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TITLE:

Data Sharing in the Oil and Gas Industry

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Preface

This thesis represents the completion of a two years master's degree programme in Applied Finance at the University of Stavanger. When deciding on the topic of our master thesis we engaged in conversation with Norsk Olje og Gass (NOROG), and data sharing among the players on the Norwegian Continental Shelf (NCS) were frequently discussed. LogisticsHub was brought up and initially piqued our interest.

Due to the extraordinary situation we find ourselves in at this time, it seemed suitable to include a section on COVID-19 and how it has affected our work. As NOROG's office and the University of Stavanger have been closed due to the situation, we have not been able to work as closely together as in otherwise normal time. The communication process with our mentors at NOROG and our supervisor at UiS have been affected as we mainly had to communicate through Skype. As our interviews were mainly carried out with businesses operating in the oil and gas industry, there is no doubt that they find themselves in an extraordinary situation with a price of Brent crude at $20.91 (29.04.2020), where most companies operate with a break-even price of approximately $35.

The process of finalising the thesis has been both educational and challenging, but serves as an important contributor in preparing us for entering the workforce. In this situation we have tried to carry on as normal as possible and maintain the close contact and working relation needed to succeed in the partnership of writing our thesis. It has been challenging and weird at times, and surreal that we are so focused on our thesis while the rest of the world finds itself in a crisis. Nevertheless, it has been a memorable process that has shown how adaptable we can be when needed.

We are very thankful to our supervisor Bernt Arne Odegaard at UiS, and our mentor Kari Anne Haaland Thorsen and the others at NOROG for their assistance and valuable insights in the process of writing our thesis.

Stavanger, June 2020

Abstract

Data sharing in business situations potentially impact innovations, operations, quality of decision makings, and costs. Companies are moving in the direction of increased data sharing as of today and an area of great value potential is logistics and the sharing of logistics information among actors. This thesis examines the impact data sharing has on business value between the players in the oil and gas industry and investigates this in the specific case of LogisticsHub, an industry initiative by NOROG, using interviews with operators, suppliers, a base company, a container owner, and a transportation company. The results from a total of eight companies convey a message that sharing logistics information impact their business value. General incentives and disincentives are outlined from the findings and the benefits seem to exceed the costs for the companies involved, given the assumption of full integration in the industry. However, it is difficult to state a universally positive effect due to the absence of quantifiable results supporting the findings. The recommendation of this thesis is to continue the implementation and further development of LogisticsHub in the industry and pay attention to the disincentives outlined and eliminate the ones possible.

1.0 Introduction

Over the past 50 years, the oil and gas industry has evolved to become Norway's most important industry. The industry has been in constant transitioning through automation and efficiency. Today there is a diversity of players on the Norwegian Continental Shelf (NCS), both on the operator and the supplier side and throughout the entire supply chain. The different actors have often cooperated, both formally in joint agreements and informally through established networks. However, as of today, there are no guidelines for such cooperation within the industry, and cooperation seems to occur only based on individual agreements (Konkraft, 2018, p. 116).

The changes and developments in the coming years are assumed to be characterised by new ways of collaboration among the players in the oil and gas industry, more specifically the sharing of data. The report Konkraft, released in 2018 as a contribution to maintaining competitiveness on the NCS, argues that the players should establish a joint industry initiative on data sharing. In the oil and gas industry, there are several areas and situations that could benefit from data sharing. Digitalised warehouse inventory, stratigraphic wells, maintenance, field development, well delivery, HMS, exploration, and logistics are some of the areas that affect the operating costs on the NCS. Through increased data sharing within these areas, the efficiency and quality could potentially improve, thus contributing to profitability. Logistics is an area where significant effects can be achieved through extensive collaboration and data sharing. Logistics is about the management of resources, from which they are acquired, stored, and transported to their final destination (Businessdictionary, n.d). In the oil and gas industry, this is a massive network consisting of operators, contractors, package - and equipment suppliers, shipping companies, and various subcontractors all serving different roles in the supply chain.

