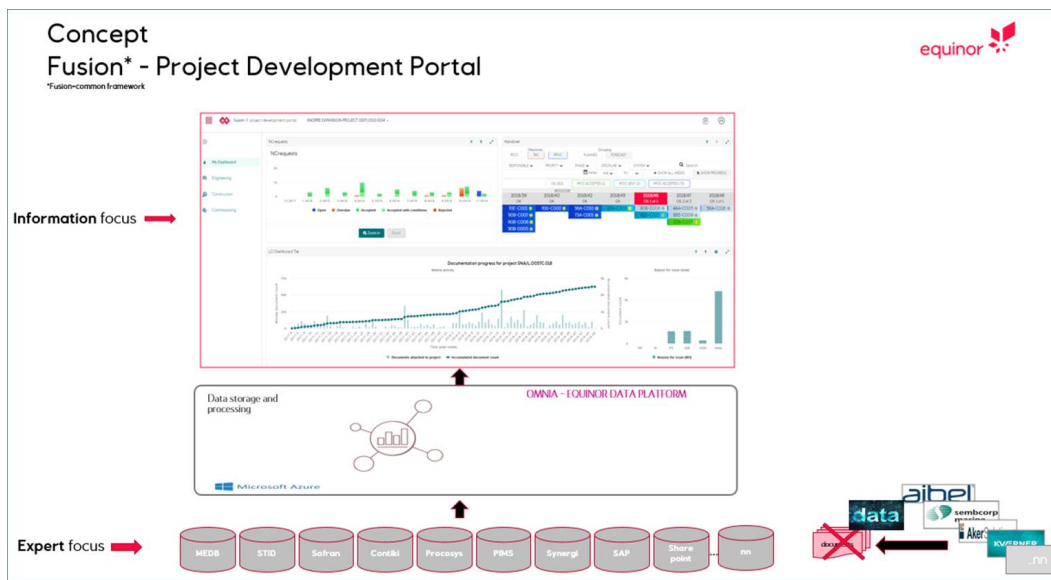

Figure 4.2: Illustration of Fusion program, cited from an internal document [7], with permission from the project leader.

The Fusion program is a Microsoft Azure-based data sharing program that allows for data-transparency and shareability. As we see from figure 4.2, data is coming from suppliers (bottom right corner) and is transferred to the relevant division, which in turn shares its data to an overarching cloud data platform called Omnia, in real time, automatically. The data is then stored, labeled, and processed and can be visualized using Microsoft Power BI. A business analytics service that provides interactive visualizations and business intelligence capabilities, with a simple interface that lets users create reports and dashboards [65], {1}.

An interview subject argued that the information management problem was too substantial for the fusion program to solve alone {3}. Arguing that data from different software typically has a different source code, defining the same information in different ways, making labeling difficult and sub-optimal. One way of solving the information management problem is to create and enforce digital standards. One initiative like this is is the Joint Industry Program (JIP). An initiative to shape the future of digital standards, requirements, and information management. DNV-GL organizes the program, with actors from the oil and gas industry, and other Norwegian industries. Their Goal is to create a standardized «digital language» for representing technical information and requirements and making an ISO standard for it.
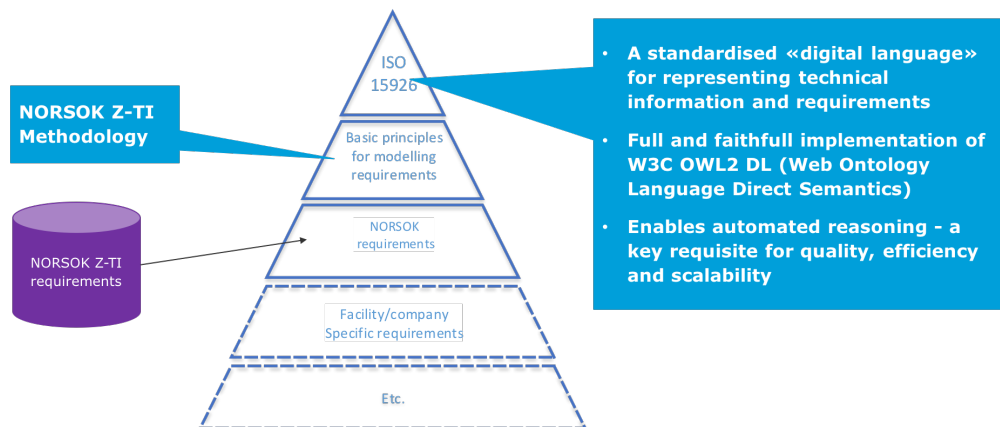
Figure 4.3: JIP initiative, cited with permission, from an internal document [8].

Figure 4.3, illustrates how the potentially new ISO 159 – 14 ISO standard would work. It would build on the already existing NORSOK standard's methodology and requirements to create a standardized "digital language." The presented ISO standard utilizes the Web Ontology Language Direct Semantics. An ontology is a vocabulary of terms that are formalized, shared by a community of users within a specific domain [66].

Analysis

In order to develop and advance a sustainable overarching digitalization strategy, solid digital understanding and capabilities are needed, across the organization. Therefore, were a few measurables established to estimate the digital understanding and capabilities across the company.

G3.1: DIGITAL TRANSFORMATION PROGRESS

This measurable was established to figure out what Equinor is doing well and, contrary, where they had room for improvements, concerning digitalization. The generalized statement generated from the interviews was:

G3.1.1: Ahead when it comes to production technology, lagging when it comes to administrative digitalization.

EXPLANATION:
Equinor has a culture and is known for being on the digital frontier when it comes to technical solutions for production and (1.3, para.6). The interviewees working on new digitalization projects highlighted a few of these initiatives. For example, the unmanned platforms, the IT-infrastructure, and the 4D seismic maps (X, Y, Z, and time) {2}. One interview subject suggested that Equinor's digitalization efforts were average in the industry {4}, while others were confident that Equinor was leading within the industry, by pointing towards the early focus on digitalization and the early establishment of a DCoE {3}.

However, when it comes to administrative digitalization, Equinor is lagging, even within the industry {1,2,3,4}. It was mentioned that Equinor was a decade behind when it comes to administrative digitalization {1,3,4}. Data-sharing was flagged as the biggest problem when it comes to their administrative digitalization problems. Data is being transferred in PDF files from suppliers and internally, thereafter stored in 10 different copies, with each copy required to be updated independently (4.3, para.5). Another problem, as explained in section 4.5, is data siloing. Where information is not shared across departments, because each department has individual and specific software, which does not communicate with each other.

CAUSES:
The data siloing comes from the old perspective of digitalization, back when digitalization was seen as specialized tools (4.2, para 9.). This perspective resulted in each department getting its own specialized system, that does not communicate with other systems. The PDF problem orientated from multiple sources. Firstly,

this sharing alternative was a quick and sub-optimal solution to previous data sharing problems throughout the supply chain. Secondly, the suppliers are incentives to hold on to this old-fashion method of data sharing. Because they are paid hourly, they are incentives to use as many hours possible, even if the work could be done automatically in a transparent cloud solution. Transparency, however, is a big concern for the suppliers {4}. They are afraid to share too much information, in fear of that other suppliers can get ahold of there information and methods. This is an understandable fear, as the supplier's methods often are their competitive advantage.

EFFECTS:
Poor data management results in a chaotic ecosystem of data sharing and Equinor paying large sums for easily automated labor, both internally and externally. The current internal data sharing system is vastly outdated and demands an extensive amount of labor. Taking time away from high paid administrative workers, to solve actual problems. This old internal data sharing system is outdated and is draining resources. The external data sharing procedures are also draining resources, compensating suppliers to share their data through "undigital" PDFs, then to have Equinor's employees to export the data from PDF to the preferred format.

SUGGESTIONS: A current solution to these data sharing problems is the new initiative called Fusion (4.3, para 5). The Fusion program is intended to tackle the data-sharing and transparency issues Equinor is facing internally. Fusion is currently being implemented, but skepticism about data standards and labeling has been voiced during the interviews {3}. The same type of data might be labeled in two different ways, with differences in the source codes. Resulting in difficulties within database management(4.3, para 7).

The transparency concern is solved in a new data-sharing initiative that Equinor has started with one of its major suppliers {4}. The initiative is currently in the initiation phase, after going through substantial legal processes. If this project is successful, can Equinor prove feasibility and get more suppliers to join the initiative. Either by pressure or by proving mutual benefits for all actors.

G3.2: Digital competency of executives

When taking a cross-sectional snapshot of the organization's digitalization initiatives, is it natural to focus on the top management and executives. Because, as pointed out in section 2.2, change has to be driven from the top.

G3.2.1: Engagement and willingness to invest is present, but the technical competence is under development.

Explanation:
As explained in section 1.3, Equinor has been early adopters of digitalization within the industry, but the utilization has not been optimal, because of a lack of direction and competence. The importance of digitalization has now been understood by the top management and the drive to refine the capabilities have drastically improved over the last year. Most of the interviewees mention this fact in the interviews {1,2,3,4}. A year ago, new digitalization initiatives did not get confronted, because of a lack of understanding. Nowadays, a better understanding has lead to better constructive-questioning, resulting in better selection and understating of digitalization initiatives {2}.

Another concern raised during the interview process was the thoroughness of the digitalization governance, the corporate governance could have been tougher {4}. Equinor is very competent in researching and testing new IT-tools. However, the company-wide implementation of best-practice is missing. New tools can be tried out in one sub-department and be successful there, but the effort stops there. A more assertive corporate governance; that forces the use of new and effective initiatives are missing.

Effects:
The lenient governance causes an abundance of IT-tools that only a handful of employees are using and best-practice is unclear. A reason for this abundance is that if a tool is developed in one department, other departments are unaware. This lack of transpraancy results in the absence of best-practice transfer. Department-barriers break the information-chain.

Suggestions:
A suggestion to improve the abundance-issue is to demand employers to use the best-practice more forcefully. Prior digitalization efforts in Equinor has done this successfully. An example was the shift from manual accounting on paper to digital accounting, of travel expenses. When the digital method was released, accounting had to be done digitally to be reimbursed. This kind of assertiveness needs to be applied to new digitalization best-practices.