This thesis examines the issue of data sharing in the context of the oil and gas industry. By looking specifically at logistics information, the purpose is to investigate whether sharing logistics information is a value enhancing activity for companies. Building on this very foundation, a project called LogisticsHub was initiated as an industry initiative by Norsk Olje og Gass (NOROG). The project aims to facilitate data sharing on logistics information throughout the supply chain in the oil and gas industry. To address the issue, interviews with companies in

the supply chain are carried out to get a deeper understanding of the different actors' point of view on sharing logistics information. The companies interviewed find themselves in different competitive situations. Some predict a great value potential, whereas others are more sceptical. Overall, the results show that data sharing in the oil and gas industry has an impact on the companies’ business value.

1.1 Thesis Structure

The thesis starts with a presentation of the case, LogisticsHub, and the companies interviewed before the theoretical background relevant to answering the research question is given. In the following section, the methodology is discussed. Next, a summary of the interviews is presented before an analysis of the findings is carried out in relation to the background material and research question, as well as an analysis of the cost and benefits related to LogisticsHub. Further, the findings are discussed, and in the end, concluding remarks of the impact data sharing has on business value is presented.

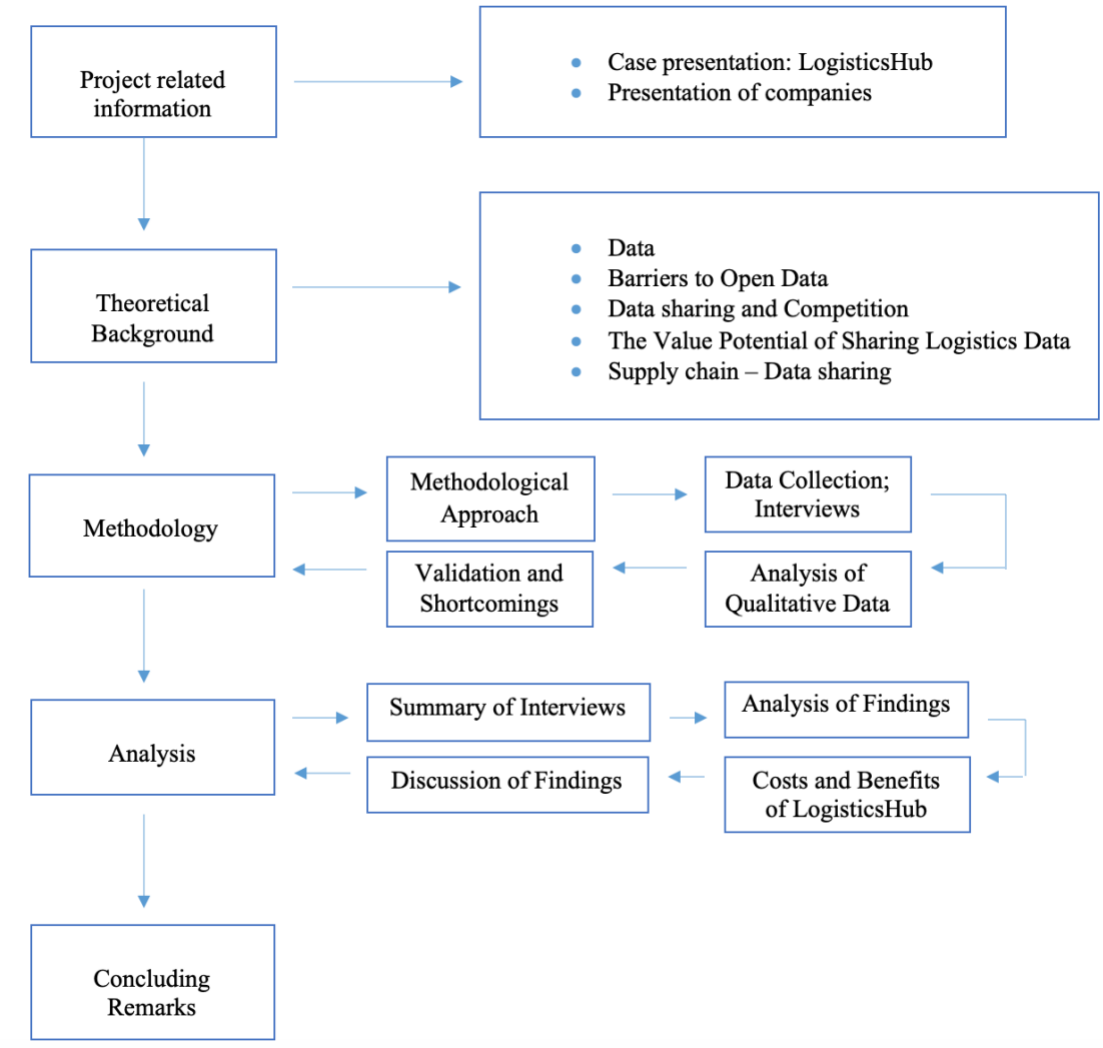

Figure 1 - Thesis structure

1.2 Motivation and Background

The oil and gas industry is characterised by huge amounts of data and advanced systems for data processing, analysis, and reporting. However, these systems have primarily been developed for internal use, rather than working with data flow between actors. This development has resulted in company-specific system solutions, which poses as one of the challenges related to data sharing in the industry today. In the industry, there is a limited degree of sharing and reuse of data, and the flow of data is hampered by insufficient standardisation and data conventions. According to the report Konkraft these conditions will likely encourage the actors to maintain competitive structures and behaviour over time that are not optimal for the industry (Konkraft, 2018, p.57).

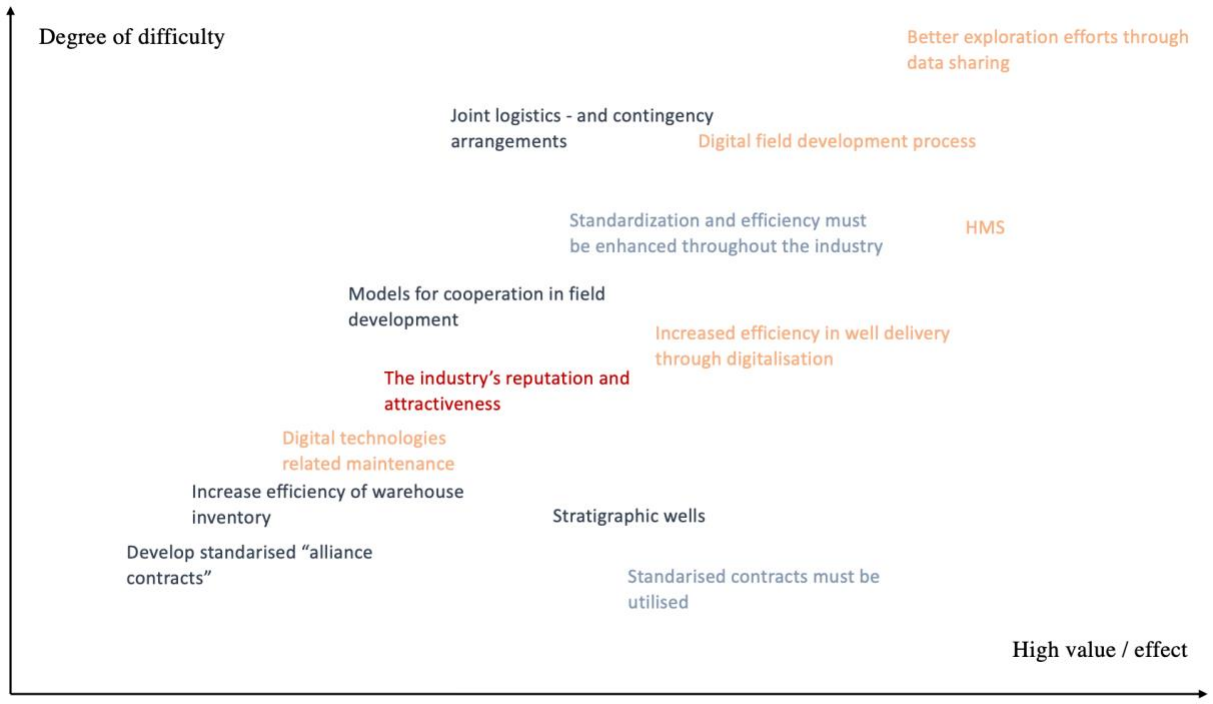

Figure 2 - Value potential of data sharing

(Konkraft, 2018, p.57)

Figure 2 displays the value potential within the different areas in the oil and gas industry. Better exploration efforts through data sharing have the highest value/effect, but also entails a high degree of difficulty concerning execution. The areas/situations are sorted according to the value potential and the difficulty of execution. Joint logistics - and contingency arrangements through increased data sharing between actors have the potential to derive high value/effect, but from the table, it is also believed to be difficult to implement in the industry today. By sharing logistics information, the industry could improve the efficiency and effectiveness of the supply chain by standardisation and cooperation of information flow (Internal communication, Wintershall DEA business case).

Incentives and disincentives for releasing and sharing data are frequently discussed within the industry. Despite this, the actors concur that superior data flow is essential to exploit new technologies and drive further innovation. McKinsey estimates that through digitalisation the oil and gas industry could cut costs with NOK 30-40 billion (Konkraft, 2018). The actors in the industry find themselves in different competitive situations and naturally have differing incentives for sharing data, and the debate mainly concerns what data to share and how widely it is to be shared. It is obvious that certain types of data are a part of the individual players' competitive advantages and sharing data could undermine their position in the market and reveal valuable business secrets. However, it is believed that the majority of data in the industry falls outside of this category, and the scepticism for sharing information and the limited data sharing in the industry today stems as much from tradition as the desire to keep "business secrets" internally (Konkraft, 2018, p. 60). Despite the given consequences due to limited data sharing, the industry has not managed to congregate on a joint initiative**.** The oil and gas industry have shared data since the 1990s, and several sharing initiatives are still being developed to increase cooperation and competitiveness on the NCS, and one of those initiatives is LogisitcsHub which was launched by NOROG and is further presented in chapter 2.0 (Konkraft, 2018).

1.3 Research Question

The idea of data sharing in the oil and gas industry has been on the agenda for a long time. But from the situation today, where there is limited cooperation between companies, poor data integration and interoperability, and lack of efficient systems processing data, it is clear that the industry lacks a strategy for implementation of digitalisation and data sharing on the NCS (Hassani & Silva, 2018). Cooperation between operators and suppliers should be improved through increased interaction, effective interface, reuse of solutions, and transfer of experience. The industry in general spends a lot of time on challenges and problems where they could have benefitted by cooperation. For example, in the exploration phase, they could speed the process and cut costs if they shared seismic surveys, as important information on patterns can be found in those surveys and improve exploration effort (Feblowitz, 2012). By sharing seismic surveys, as well as drilling - and production data it could enhance exploration in already developed fields and drive innovation of new fields. Despite the benefits of sharing seismic and exploration data, seismic surveys are very costly to generate, and by imposing companies to share the data it eliminates the incentives for generating the data. Instead, it incentivises the operators to wait for others to explore and generate the data rather than doing it themselves. This could potentially result in a situation where there is undersupply of data and none of the actors wants to bear the cost of conducting, for example, seismic surveys. Thus, given the competitive environment of the operators and low operating margins in the oil and gas industry, understandably, there is a barrier that makes sharing such data seem irrational.

There is tremendous potential for sharing data in the oil and gas industry, by enabling the use and extraction of data throughout the disciplines. Several areas are identified that could benefit from data sharing like HMS, well data, maintenance data, operating data, and logistics. Still, sharing such information could also potentially enhance other companies' competitive advantages, and undermine one's own position in the market (Knoph, 2017). Given the consequences of data sharing, there are different situations where sharing is beneficial and where it might not seem like a strategically good choice. In this thesis, the logistics area will be further investigated as this thesis aims to answer the following research question: Does data sharing between the players

in the oil and gas industry have an impact on business value? We will look at this question in the context of a specific example, LogisticsHub.