G3.3: Hierarchical position of digital change-agents

As discussed in section 2.2, change has to be driven from the top, but as described in section 4.3 needs can often be more easily assessed from the people working hands-on with the problems. This measurable is, therefore, trying to evaluate where within the hierarchy, the digital change initiation is originating.

G3.3.1: Key-personnel is driving the digital change efforts, dependent on personal interest, not hierarchical position.

Explanation:
Some division within the interview samples, some suggest that the digital transformation is driven from the top {1,2,4}, some say that the ides come from the lowest hierarchical level {3}. In general, it is agreed upon that key-personnel with special interest, no matter the position, are the drivers of the digital change. Naturally, is there a higher density of digital change agents within the IT-community of the organization. But therefore is it important to cultivate a collaborative culture between the technical-driven and the business-driven, as discussed in section 2.2.2. In order to combined the hard skills of the technical enabled and the soft skills of the business enabled. Collaboration is key in order to actualize this, the necessity of collaboration will be discussed in section 4.5.

Guideline 3 Insights

Throughout the organization, the impact of digitalization has to be understood, from the lower hierarchical positions to the executives. Equinor is on the digital frontier when it comes to offshore production; however, they lag a decade when it comes to administrative digitalization (G3.1). Nonetheless, digital capabilities are growing throughout the organization. The change is driven by key employees, with special digitalization interest. Over the last year, however, executives have caught up (G3.2), to more efficiently govern the digitalization. The executive development was driven by a long-lasting will and engagement to invest in digitalization (G3.3). Still, some concerns about the assertiveness of the digital corporate governance were raised under the interview round with more senior employees {3,4}. This concern was directed towards the abundance of IT tools. Which stems from an old perspective of digitalization, when digitalization was seen as specialized tools (4.2, para 9).

Another cause for the administrative lagging is a lack of collaboration, resulting in data and department siloing (explained in section 4.5). Equinor's solution to these problems are the new digitalization initiative called Fusion (4.3, para 5). The fusion program is intended to tackle the data-sharing and transparency issues Equinor is facing. Some skepticism about the program was disclosed under the interviews. Regarding the lack of data standardization that a database program depends on. Efforts to standardize data, such as most sectors have done with the ISO-standard, are also being perused by Equinor in collaboration with the industry. Efforts like these drive the digitalization understating and capabilities, in order for the organization and industry to catch with the lag.

4.4 Digitalization Must be Supported by the Firm's Corporate Culture.

Successful implementation of change, such as digitalization, requires a combination of managerial competencies, technological insight, effective leadership, and ultimately an enabling culture. Although soft skills, such as leadership and excitementsupported by culture – are recognized as success factors for digital transformations, research has shown that these factors often receive insufficient attention [20].

Theory

Equinor has had a prevalent focus on technology and efficiency improvements to optimize production. However, the digital revolution is indeed cultural, not merely technological. It is vital that the cultural change and excitement is driven from the top down, from the chief executives and the board's leadership. [12]

Organizational culture is a *"set of values, norms, standards for behavior and shared expectations that influence the ways in which individuals, groups and teams interact with each other and cooperate to achieve organizational goals"* [67]. Although the phrase "Organisational culture eats strategy for breakfast, lunch and dinner" (originated by Peter Drucker, renowned management consultant, and made famous by Mark Fields, former President of Ford) is intentionally hyperbolic, there is some truth to it [68]. Accordingly is it beneficial for firms to shape and encourage an organizational culture that is relevant for the digital age. Liri Andersson and Ludo van der Heyden accentuate the importance of a digital culture to be: agile, transparent, authentic, exploitative, and people-centric. Further, they highlight the importance of a learning culture that challenges assumptions. Compared to traditional organizational cultures, a learning culture will be more collaborative and less hierarchical. [12]

Analysis

To get an overall understanding of the culture in Equinor and determine if the *digital-enabling culture traits*, described in the theory section above, are prevalent. Trough the interviews, a description of the general culture and a digital specific description of the culture was queried. Firstly, an open question about the culture was asked, to get an as unbiased measurable as possible, then a more digitalization-specific was asked for.

G4.1: DESCRIPTION OF CULTURE

As described in the theory above, a few culture traits are important when it comes to digitalization. it is suggested that a thriving digital culture should be: agile, transparent, authentic, exploitative and people-centric (4.4, para.3)

G4.1.1: The culture is not transparent nor exploitative enough and too people-centric.

EXPLANATION & CAUSES:
After interviewing personnel working with strategy, at different hierarchical levels, it was made clear that the culture was too people-centric additionally, not transparent, exploitative, nor agile enough (4.4, para.3). As explained in section 2.1.3, the whole industry is to people-centric and Equinor is no exception. E.g., in regards to administrative digitalization: Equinor prioritizes manual labor over automation and use manual workarounds or disparate small systems where relatively easy automation solutions could solve the problem. This also demonstrates a lack of exploitativeness because they do not use the best available solution.

Transparency issues are highlighted in the collaboration guideline (4.5) . Another problem highlighted by the interviews was: that projects did not utilize an iterative approach, and lessons learned where not transferred, rather forgotten. When working on a new digital initiative, much work is done in the scoping and planning phase, but after the output, often a report, is completed the project is closed and no updates or iterations are done to the initiative {4}. Causing the initiative to be outdated faster than necessary, and the lessons learned are not exploited further.

EFFECTS:
The effects of lacking agility and exploitativeness are jointly dependent. Because a lack of agility often results in projects not being fully exploited. When an initiative is not implemented across the organization, they are not utilized to the fullest, resulting in potential value being unexploited. Both these culture traits, or lack thereof, results in a loss of knowledge transfer.

SUGGESTIONS:
A review of the projects models used, combined with better cross-department collaboration, would help these problems. A more agile approach, with a focus on knowledge transfer at the end of the projects, would help. A suggestion would be to invest in a more sustainable and user-friendly database to increase transparency, agility, and exploitativeness. The current DCoE and Fusion program are

two initiatives that have the potential to meet these needs.

G4.2 DIGITALIZATION-ENABLING CULTURE TRAITS

G4.2.1: Historically good at technology R&D, but still fundamentally conservative.

EXPLANATION:
As described in section 1.3, Equinor was an early digitalization adapter within the industry and are at the forefront of offshore technology advancements. The nature and dangers of the industry have also made a cultural history of putting security and safety first. This safety-first approach has naturally enabled a conservative culture {2,4}. Two of Equinor's four values are "Caring" and "Courageous" (1.3, para.7). The balancing of these two values is currently being figured out when it comes to Equinor's current digitalization strategy. Some interview subjects stated that Equinor is too conservative {1,4}, while others stated they were sensible and sustainable {2,3}, concerning digitalization.

CAUSES & EFFECTS:
There are multiple causes for the conservatism in relation to safety. Historically the O&G offshore industry has been considered hazardous, understandably, is this an important area of focus for Equinor. Equinor has a vision of zero harm, and are working hard towards their goal. This is made clear by an almost 70% decrease in Serious Incident Frequency (SIF), since 2009 [19]. The conservatism affects the culture as well. From the interviews, it was revealed that Equinor has a culture for "No mistakes permitted." This disincentivizes the "fail-fast" culture that digitally advanced companies have embraced, see chapter 2.1.3.

SUGGESTIONS:
Equinor has a clear focus on safety. In alignment can digitalization be used as a driver for safety. Safety has improved by the utilization of ROVs (Remotely Operated Vehicle) instead of divers and will be improved by unmanned platforms, in the near future {2,4} [69]. Reducing risks of diving complications and reducing risks associated with helicopter flights by reducing worker transportation.

Guideline 4 Insights

Identifying and promoting the right organizational culture is key, to enhance the digitalization process and find the right strategy for the firm. Organizational culture can be interpreted in multiple ways, but as defined in this thesis (see 4.4, para.3), some cultural traits are more beneficial than others. It is accentuated that a digital culture needs to be: agile, transparent, authentic, exploitative and people-centric (4.4, para.3). Contradictory, is the industry deemed too people-centric (2.1.3, para.6), and the analysis show that Equinor is no exception. The analysis also revealed that Equinor is conservative and not exploitative enough. The conservatism stems from a natural safety focus relating to the hazardous working environment on offshore oil-rigs. The lack of exploitativeness comes from a not agile enough project management inhibiting knowledge transfer. However, the analysis also showed that Equinor has an enabling culture for technology R&D and implantation. Thus, learning from that culture could improve the lagging digitalization enabling culture. By taking more advantage of Equinor's DCoE and letting digitalization increase the safety in a modern way to align digitalization with Equinor's core values.

4.5 Digitalization Demands a Greater Level of Collaboration.

In today's accelerating digitalized market value creation can no longer be linear or ad hoc. To succeed businesses require a constant; sharing of information; assessment of opportunities; review and realignment of needs – to continuously reformulate their strategy. This can only be accomplished through continuous, transparent collaboration within the organization and with suppliers across the supply chain. [12]

Theory

Grand organization like Equinor are divided into organizational departments, for structure and overview. However, *silos* can then easily occur, inhibiting cross-functional collaboration. Unlike the silos farmers use to separate grain, organizational silos can be more like different countries. Within the organization, employees within different departments often use a different vocabulary and have a different work culture. If the department borders become too rigid, cross-department collaboration will stop, and a "Us vs. Them" mentality will arise. To combat this natural tribalism, efforts need to be put in place [70].

One effort to break down silos can be a common goal, such as digitalization. Like Vijay Govindarajan from the Harvard Business Review: "Innovation is the Trojan Horse that can be sent in to break down silos" [71]. Innovation can only happen if leaders embrace change. Leaders need to create a compelling case for digitalization and next aligned a strategic agenda for further innovation [71]. This follows fully in line with the principal about digital transformation, in section 2.1.2. Furthermore, digitalization demands a greater level of collaboration throughout the supply chain.

As mentioned in 2.1.3, is *Circular collaborative ecosystems* mentioned as one of the four themes that are central to the digital transformation of Oil and Gas over the next decade. Highlighted advantages are: providing operational transparency, fast tracing innovation, reducing costs. This is accomplished by building integrated digital platforms, where Oil and Gas companies can communicate with vendors and the wider society. This will create transparency and connecting "communities of interest" across the industry in order to have cross-company experts improve designs and innovate faster in a mutually beneficial way. [3]

Figure 4.4: Circular collaborative ecosystems [3]

When the oil price dropped in 2014, a group of North Sea oil and gas companies collaborated to reduce cost. Their collaboration resulted in reduced lead times and inventory costs. The group of companies created a shared online trading platform for managing spare part and tools. The platform organized a pool of spares, from nuts and screws to compressors and values, cataloging more than 200,000 parts. This cut lead time and inventory costs by sharing a common platform and warehouse. [72]

Another way digitalization will enhance collaboration is through smart contracts, which utilizes blockchain technology. Smart contracts allow for direct transactions that are secure, transparent, in near real time and do so at a lower cost for all parties. The contracts are secure and transparent because they allow data and value to be transferred on a distributed network that, runs records and compares multiple copies of securely encrypted transactions. The blockchain technology is complex in its technicalities. However, what makes it secure is the fact that no single machine contains all the information, rather all machines connected to the network have all the information. So in order to gain control of the system and make false transactions; the hacker has to have more computing power than the combined network, which is infeasible on today's smart contract platforms, such as Ethereum.

At the present time, organizing the development of an oilfield or platform is a complex task which requires many labor-hours. The complexity stems from the sourcing of thousands of parts from hundreds of suppliers. This creates intricacies that are hard to manage, such as; tracking risks and responsibilities; and complications exchanging data at the right time to the right people. In the same manner, can the tracking of money flow also be strenuous, increasing the risk of corruption and financial mistakes. Smart contracts solve all these problems. These contracts are built on the blockchain technology, which makes them autonomous, in real time, transparent and secure. Smart contracts track contractual obligations and responsibilities and automatically release funds when the obligations are met, cre-

ating an autonomous flow of money.

Already in 2017 started Equinor testing smart contracts as a mean of improving energy trade efficiency: *"Shaving off the mystique surrounding blockchain technology, the goal is to move away from cumbersome paper-heavy processes to a platform with secure smart contracts and authenticated transfers of electronic documents. In short, digitalizing operations in energy trading can make it a quicker, cheaper and more secure process."* [73]

A joint effort initiated by Equinor, Shell, and BP using Vakt, a blockchain designed to cater to the energy trading in the industry, went live in late 2018 and since has more industry leaders joined the platform [74]. The project has so far been a success, in the future, it would be beneficial to implement this blockchain expertise into more smart contracts which would digitally transform the administrative side.

Analysis

Since *digitalization demands a greater level of collaboration*, the interviews tried to uncover the state to the collaboration across functions and departments, internally, and with suppliers, externally.

G5.1: Cross-functional collaboration

G5.1.1: Internal collaboration can seem somewhat random and subject to silo-structures.

Explanation:
Collaboration across functions and departments can be challenging in large corporations, and silos structures can easily occur (4.5, para.1). This is generally the case for Equinor as well, particularly when it comes to administrative work. Conversely, the subjects interviewed currently working on implementation projects, so-called joint efforts, seemed to be happy with the collaboration. Because their project model is closer to a *matrix organizational structure*, with collaborators from diverse departments and functions {2,5,6}. Differently, digitalization initiatives were described as randomly put together, employees with special interest come together on their own initiative {1,3,4}.

Causes:
Silo structures can easily occur when structuring grand organizations (4.5, para.2). Today's digitalization collaboration is suffering from a lack of overarching strategy

and direction. This originates from the developing digital competencies of the executives (4.3). The Digital Center of Excellence (DCoE) was to created to improve collaboration, but as described in section 4.2, the DCoE guidelines predominantly focuses on the production side of Equinor's operations. This might be one of the causes for why collaboration seems to work better on the production side, rather than the administrative side.

EFFECTS:
A production-focused DCoE, has resulted in lagging administrative collaboration. Additionally, are the individual projects affected by the choice of project model. The workers within a matrix structured project collaborate better because they are put in teams with a common goal, as described in (4.5, para.3)

SUGGESTIONS:
Therefore, might a suggestion be to learn from the project model and create teams with collaborators from various positions to further the common goal of improving the administrative digitalization. One way of promoting this is to create more *integrated business cases* {4}. An integrated business case is put together of actors from different departments with different technical skills. Another way to prompt collaboration is through transparent data-sharing, such as the Fusion project that is currently being developed (4.3, para 5)). When transparency is increased, is it easier to see what others are working on and accordingly easier to collaborate and make use of best-practices. If the Fusion program is successful, and the DCoE brings digital administration under its scope, cross-functional collaboration has the potential to increase significantly.

G5.2: COLLABORATION WITH SUPPLIERS The O&G industry is greatly dependent on its whole supply chain (4.1, para.1). Therefore is good communication and collaboration with suppliers key (4.5, para.1).

G5.2.1: Digitalization incentives differ significantly across the supply chain, nonetheless developments are being made.

EXPLANATION:
The digital transformation of the O&G industry calls for circular collaboration ecosystems (4.5, para.4). However, to achieve this, the different incentives for doing so needs to be examined. Throughout the supply chain, the incentives are very different. Nonetheless, a new deal or collaboration effort are being made with one of Equinor's bigger suppliers to sort out these incentives {4}.

CAUSES:
The main restrictive cause for collaboration with suppliers, is the suppliers fear of sensitive information getting to their competitors. This leads to a reluctance to have a transparent data sharing with Equinor. Additionally, are the supplier's incentives stacked against a transparent and automatic data sharing solution. The suppliers are getting paid an hourly fee for each hour of manually typing their data from their systems onto a PDF. So an automated solution would in the short term hurt them financially.

EFFECTS:
The effects of manually transferring data are costly for Equinor. They first have to pay the hourly fee to the suppliers, then pay their own employees to transfer the data from the PDF onto their own systems.

SUGGESTIONS:
A transparent data sharing solution would solve these challenges in an instant. An understanding of the supplier's incentives is needed. In order to convince the suppliers that they might lose financially in the short term, but in the long run they both benefit from digitalization. Because, a lowering of cost for Equinor would make other currently unfeasible reservoirs, feasible, resulting in more work for all. The Fusion program discussed in (4.3, para.5) has the potential to solve the data sharing issues. Smart contracts as discussed in (4.5, para.6) has the potential to solve the insufficient collaboration with external suppliers.

Guideline 5 Insights

Digitalization demands greater collaboration throughout the supply chain and across business functions. The industry has shown potential for collaboration between the big actors with initiatives like Vakt (4.5, para.9) and the shared on-line trading platform (4.5, para.5). However, incentives throughout the supply chain still need to be addressed (G5.2). Internally are Equinor still subject to silo-structures and collaboration around new digitalization initiatives can seem somewhat random (G5.1). However, if the Fusion program (4.3, para.5) is successful and the DCoE (4.2, para.2) brings digital administration under its scope, cross-functional collaboration has the potential to increase significantly. The Fusion program is also designed to improve collaboration with suppliers. Smart contracts could also solve some of the external supply chain related collaboration issues (4.5, para.6). The interviews affirmed that collaboration is a key focus area for Equinor and improving collaboration both externally and internally is extensively worked towards. If the suggested initiatives come to fruition, then collaboration on all fronts has the potential to improve greatly.

Strategy

4.6 Business Strategy in the Digital Age Becomes a Continuous Process.

Building on what is already discussed, in subsection 2.2.2 about business strategy being a continuous process, not just a linear process with a final product. About continuity of business strategy has become increasingly more important recently, because of a faster paced, dynamic market. Previously, organizations and top management had a generous window of time to formulate a strategy. However, the impact of digital is changing both the time frame and the acceleration, of the business reality faced. In order to adapt to these changes, Andersson and Van der Heyden suggest some distinctive areas of improvements.

Theory

Liri Andersson and Ludo van der Heyden [12], suggest that boards and executives in the digital age would benefit from adapting strategy development as follows:

- **Constant engagement.** As discussed in section 2.2.2,When formulating a strategy boards have to have a continuous engagement with executives and key personnel, not just one-off contact every so often.

- **A continuous process.** An agile, iterative, process has to be the new way to formulate strategy, where progress is steadily followed up by analysis and decisive decision making has to be idolized in the validation or rejection process.

- **A wide and impartial understanding.** As discussed in section 4.1, an unbiased and solid understanding of the ever-evolving environment is necessary for a quality strategy definition.

- **The merger of formulation and execution** As discussed in section 4.2, prior strategy processes had the leisure of defining, then selecting, then communicating and then finally monitor the executing of a strategy, in different distinctive stages. However, modern strategy formulation must scan, evaluate, formulate, and implement in a more continuous and sometimes simultaneous fashion.

- **Collaboration across hierarchical levels.** As discussed in section 4.5, the best suggestions for improvements might come from the workers at a lower hierarchical level in the organizations because they work hands-on with

the problem. Then it is the top management's job to secure a free flow of information up the hierarchical ladder and productively manage these ideas, which is easier for them to do because they have a fuller understanding of the organizations needs.

- **Digital enabling of all aspects of the business strategy.** As discussed throughout the thesis, a way of positioning the company to quickly implement new and effective technologies, instead of lagging behind, is to embroil the digital into the core business strategy. If the overall business strategy incentives a consistent digital evolvement, the organization is well-equipped to utilize new technology and to do so faster then the compaction.