2.0 Case presentation

In 2020 we can trace our toothpaste shipment from China in a very detailed manner, but the oil and gas industry does not know where their million-dollar equipment is until it arrives at their front gate. There is a tremendous potential for reducing costs and allowing for a more efficient supply chain on the NCS. In 2013 EPIM (Exploration & Production Information Management Association) initiated a project called LogisticsHub as a response to the challenges of tracking logistics in the oil and gas industry. Through the project, EPIM wants to enable visibility and transparency in the supply chain by sharing logistics information on the shipment of containers between the companies in the Norwegian offshore industry. EPIM, the initiator of LogisticsHub, merged with NOROG in 2019 and therefore the solution is owned by NOROG at this time, and they are further referred to as the initiator in this thesis. The next section outlines descriptive information of the details and objectives of the LogisticsHub project and its initiator, and the justification for sharing logistics information.

NOROG is the association for the oil companies operating on the NCS. They are a nonprofit organisation representing the operators' arena for collaboration and information sharing within the Norwegian oil and gas industry (Norsk Olje og Gass, n.d). The organisation aims to facilitate and operate joint initiatives in the industry and the operators fund the organisation through a "member fee", which covers the cost of operations for all services and initiatives for the industry. A budget is presented yearly and has to be negotiated and accepted by its members. The operators usually fund the organisation and its projects according to the number of licenses they hold, meaning operators like Equinor bear a bigger cost than smaller operators (Internal communication, *NOROG*). As LogisticsHub is an initiative by NOROG, the funding of the project is covered through the "member fee", and thus not entail specific costs other than costs related to implementation which is elaborated in the analysis (5.2).

LogisticsHub is not a tangible or visual platform, rather a solution that processes standardised information by feeding and extracting information from connected systems. The solution is developed and available for use for all actors operating on the NCS, but as of today the solution

is not an obligation in the industry, but rather an initiative presented to the industry. The actors contact NOROG to request access to LogisticsHub, before the involved participants connect their existing systems to the LogisticsHub solution, and the user-organisations can then share and display information provided by all the involved actors in the logistics operations (EPIM, n.d).

LogisticsHub is developed to manage, coordinate, and provide access to tracking information provided by all involved participants operating on the NCS. Tracking is conducted through the entire value chain from the container is hired, shipped to the supplier, loaded with equipment, transported to the supply base, sent by boat to the drilling rig, and eventually transported back the same route – as illustrated in figure 3. The foundation of introducing an effective tracking tool for the industry is primarily to agree on a common standard, where the goal is to provide operators, supply base, suppliers, container owners, and transporters with relevant tracking information throughout the logistics value chain (Internal communication, NOROG).

As it is not possible to trace the equipment that is sent between the players in the oil and gas industry today, it is difficult to plan the use of resources. This results in expenses related to delays, overtime payments, and poor interaction between the players. A common situation today is that two trucks drive from base to operator - one loaded while the other is empty. On the return, the same trucks are driving, but now the opposite one is loaded while the other is empty. At the same time, employees of the operator must work overtime because the equipment does not arrive as expected. Thus, LogisticsHub is designed to help the players on the NCS to utilise their resources by improving the area of logistics. In the offshore industry, containers are referred to as CCU's (cargo carrying units), which is designed for repeated use in the transportation of goods and equipment. The project aims to involve all the actors in the oil and gas industry and is supposed to represent a concept for sharing tracking information of the CCU's and the equipment being sent. Standardisation, collaboration, and data sharing are keywords that represent the solution and are essential if the solution is to succeed. LogisticsHub has been available for operational use since 2016 - but before the solution is integrated in the industry, there is a lot of effort that needs to be done as NOROG wants this initiative to be implemented by all the players on the NCS (International communication, NOROG).

In May 2018 Wintershall DEA initiated the LogisticsHub Pilot Project in collaboration with Swire (container owners), Halliburton (equipment supplier), Asco (supply base), and Bring (transporter). Equinor has also participated by observing the project. The intention was to evaluate the impact of the LogisticsHub solution to their current supply chain operations and find out how the solution could provide value to their future supply chain information architecture. Wintershall DEA's overall goal is to reduce the direct and indirect cost and increase efficiency in the logistics value chain. The expected benefits from using the solution include improved planning as a result of early identification of potential delays, better information through transparency in the value chain, optimise CCU and equipment rentals, the possibility to track lost CCU's and optimise transport. The pilot intends to verify the integration of the solution and to prove whether the solution adds value to the operation, and gain experience with track and trace solutions. In line with the pilot project, NOROG has carried out a business case that evaluates and supports the pilot project. The business case shows that LogisticsHub brings value to the current supply chain operations and has met the majority of the identified targets defined for the project (Internal communication, Wintershall DEA business case).