As Andersson and Heyden point out: agile project management is essential in a thriving digital culture. Simply put, agile project management (APM) is a project management life cycle (PMLC) that is beneficial to use when managing projects whose goals are clearly specified but whose solutions are not, at the beginning of the project. APM is beneficial to use in; complex projects; and in projects that demand a dynamic management approach. Because APM continuously adapts to the changing project and environment. [9]
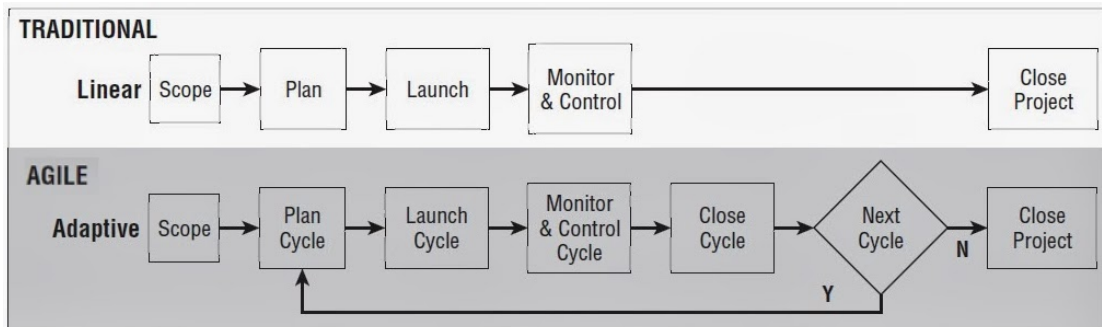

Figure 4.5: Traditional & Agile Project Management Life Cycles [9],

In the fast-paced environment digitalization is currently in, the traditional approach to PMLC is not viable. A strategy is about selecting a direction, without a specific goal, and then updating this course consistently in correspondence with the changing environment [75]. In figure 4.5, we see that the linear traditional project management life cycle ends abruptly. However, Andersson & Hyden, Wysocki and Grant suggest that a agile PMLC is beneficial in digitalization efforts [9, 20, 75]. This is because the agile PMLC offer an iterative approach with cycles to update the current strategy in line with the dynamic environment.

Analysis

As discussed in the theory above, has the digital age a radically shorter time frame for controlling and updating strategy. Thereby calling for an iterative approach to strategy, with frequent follow-ups and alterations. In order to figure out if Equinor's approach t strategy had changed with the digital age: two measurables where selected. The time frame for the digital transformation and the level of project follow up.

G6.1: TIME FRAME FOR DIGITALIZATION

This measurable was established to control if Equinor had a concrete goal for their digitalization efforts, with a concrete time frame.

G6.1.1: Equinor's time frame for digitalization is regarded as long-term, with increasing uncertainty.

EXPLANATION:
All the interview subjects agreed that Equinor time frame for digitalization was regarded as long-term, with no clear goal. In the short term, however, Equinor has a detailed road map for the digital endeavors {2}, which is reasonably specific until 2022, but not after.

CAUSES:
Digitalization is uncertain in the long run by definition. New technology is often emerging, with the potential to drastically change the present environment. Consequentially is the digital road paved as we go. Another cause for Equinor's long and uncertain time frame are their fail fast-adverseness and a perfectionist attitude {4}, (2.1.3). Resulting in a more episodically rather than a continuous process (2.2.2, para 2). Because developments are expected to be perfect on the first iteration. This inhibits a agile PMLC and looks more like a traditional PMLC (4.6, para 3 & Figure 4.5).

EFFECTS:
An uncertain future affects the direction of the overarching digitalization strategy or lack thereof. This, in turn, makes the initiatives put in place seem haphazardly or at least makes employees question the future. A lack of direction and a uncertainty in the overarching strategy is disrupting the culture and the moral (2.2.2 & 4.4).

SUGGESTIONS:
Time frames for deciding on strategic directions are shirking, in the current accelerating digital environment. Strategic plans spanning up to five years are a luxury of the past. Shorter, more agile project models are a necessity in today's market environment. To navigate in this shrinking time frame a more rigid overarching strategy with a clear direction to lessen insecurity is necessary.

G6.2: LEVEL OF PROJECT FOLLOW-UP

Continuity of business strategy has become increasingly more important recently,because of a faster paced, dynamic market (4.6, para.1).

G6.2.1: Project continuity, follow-ups, and spread of best-practice are now being prioritized.

EXPLANATION:
Prior digitalization endeavors were often not followed nor implemented across the organization. One interviewee described the implementation of new digitalization initiatives as "provide and pray" {2}. Multiple interview subjects mentioned that Equinor has learned from this prior mistake {1,2,3,4}. Nowadays, there is predominantly more focus on following up projects, and a more continuous approach is utilized.

CAUSES:
The lack of collaboration, as mentioned in section 4.5, made it difficult for new initiatives to be known, spread, and implemented across departments. In the cases where they got implemented in other departments, the knowledge transfer was too poor. Thus, when a new initiative reached a new department, the best-practice did not get transferred with it. Another cause for the lack of project continuity and spread of best-practice is time constraints. Because of the recent boost in oil prices and feasible projects has the company been preoccupied with other endeavors {4}.

EFFECTS:
The lack of transparency and spread of best-practice, lead to a sea of specialized IT-tools unused and unknown to most employees {1,4}. The recent boost in available projects has downplayed the importance of digitalization upgrades. Naturally resulting in a project-prioritization of resources, instead of allocating resources to digitalization, upgrading, and optimizing.

Suggestions:

An increase in collaboration would greatly improve the spread of best practise and the continuity of projects (4.5, para.1). Furthermore, investing in effectivization such as digitalization should be done in financial downturns, when activity is low and time constraints are lessened. However, investing in downturns might be beneficial, but there are associated risks, which might not align with Equinor's risk-averse nature.

Guideline 6 Insights

The impact of digitalization in a accelerating, dynamic environment has changed the time frame for strategy. Trends and new technologies are arriving at a advanced rate, generating numerous strategic choices, while the time frame for deicing-making is shrinking. Equinor's time frame for digitalization is regarded a long-term, with reasonably specific goals til 2022, but with increasing uncertainty (G6.1). Prior digitalization endeavors were implemented in a "provide and pray" fashion, with little to no follow-ups on the project, implementation, nor spread (G6.2). The analysis pinpointed multiple causes, such as: a lack of collaboration and current time constraints. Suggested solutions are a shorter, more agile project models, combined with a clear overarching strategy. A revision of project models, a clear direction combined with the collaboration suggestions discussed in section 4.5 would greatly help the business strategy to become more of a continuous process.

4.7 Decision-Making in the Digital Age is Increasingly Data-Driven.

Theory

Data-driven decision making is beneficial in all part of the organization. In Equinor, for example, their digital road map (see section 4.2) emphasizes the need for data-driven operations. Where production optimization and maintenance improvements are used to maximize assets value through IOT-technology. Big data analytics is feasible since the sensor technology has developed quickly, simultaneously as the price has dropped. In maintenance optimization, the idea is that a wast net of sensors send information to a computer that utilizes machine learning to predict exactly when maintenance is optimal, so maintenance is not done too early, or even worse, too late. Likewise, is the use of data-driven decision-making beneficial in the administrative side of the organization. [18]

As we read in section 4.2, have Equinor collected more than 26 petabytes of data form their oil-rigs. However, data collection on the administrative side cannot be achieved on the same scale. Nonetheless, data-driven decisions can help managers decide on the basis of evidence rather than intuition. For that reason, it has the potential to revolutionize the administrative decision-making as well. [76]

For an administrative decision-making transformation to be possible, a reconsideration of the decision-making process is needed, both how decisions are made and who makes them. In traditional companies, data is often scarce. Resulting in decisions being made depending on intuition and experience. With a correlation between the importance of the issue and the rank of the decision maker. In the big data community, this phenomenon is recognized as "HiPPO" – the highest paid person's opinion [76]. In order for companies to let evidence, rather than intuition, decide, a thorough understanding of data, data collection, and data analysis is needed thought the company, to examine and challenges decisions. [76]

Top-management decision making needs to be updated, as well. The traditional, static, executive summary based decision making needs to be transformed with the digital. In the new business reality, top management decision making has now the opportunity to draw insights from the analysis of networked, interdependent, and complex information patterns – in near real time. The use of big data and increasingly smart algorithms allows for fast processing of complex information to facilitate decision-making in a data-driven way [12].

The emergence of new technologies like artificial intelligence has created opportunities to solve problems that previously were believed to be impossible to solve without human interference. In big data analytics, a subset of AI called machine learning and data mining are the most applicable. Machine learning can be divided into two parts, unsupervised and supervised. Supervised learning utilizes given historical data to train an algorithm over and over again, simulating a vast amount of iterations, in order to predict an outcome. Unsupervised learning utilizes the same procedure, but this time, the learning sequence optimize against a given output to predict against.

Equinor has collected an enormous amount of data. In order to analyze this amount of data, machine learning techniques have to be applied. By utilizing advanced analytics; precise models can help identify profitable opportunities and avoid risks. Industry applications for machine learning include; predicting failure of sensors; analyzing hydrocarbons in the ground; and exploring new energy sources. [3]

Analysis

An oil rig generates petabytes of data ((2.1.3, para.2), that can be used for decision making such as optimization and maintenance scheduling. However, data for decision making on the administrative side is slightly harder to obtain. Nonetheless is a data-driven decision-making process important in the digital age. To gain insights on the decision process, three measurables where established:

G7.1: GROUNDS FOR DECISION-MAKING

This measurable is trying to consider if enough data is collected if the data is relevant and if the data is stored, shared, and utilized in an accessible way.

G7.1.1: Business cases are used for decision making throughout the company, most are content with it, some say it is not optimal for innovative work.

EXPLANATION & CAUSES:
A business case is a formal, structured, and analytical method to present whether or not a project should be initiated. A business case tries to quantify parameters, by estimation, and include intangible characteristics, such as employee satisfaction. Business cases have been the norm for a while in Equinor, for all kind of decision making. The interview sample was practically split in half on the satisfaction of business cases in new digitalization efforts.

EFFECTS:
Some expressed that the business case was not effective when it comes to new digitalization efforts, because the effects are hard to estimate {2}. Other, more senior, personnel were happy with it and thought it was beneficial to approximate estimations since an educated guess is better than nothing.

G7.2: DATA COLLECTION & PROCESSING

G7.2.1: A large amount of data is collected, so big data analytics can advance.

EXPLANATION:
The petabytes of data collected are from the production side, is an enormous amount of data. However, big data analytics at Equinor are in the initial phase. Big data has recently been given a lot of attention and resources lately. One interview subject, working close to the big data initiative, explained: "You have to collect the data before you can analyze it" {2}. That is why recent efforts have been focusing on collecting the data, until now, when Equinor is ready to begin the big data analytics on a large scale.

EFFECTS:
By utilizing advanced analytics; precise models can help identify profitable opportunities and avoid risks. Big Data analysis could examine overall workflow, find pain-points in the value-chain, and improve on these. Most of the interviewees had confidence that the big data analytics initiative would be fruitful {1,2,3,4}.

SUGGESTIONS:
When the operational big data analytics have become fruitful, lessons learned can spill over to the administrative side and thereby promoting a more data-driven decision-making process there as well. By, for example, analyzing labor-hours saved when going from manually transcription work to an automated cloud solution.

G7.3: DATA UTILIZATION & TRANSLATION

G7.3.1: Data is not always processed and translated in the best way.

EXPLANATION:
Form the interviews; the participants seemed content with the amount of relevant data at their disposal, before a decision {2,3,4}. However, some suggested that the data was not translated and presented in the best way possible, often too technical or to abstract {1}. Insufficient description of the desired outcome can deprive the initiatives of understanding and enthusiasm.

CAUSES:
A lack of beneficial soft skills seems to be a major cause for the lack of excitement around the digitalization initiatives {1}. As described in section (2.2.2, para.5) the right soft skills are essential for change-agents to have. The change-agents have to communicate their enthusiasm and motivation for the project (2.2.2, para 5).

EFFECTS & SUGGESTIONS::
A lack of these beneficial soft-skills can cost Equinor valuable digitalization opportunities. Therefore, is it important to be aware of the tendency that technically inclined employees not always have the need soft-skills; and take this under consideration when evaluating a new project, or invest in improving these skills.

Guideline 7 Insights

In order for organizations to keep up with an increasingly digital environment, their decision-making has to be increasingly data-driven, to set the appropriate direction and strategy. Equinor has a company-wide decision-making process of utilizing business cases. Most employees are content with this, but others say it is not optimal for innovative work (G7.1). Equinor has begun the data collection process. The DCoE has collected over 26 petabytes of operational data from the offshore rigs. Data collection is fundamental for big data analytics to begin. Big data analytics are a priority at Equinor, and resources are invested thereafter (G7.2). Some interviews suggested that the desired outcome, of digitalization initiatives, was not translated well enough up the hierarchical chain (G7.3). The suggested causes for this was a lack of needed soft skills, discussed in section 2.2.2. Equinor's data-driven decision-making has so far concerned operational data. When operational big data analytics have become fruitful, lessons learned can spill over and get utilized on the administrative side as well, to help guide the overarching digitalization strategy.

4.8 Digitalization Requires Firms to Enter Uncharted Territories.

Theory

There is a consensus that a firm should focus on playing to its strengths and exploit its core business competencies. However, now more then ever, because of a fast-pasted globalized market, innovation and exploration of new business models and revenue streams are more important than before to stay in and stay relevant in a market. The consequences of failing to do so are well documented in case studies of companies like Kodak, Nokia, and Ericsson. These cases are common in most MBA programs, and they highlight the possibility for insolvency when innovation and adaptation have failed. In order to cope with the uncharted territories of the digital revolution; organizations must move from the traditional to a learning organization (see section 2.2.2. Google has harnessed the power of a learning culture, they even deliberately look for curious learners in their hiring process, thus fostering a culture of continuous learning to an organizational level. Indubitably, is this one of the factors driving Google to be one of the worlds most influential organizations and other organizations could learn from their attainments. [77]

For an organization to become digitally mature, risk-taking has to become a cultural norm. Digitally mature companies are more at ease taking risks than their less digitally mature peers [2]. They consider failure a part of innovation and encourage employees to make this necessary prerequisite for digitalization. The oil industry has a hazardous history, where risks can result in fatalities. This has prompted the industry to be more risk-averse than other sectors.

Since the oil & gas industry is lagging when it comes to digitalization, a more radical transformation is required to catch up. A radical transformation requires a organization to be comfortable taking risks. Such large scale radical changes are called Kaikaku, in Lean, the Japanese word for "radical improvement". The opposing term being Kaizen, meaning " continuous incremental improvement." [10]
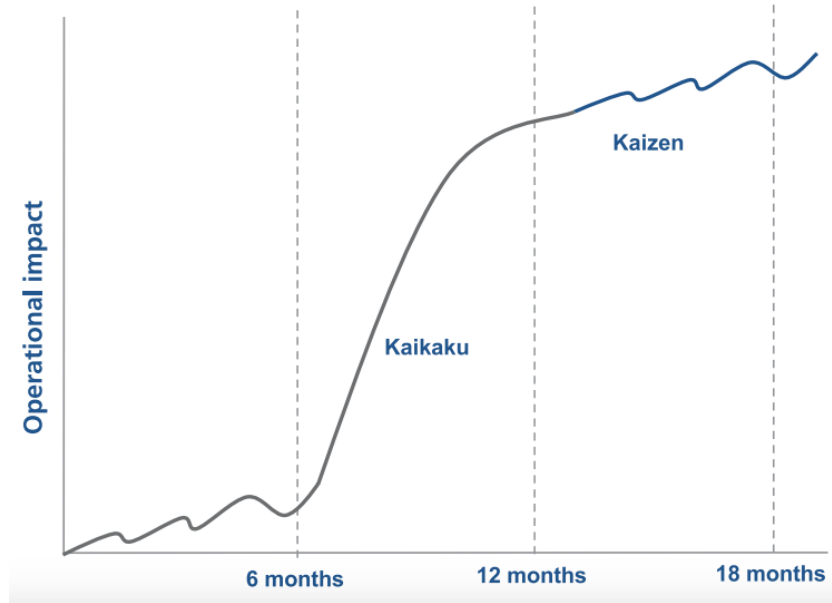
Figure 4.6: Visualization of Kaikaku vs Kaizen. Operational impact over time. [10]

For a company to avoid marginalization they have to reinvent themselves consistently. Figure 4.6, illustrates how both Kaizen and Kaikaku can be utilized in a combination. A period of radical change followed by a period of more continuous improvements. This model was pioneered by Taichii Ohno, the originator of the Lean model at Toyota, where he experienced success with this combination model. [10]

Analysis

In the context of digital, what it means for firms to enter uncharted territories, are the risks associated with innovation and innovation-implantation. Thus, these are the measurables for this guideline. As explained in the theory above, a company will become redundant if it does not invest in R&D internally, or risk to implement new initiatives derived externally.

G8.1: COMMITMENT TO INNOVATION AND IMPLEMENTATION

As mentioned in section 4.2, the globalized market structure has accelerated the pace of innovation. The global connectivity makes ideas travel at the speed of the internet. Which makes the spread of best-practice faster than ever, but at the same time makes for a flood of information, so it can be difficult to sort out the best-practices suited for the company's environment. That is why it is important

for large organization to have an up-to-date R&D department. Additionally, the innovation front runner position is favorable because, the primary implementers; have the most to gain.

G8.1.1: Committed to innovation, but the time and certain competencies are limiting implementation.

EXPLANATION:
Equinor has a culture for technologically innovation (1.3, para.6). They have long been the front runner in off-shore technologies, but they are lagging when it comes to administrative digitalization (1.3, para.6). However, have their commitment to administrative digitalization has recently been reinforced {2}.

CAUSES:
There are multiple causes for this: as discussed in section 4.4 are Equinor not exploitative enough. The best-practice is not implemented across departments. One interviewee pointed towards an aging workforce, thereby limiting the interest in staying updated on new technologies {1}. Some pointed towards the recent boost in feasible projects, causing resources directed towards innovation to be limited {4}. Lastly, some were satisfied with the R&D, but thought the digitalization approach should be fundamentally changed towards a more revolutionary approach {3}.

EFFECTS:
The whole industry is behind on digitalization (2.1.3, para 1). The effects are that the industry is behind a decade in certain areas, especially administrative digitalization. This makes for a great and feasible improvement opportunities and thereby creating room to gain a competitive advantage.

SUGGESTIONS:
To realize this competitive advantage, a thorough commitment to innovation and implementation is needed. The commitment to innovation is present, but the organization-wide implementation of best-practices have been limited. Through better collaboration and assertive top-management, best-practices can be sorted out and implemented.

G8.2: Willingness to take on risk

The consequences of failing to adapt and innovate are dire (4.8, para.1). Thus, a company has to be willing to take on risk, in order to further their possibilities and maintain or improve, their competitive position.

G8.2.1: The enthusiasm and willingness to take on R&D risk is there and the capabilities are growing.

Explanation:
Historically, has Equinor and the industry been in a relatively comfortable financial situation, with high margins {4}. Therefore has there been no overbearing need to take on risk and innovate {1,3,4}. This changed drastically during the last recession of 2014 and the willingness to innovate increase substantially (1.3, para.3). The enthusiasm and willingness are shown by Equinor's early adaptation of digitalization (1.3, para.4). The interview subjects also pointed out that there has been a thriving digitalization progression of capabilities over the last year {1,2,3,4}.

Effects:
The effects of an early digitalization adoption by Equinor, are that they now are early implementers of digital initiatives. The new Johan Sverdrup oil field is getting substantial digital investing. Initiatives such as a digital twin, big data analytics, and more {2}. These initiatives would not have been possible without the risks associated with the relatively early adoption of digitalization.

Suggestions:
Because of the lack the historically lack of focus on digitalization Equinor's digital impact can be described as Kaizen ((4.8, para.33) for a considerable time 2.1.3. Now however, can the digital impact be categorized as Kaikaku ((4.8, para.3). Nonetheless, the time interval between these periods was too long. As suggested in (4.8, para.4) the sifting Kaikaku/Kaizen time periods should have shorter intervals.

Guideline 8 Insights

In order for a company to continuously update its strategic direction, exploration through continues learning and experimentation are required (Kaizen & Kaikaku). Equinor is committed to innovation, but lack certain competencies and are constrained by time (G8.1). Equinor has a history of being enthusiastic and willing to take on R&D risks when it comes to production. However, when it comes to administrative digitalization their digital impact has been incremental (Kaizen, see fig. 4.6), but later improvements can be described as more radical (Kaikaku, see fig. 4.6) (G8.2). A combination of the two is favorable, but the sifting Kaikaku/Kaizen time periods should have shorter intervals. Another suggestion is that developed innovative solutions should be implemented further, organization-wide. It is important to remember that the O&G industry is hazardous, and some risks result in fatalities. However, the risks discussed under this guideline are related R&D these digitalization initiatives will demand less human interaction, thereby creating a safer production and work environment. Which strengthen Equinor's total strategy – Always safe; high value; low carbon.

4.9 Digitalization is About Continuous Management of Change.

A successful digitalization transformation is more than technology implementation. INSEAD's "The Real Impact of Digital" [20] study revealed that only 12% of the 1,1600 managers, board members, and executives listed technology as a critical success factor for digital transformation. Conversely, was success perceived as being rooted in management and leadership. They called for a focus on culture, management, and people. Ironically, the need for traditional change management is increasingly important for digital transformation. Change management is written extensively in section 2.2.2. [20]

Theory

In today's market, firms who want to sustain and thrive in an ever-changing environment need to evolve past one-off change-management programs and invest more in continuous change. Circumstances have always occurred when a fundamental organizational change was needed. In the past, however, one-off solutions to change-management were the norm. In 2004, for example, Shell's shares priced dropped dramatically because of a government intervened re-estimation of their reserves, which were overstated by 20%. The one-off solution then was to fire their CFO, apologize and cut top-management bonuses. [78, 79]

One-off change management programs may have worked in the past, but in today's fast-paced market; corrections after-the-fact is a costly and unsustainable practice. Digital enablement is a continuous process because once profited from one new technology; a completely different, advantageous technology is emerging. Digitalization can, therefore, not be considered as a one-off change management program. Instead, it must be treated with continuous transformation, with constant testing, learning, and adaptation.

In August of 2018 Deloitte published their global CIO survey [11], establishing guidelines for sustainable change beyond the digital era. This was the third, yearly, global CIO survey, each building on the last. The first survey [21], in 2015, presented three types of value-creating CIOs. This report summarized that no CIO pattern type was superior to the others. Only three years later, exemplifying an enormously fast-paced environment, the 2018 report suggests that the "Trusted operator" CIO type will gradually become obsolete as the digital era progresses. Firstly this shows how fast the business environment changes. Secondly, this corresponds positively to the other points made in this thesis regarding

leadership guidelines. Finally, Equinor's current digitalization strategy praises the "trusted operators" model, by solely focusing on the operational side, instead of transforming the organization to a technology-enabling, learning, strategy focused corporation.
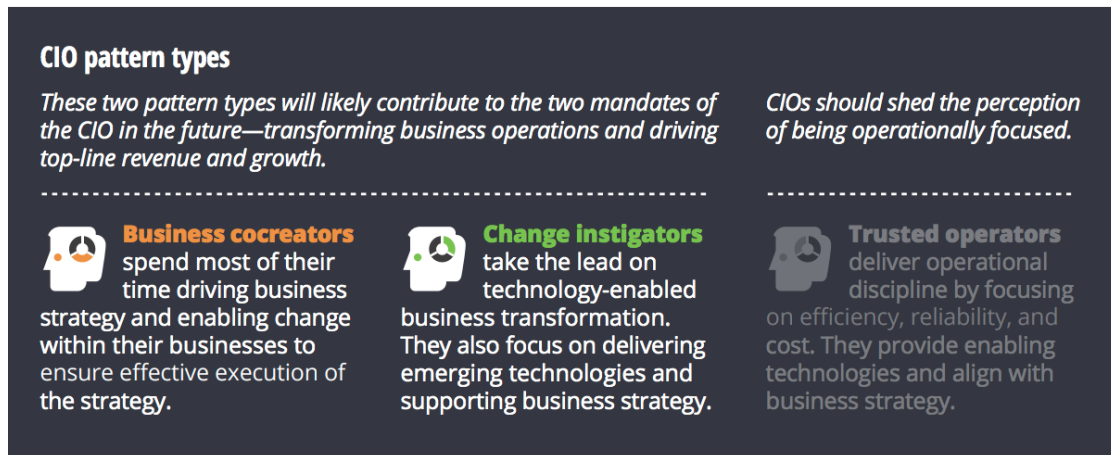

Figure 4.7: CIO value-driving pattern types [11]

Analysis

Today's fast-paced market calls for continuous management of the overarching strategy and direction, through continuous management of change. In order to analyze the management of change we primly begin with measuring the state of the digital project management, then the degree of management engagement and finally, the agility of the overall digitalization strategy.

G9.1: STATE OF DIGITAL PROJECT MANAGEMENT

In order to asses the management of change, firstly the general management of digitalization projects had to be investigated. This was done asking questions about description, development, and coordination of initiatives.

G9.1.1: Good individual initiatives, lack of coordination and spreading of best-practice.

EXPLANATION:
The interviews unveiled that there were plenty of different individual digitalization initiatives developing in different parts of the organization. Such as the Fusion program, the digital twin, and unmanned platforms (G8.2.1), to name a few initia-

tives described in this thesis. At an individual level, these programs are effective. However, a major challenge before has been the coordination of programs and the spreading of them throughout the company.

CAUSES & EFFECTS:
As explained in (G2.1.1), digitalization was only seen as a specialized tool. Causing prior initiatives to solve local problems with specialized solutions. By creating an individual IT-tool for each department, often for similar problems, that did not communicate with each other. The effects of an inability to spread best-practice is a lack of exploitativeness. The specialized programs could have been taken advantage of through the organization, but a lack of communication caused siloing.

SUGGESTIONS:
Better communication organization-wide regarding opportunities and best digital practices would help extensively. The Fusion program, will hopefully assist this problem, by creating transparency throughout the organization. Employees will know what the other departments are working on. Thereby creating shareability of information and data across the company. However, some are still skeptic about this solution, without standardization first {3}.

G9.2: DEGREE OF EXECUTIVE ENGAGEMENT

Multiple competencies are beneficial for a change-leader (2.2.2,para.1), engagement is foundational. Since digitalization is driven from the top (2.2,para.5), executive engagement is pivotal.

G9.2.1: Executives and management are engaged and enthusiastic and technical capabilities are increasing.

EXPLANATION:
All the interview subject agreed that the engagement from the top was present {1,2,3,4,5,6}. Most mentioned that both the digitalization capabilities and the engagement had risen substantially over the last year {1,2}.

CAUSES/EFFECTS:
The main focus, for executives, is for digitalization to increase functionality and secure value realization. Therefore, if the results from a digitalization initiative are somewhat intangible or not completely understood, they can be rejected on a false premise. This again highlights the importance of engagement and technical capabilities of change-leaders.

G9.3: AGILITY OF OVERALL DIGITALIZATION STRATEGY

As explained in section 2.2, it is important for any strategy to have an overall direction and goal. Additionally, it is essential that the overarching strategy is agile and changing with the environment.

G9.3.1: No predominant overarching digitalization strategy.

EXPLANATION:
None of the interview subjects could identify or suggest an overarching digitalization strategy for the company {1,2,3,4,5,6}, suggesting that there is none. When further elaborating some implied that the overarching strategy, was to use digitalization as a tool for effectivization. In the interviews, it was highlighted that Equinor has plenty of digitalization initiatives. However, continuous management of them is missing. Company-wide implementation and an overarching strategy and direction are missing {1,3,4}.

CAUSES:
The main cause for the lack of an overarching strategy is the ambiguity or the misapprehension of digitalization. Since, digitalization was previously seen as a costly, specialized IT-toll and now is seen as a mean of effectivization, there is a difference in definition within the organization. Clearly, it is hard to set a common direction when the definition cannot be agreed upon.

EFFECTS & SUGGESTIONS:
The effects of no overarching strategy in a large organization like Equinor is that multiple initiatives pull the organization's strategy in different directions, when a common direction is needed. A clear, direct, overarching digitalization strategy is needed. Digitalization is treated as a mean for one-off solutions to sub-problems. When really, an overarching continuous transformation is needed.

Guideline 9 Insights

For an organization to capitalize on digitalization, will and ability to change have to be predominant across the organization. The process of continuous change management has to driven from the top. If sustained change-management is achieved, the rewards are enhanced competitive position through unparalleled agility. The continuous management of change has to be driven by an overarching strategy. This is especially true for an overarching digitalization strategy because the environment is notorious for rapid change. Whit this in mind is it surprising that Equinor currently has no overarching strategy for digitalization (<u>G9.3</u>). Equinor has a lot of independent, well off, digitalization initiatives, but no overarching strategy to combined them (<u>G9.1</u>). A determinant for this has been the digital capability level of executives, which has increased substantially over the last year. The needed engagement and enthusiasm has been there continuously (<u>G9.2</u>). As mentioned in 4.5, the digital road is paved as we go, but a direction for strategy is important. As distinguished throughout this thesis, an overarching strategy is detrimental for digitalization.

Chapter 5

Quality of Study

In all types of research, is it essential to show proof of credibility and quality. In this thesis, the quality will be measured by reliability and validity measurements, that often are associated with quantitative research, but can easily be assimilated for qualitative research [50]. To thoroughly assess the quality of the research design, both internal and external reliability and validity, will be addressed in this chapter. Reliability refers to the consistency of a measure of a concept. Validity refers to the integrity of the conclusion.

5.1 External Reliability

External reliability can be described as the degree to which other researchers can replicate the study [50]. This is certainly more straightforward in quantitative research, with numerical analysis, but is possible in qualitative research too. To replicate a study it is beneficial to adopt the social role of the original researcher. This master thesis is by a master student that has gained insight into Equinor's digitalization initiatives through semi-structured interviews, public information, and internal documents. The latter is subject to a Non-Disclosure Agreement (NDA) and can therefore not be published. The interview objects are treated anonymously, to prompt honesty and subjective opinion, thus making it difficult to replicate the exact interviews, unless Equinor and the interviewees themselves approve the distribution of the transcripts. These aspects hinder an identic replication. However, as described in section 3.3, the interview objects were *purposively sampled*, so there is reason to believe that the same results would be achieved if the same criteria were selected for.

Throughout the research, process documentation has been key and done thoroughly. To improve reliability, a database of transcripts, interview guides, audio files was created early in the process and stored electronically. A digital transformation is rapidly evolving, therefore is it important to denote that this study is a snapshot of Equinor's current digitalization process. Thus the replication of this study at a later time would be dependent on the same changes as the organization has gone through its self, in this time. [50]

5.2 Internal Reliability

Internal reliability is a consistency measurement of indicators. Whether the indicators that make up the assessment are consistent with each other. In this thesis, the indicators are the questions asked in the semi-structured interview, and the internal reliability is measured through the consistency of opinions on concepts, derived from the questions. The interview had a wide scope, but where some overlap occurred, the answers were deemed very consistent with the underlying concepts. *Inter-observer consistency*, could be a challenge within qualitative studies with more than one researcher. However, it can be beneficial too. Inter-observer consistency issues arise when multiple authors have conflicting subjective judgments about the same concept. The up-side of this, however, is that the probability of miss-judgments and personal biases-effects are lower. To take advantage of these positive effects, key concepts were discussed with peers, writing comparable digitalization theses, and counselors in Equinor. [50]

5.3 Internal Validity

Internal validity mainly relates to the issue of causality, the relationship between cause and effect. More specifically, internal validity considers whether a causal relationship between two or more variables derives a right conclusion. For example, one can say that the culture is inhibiting the digital transformation. Then, the internal validity raises the question of how confident we are of the causal relationship. The causes described in this thesis are derived from qualitative research, with an interpretive approach, meaning that transcripts and the literature are the sources of the connection between cause and observation. The conclusions are perceived truths and should not be seen as absolute truths since they are subjected to subjective interpretation. The scope of the thesis limits deep investigation into every observation and causes, thus making the causes in this thesis perceptions rather than absolute truths. [50]

5.4 External Validity

External validity is a measure of whether the findings of the study are applicable and can be generalized beyond the conducted research context. In other words, if the findings in this study are applicable and can be generalized across Equinor and the industry. To reflect on this, a series of questions will be discussed. [50]

Have the right employees been interviewed?

The first research question defines a desire to unravel Equinor's current state of digitalization, across the organization. This entails that interviews with employees from different departments were necessary. A total of 6 interviews where conducted. The fact that Equinor has more than 20,000 employees makes it difficult to interview even a percentage. This highlights the importance of the quality of the actual interview participants. Leaders of digitalization initiatives and top management have a relevant and updated picture of the current state. Conversely, have employees working in the "virtual coalface" a better notion of the genuine need. The observations were repetitive thought the interview process, consistent with internal documents and public information. Therefore, are the author fairly confident that the insights can be generalized across the organization. The findings also correspond consistently with issues in the industry, suggesting that the findings can be applicable at an industry level also.

Have enough interviews been conducted?
Semi-structured qualitative interviews generate a vast amount of data and require a large amount of processing work. This combined with time constraints limits the number of interviews. The author initially wanted as many interviews as possible, but there is a point of saturation, as suggested by the repetitive nature of the interview answers. The number of interviews in qualitative research is heavily debated in the literature [80]. However, anywhere from 4-12 is good enough [80]. The number of interviews can always be subject to scrutiny. Having mentioned that, the author is confident that the research has synthesized trustworthy insights, based on the nature of the interpretivist approach and the purposive sampling. However, on certain topics there where inconsistent responses, resulting in insufficient measurables; thus, some insights were deemed inconclusive, therefore not discussed nor used.

Have the right questions been asked?
During the defining of the research questions, it became clear that there where ambiguity to the terms central to this thesis, terms like digitalization and digital transformation. Therefore, to reduce ambiguity, the interview guide begins by asking the participant to define digitalization. Other concepts, like culture, where defined in the question itself. Other concepts were deliberately avoided because of ambiguity. The semi-structured form also allows for angling and tailoring the questions depending on the interviewee's background and expertise. The interview guide started out with about 30 questions but was concentrated down to a concentrated 12 questions, with complementary follow-up questions, that were asked if needed A. The concentration process consisted of reducing and reformulating overlapping questions and selecting the most relevant.

Have the research questions been answered?
Research Question 1 was answered by conducting a qualitative analysis based on the semi-structured interviews. The analysis resulted in a snapshot of Equinor's current state of digitalization. Research Question 2 was answered through analysis of the RQ1 findings in relation to preliminary theory presented in chapter 2 and guideline relevant theory in chapter 4. For the reader's ease and convenience, the most relevant theory was placed under each respective guideline, with a summary of the relevant analysis findings, called insights.

Can the results been quantified?
The quantification of the results in this thesis has been subjected to limitation by the grand scope of the thesis. Initially, a value-at-stake analysis on the planed thesis timeline, this would help quantify the benefits of a rapid digital transformation, but time and other resources were cut short. Topics investigated in this thesis could be master theses on their own, so there is an opportunity for further research.

Summary
Based on these descriptions and reflections, the author is confident that the initially outlined research questions are answered by observing, identifying, and measuring what is sought out. Due to the scope and the research process, the author is also confident that the insights gained can be generalized across the organizations and the industry.

This thesis is a case study of Equinor, however, based on literature, there is good reason to believe that multiple aspects of this study is applicable to companies with similarities to Equinor, both domestically and internationally.

Chapter 6

Conclusion

The main objective of this thesis is to evaluate Equinor's current overarching strategy for digitalization and, thereafter, suggest potential improvements. Additionally, see if the findings are applicable and can be generalized throughout the oil and gas industry. The research was conducted by answering the following research questions:

RQ1: *What is Equinor's current digitalization strategy?*
RQ2: *What efforts can be made to improve Equinor's current digitalization strategy?*

The research questions were answered through a qualitative case study, based on semi-structured interviews with key personnel across multiple digitalization initiatives. The observations made from the interviews are visualized in figure 4 and discussed throughout chapter 4. This analysis is based on preliminary theory in chapter 2 and specific, relevant theory under each guideline. The summarized findings on RQ1 are presented in 6.1 and the summarized findings on RQ2 are presented in 6.2.

6.1   Equinor's Current Digitalization Strategy

In order to measure Equinor's current strategy for digitalization, nine guidelines where established based on relevant literature on directing digitalization [2, 3, 11, 12, 20, 21]. The analysis discovered 21 observations, which are discussed elaborately in Chapter 4, under the following guidelines:

4.1 Digitalization requires an unbiased understanding of the external environment.
4.2 The meaning and impact of digitalization to the firm must be clearly stated.
4.4 Digitalization must be supported by the firm's corporate culture.
4.5 Digitalization demands a greater level of collaboration.
4.6 Business strategy in the digital age becomes a continuous process.
4.7 Decision-making in the digital age is increasingly data-driven.
4.8 Digitalization requires firms to enter uncharted territories.
4.9 Digitalization is about continuous management of change.

The analysis highlighted multiple root causes to Equinor's digitalization problems. Four out of five root causes predominantly caused the adverse observations.

One cause describes the external environment, and four causes describe the current digitalization strategy.

Firstly, the analysis showed that Equinor is subject to the same external forces as the industry (G1.1.1), such as, greater penetration of renewables and a shift in global demand patterns (Fig. 4.1). However, Equinor is doing well, relative to a lagging industry (G1.2.1). Both these observations are a result of the oil and gas industry's interdependence.

Digitalization is interpreted ambiguously in Equinor. The definition of digitalization varies significantly within Equinor (G2.1.1). The interviewees perceived the organization-wide definition as: "something to do with the use of digital tools" (G2.2.1). This outdated view of digitalization is rampant within the organization causing digitalization capabilities to be deprioritized (G3.2.1), contributing to Equinor's administrative digitalization lag (G3.1.1). Though Equinor's culture is perceived as conservative (G4.2.1), the engagement and willingness to invest in production technology is present. The digitalization ambiguity makes it hard for Equinor to set a strategic direction, resulting in a long-term time frame for Equinor's digital transformation, with increasing uncertainty (G6.2.1).

Equinor is insufficiently collaborating internally, across the organization, and externally, with suppliers. The collaboration around new digitalization incentives is perceived as somewhat random and subject to silo-structures (G5.1.1). Key-personnel is driving the digital change efforts, dependent on personal interest, not hierarchical position (G3.3.1). Digital collaboration incentives differ significantly across the supply chain (G5.2.1), resulting in outdated and costly data sharing practices with little transparency. Nevertheless, developments are being made, new initiatives like the data sharing program Fusion (4.3) and the data standardization program JIP (4.3), are currently being developed.

The digitalization governance in Equinor is under development. Executives and management are engaged and enthusiastic, but technical capabilities are currently improving (G9.2.1). Moreover, project continuity, project follow-ups, and spread of best-practice have been somewhat neglected (G6.2.1). Partly because the culture is not transparent nor exploitative enough and too people-centric (G4.1.1). These cultural traits are built on crucial soft skills (G7.3.1), that Equinor's change-agents currently are developing. Both soft skills and hard skills are needed to efficiently translate Equinor's vast amount of data (G7.2.1 & G7.3.1).

Finally, none of the interview subjects could identify or suggest an overarching dig-

italization strategy for the company (G9.3.1), implying that there is none. Equinor has a lot of independent, well off, digitalization initiatives, but no overarching strategy to combine them (G9.1.1). Strategic direction is lacking, and an overarching strategy to govern the independent initiatives is missing, resulting in best-practices being neglected, and lessons learned forgotten. Nevertheless, the enthusiasm and the willingness to take on risk is present, and governance capabilities are currently enhancing (G8.2.1).

The findings correspond consistently with industry literature and strategy literature. Demonstrating that the findings can be applicable at an industry level, as well as to other grand organizations subject to change and digitalization. The generalization across and shareability to other O&G companies are predominantly grounded in that the whole industry is lagging, when it comes to digitalization (1.3). The generalization across and shareability to other large corporations are predominantly grounded in that large organizations often are rigid, subject to silo structures and subject to an accelerating global market (4.5). For further elaboration on the external validity see section 5.4.

6.2 Suggestions to Improve Equinor's Current Digitalization Strategy

In order to improve Equinor's overarching digitalization strategy, relevant suggestions from the literature will be presented to tackle the root causes. Firstly, to handle the digitalization ambiguity, the literature suggests that the meaning and impact of digitalization must be clearly stated (4.2). The analysis showed that the digitalization definition varied significantly, therefore should a unanimous definition organization-wide be enforced. Either the current one or a renewed definition that is consistent with the company's future digitalization strategy should be implemented (4.2). The DCoE and the Digital Road Map formulates Equinor's digitalization impact. However, Equinor's digitalization impact is limited to the operational side of the business, thereby, disregarding the administration side. Digitalization of the administration needs to be brought under the DCoE's scope, and lessons learned from production digitalization should transfer over to administrative digitalization (4.3).

Digitalization ambiguity is one reason for the collaboration insufficiency and the absence of digitalization direction and strategy. In today's accelerating and digitalized market, value creation can no longer be linear or ad hoc (4.5). To succeed businesses require a constant sharing of information, assessment of opportunities,

and realignment of needs – to continuously reformulate their strategy. This can only be accomplished through continuous, transparent collaboration within the organization and with suppliers across the supply-chain (4.5). A Circular Collaborative Ecosystem (CCE), like Fusion (4.3), is needed. CCEs takes use of integrated digital platforms to strengthen the collaboration among ecosystem participants, reducing costs, provide operational transparency, and help fast-track innovation (2.1.3). Another way to break up silos is through smart contracts. Smart contracts utilize blockchain technology to allow for direct transactions that are secure, transparent, and in real time at a low cost (4.5, para.6).

Insufficient collaboration can be improved by developing digitalization governance. Currently, are important governance competencies like transparency, exploitativeness, and project continuity – to spread best-practice – under development. The analysis showed that most of the governance problems could be solved by facilitating for better collaboration and communication (4.5). Firstly, however, must the possible digitalization capabilities be fully understood (4.2). Equinor is missing proper collaborative governance to combine the technology-enabled and the business-enabled.(4.3). Equinor's current digitalization governance praise the "trusted operators" model (4.9), by solely focusing on the operational side, instead of transforming the organization to a technology-enabling, learning, strategy focused corporation. Digitalization cannot be treated as a one-off change management program. Instead, it must be treated with continuous transformation with constant testing, learning, and adaptation (4.9).

The analysis showed that the most adamant digitalization governance concern was the absence of an overarching digitalization strategy. Equinor have plenty of independent, well off digitalization initiatives, but no overarching strategy to combined them (4.9). The digital road is paved as you go, but a direction for the strategy is detrimental. In order for a company to continuously update their strategic direction, exploration through continues learning and experimentation is required (Kaizen & Kaikaku) (4.8). What looks like Equinor's current digitalization strategy, can be described more as operational effectiveness (OE) rather than a strategy. A drive towards OE can turn a blind eye towards the importance of strategy and strategic positioning, resulting in diminishing returns (2.2). Digital strategy drives digital maturity (2.2). Thus, the most fundamental suggestion is to define a clear and sustainable overarching digitalization strategy, in coherence with Equinor's future digitalization objectives, combined with an emphasis to continuously manage it.

81

Chapter 7

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Appendix A

Intervjuguide

Introduskjon

Hei! Igjen, mitt navn er Tore Lundell-Nygjelten, jeg studerer Industriell Økonomi på Universitet i Stavanger og skriver nå en masteroppgave i samarbeid med Equinor. Oppgaven omhandler digitaliserings initiativer i Equinor, mer spesifikk, total-strategien for digitalisering innad i Equinor. Dette intervjuet er en del av flere intervjuer i med nøkkelpersoner i forskjellige avdelinger i Equinor. Hensikten med masteroppgaven, og derav dette intervjuet, er å finne ut av hvordan digitale initiativer blir håndtert nå og om hvordan man kan forbedre total implementeringen av digitale løsninger i Equinor.

Også vil jeg benytte muligheten til å takke for tiden og involveringen i prosjektet, det setter jeg utrolig pris på. Også skal jeg bare informere om at intervjuet er fullstendig anonymt og vil ikke bruke navnet ditt eller noe sensitiv informasjon som kommer ut av dette intervjuet. Intervjuet vil som sagt være en del av flere som vil bli brukt til å finne et gjennomsnittlig bilde på status quo av dagens digitaliserings affærer. Så, desto mer nøyaktige skildringer du forklarer, desto bedre anbefalinger kan jeg komme med på slutten av denne prosessen. Derfor, ber jeg om dine helt ærlige, subjektive meninger under intervjuet. Dette er et semi-strukturert intervju, slik at jeg vil gjenre at du snakker litt rundt spørsmålene om ting du føler er relevant til temaet. Temaene jeg vil gjennomgå er:

- Markedskrefter

- Organisasjonen

- Strategien

Igjen vil jeg understreke betydningen av at svarene er ærlige og subjektive, akkurat slik du føler det. Hvis det er noe du syntes er uklart eller du ville hatt utdypet er det bare å stoppe og spørre, når som helts under intervjuet. Høres det bra ut?

I

#	Spørsmål	Relevanse/Leadership Guideline
1	Kan du være så snill å fortelle litt om deg selv og din rolle i Equinor?	**Generelt**
2	Kan du beskrive hva du personlig mener med begrepet: *digitalisering*?	**G2**
3	Hva oppfatter du at digitalisering betyr i Equinor i dag? *Føler du det er en felles forståelse for begrepet innad i Equinor? (At alle mener det samme med begrepet)*	**G2**
4	I forhold til digitalisering: Hvor tenker du at Equinor står? Hvor oppfatter du at selskapet er langt fremme og hvor oppfatter du at selskapet har en lenger vei å gå? Dersom vi skiller mellom digitalisering og teknologi-utvikling. Altså ser bort i fra teknologiske innovasjon av utstyr og komponenter og heller ser på digitalisering av prosesser, føler du selskapet er langt framme eller at selskapet har en lenger vei å gå? *Sammenlignet med andre selskaper/bransjer?*	**G1/G3**
5	Hva tenker du om ledelsen og digitalisering i Equinor? *Oppfatter du at det er en felles oppfatning av behovet? (innad i ledelsen og gjennom organisasjonen) Hvordan oppfatter du ledelsens sitt engasjement rundt digitalisering? Hvilket ledd i organisasjonen føler du har mest kompetanse på digitalisering?*	**G3/G4**
6	Hvem opplever du at det er som pådrivere av digitaliseringsprosessen i Equinor? *Hvordan får de gjennomslag? Hva oppfatter du er bakgrunnen for Equinor's fokus på digitalisering? Hva er det av ytre faktorer som har påvirket Equinor sin digitaliseringsstrategi?*	**G1/G3**

7	(Nå bytter vi litt tema også vil jeg gjerne høre hvordan du oppfatter kulturen i Equinor.) Kultur er jo mye, for eksempel: verdier, normer, standarder, væremåter, som påvirker mennesker til å nå mål. Dersom du kort skal beskrive kulturen i Equinor i dag (rundt digitalisering) – Hva ville du trekke frem? *Hva er det i Equinor sin kultur som støtter implementeringen av digitalisering og hva kan hindre det slik du ser det?* *Hva vil du si at er Equinor-kulturen sine «sterke» og svake sider i forhold til å tilpasse seg en digital hverdag .*	**G4**
8	Jobbing med strategi er jo en kontinuerlig prosess. Dette vil mest sannsynlig være tilfelle også for Equinor sin digitaliserings strategi. I en stor organisasjon er det alltid en utfordring å sikre endringsvilje og kontinuerlig fokus over tid. Vi kan starte med: Hvordan oppfatter du tidsperspektivet for Equinor sin digitaliseringsprosess? Er det klare initiativer (del-mål) med tidsfrister? Er det 5 årsplaner, 1 årsplaner? Hvordan oppfatter du at det jobbes for å sikre engasjement over tid? Sikre at det blir en kontinuerlig prosess? Sikre tilpassing til endringer i omgivelsene ? *Hvilke utfordringer ser du med å jobbe strategisk over tid?*	**G6/G9**
9	For å evaluere digitaliserings-initiativer må beslutninger tas. Kan du beskrive litt; grunnlaget for beslutninger i Equinor i forhold til digitalisering? *Informasjonen/dataen beslutninger er bygget på?* *Når en beslutnings skal bli tatt, føler du at du har <u>nok</u> data som beslutningsgrunnlag?* *Når en beslutnings skal bli tatt, føler du at den relevante dataen blir <u>brukt</u>?* *Har du noe konkret forslag til hva som kunne vært gjort annerledes.*	**G7**
10	Jeg vil gjerne høre litt om samarbeid, innad i Equinor med dine kollegaer, og utad (med f.eks. kontraktører og rådgivere) Hvordan oppfatter du er samarbeidet på tvers av avdelinger og funksjonaliteter er innad i Equinor? Informasjonsflyten? *-Dialog*	**G3/G5/G7**

	-Data/informasjon Hvordan beveger ider seg igjennom hierarkiet? *Fra bunn til topp?* *Hvordan blir informasjon kommunisert fra topp til bunn?)* Hvor effektivt er samarbeidet med eksterne partnere? *(Informasjonsflyten?* *-Dialog* *-Data/informasjon* *-Kontrakter)* Når det kommer til samarbeid: *Hvor ser du utfordringer og barrierer og hvor er man evt gode?* *Har du noen konkrete forslag til forbedringer/tiltak?*	
11	Dagens markedskrefter skaper stor konkurranse og tvinger selskaper til å tenke nytt og bredt. Føler du Equinor satser nok på nyskaping? *Innenfor administrativ digitalisering?* *Føler du Equinor er villig til å ta risker for å utvikle eller ville du kalt dem risk-averse (risiko-motvillig)? Når det kommer til administrativ digitalisering.*	**G8**
12	Avslutningsvis vil jeg gjerne høre litt om din forståelse av totalstrategien for digitalisering i Equinor. <u>Kan du snakke litt om totalstrategien for alle digitaliserings-initiativene?</u> *Føler du det er en overordnet plan som samkjører alle disse initiativ?* *Informasjonsflyten imellom løsningene.*	**G3/G7/G9**