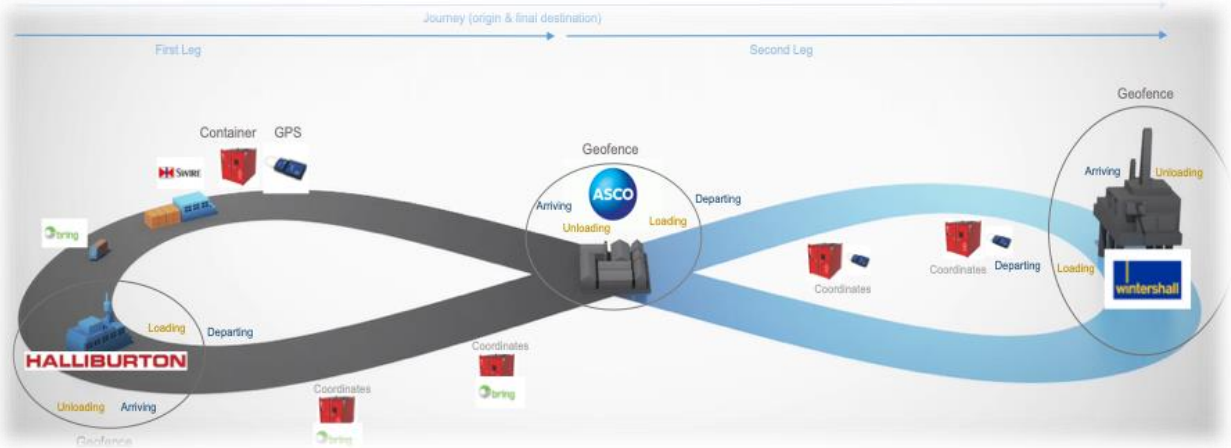

Figure 3 - Demonstration of the workflow

(Internal communication, *Wintershall DEA business case)*

2.1 Presentation of Companies

Table 1 presents a brief overview of the companies interviewed concerning answering the research question of this thesis and a presentation of the initiator of LogisticsHub. The companies represent actors from the entire supply chain, all associated with the LogisticsHub project. Thus, there is at least one company representing each role in the supply chain. LogisticsHub is an industry initiative by NOROG and the goal is for all the players on the NCS to implement the solution. This is still an ongoing process, and the companies selected for the interviews are the main companies involved in the project. Some have implemented the solution, whereas others are in the initial face of introducing the solution to its corporate leaders. Figure 4 illustrates an overview of the association with LogisticsHub for the companies interviewed.

Company	Role	Description
Norsk olje&gass	Association for oil and supplier companies.	Norsk Olje og Gass has more than 100 member companies conducting activities related to oil and gas on the NCS. It represents the operators' arena for collaboration and information sharing within the Norwegian oil and gas industry. As well as addressing key issues concerning the industry (Norsk Olje og Gass, n.d).
equinor	Operator	Equinor is a Norwegian Energy company founded in 1972 under the name Statoil. It is the largest operator on the NCS and is present in several oil and gas regions throughout the world. Through their exploration and production activities they hold many of the most valuable licenses on the NCS (Equinor, n.d).

	Operator	ConocoPhillips is an American company founded in 2002 after merging with Phillips Petroleum. It is among the largest operators on the NCS and one of the biggest independent producers of oil and gas in the world. ConocoPhillips has interest in several of the biggest fields in Norway through its main activities; exploration and production (ConocoPhillips, n.d).
	Operator	Wintershall DEA is a German company founded in 1899. It is the leading independent producer of crude oil and natural gas in Europe with presence in approximately 100 licenses on the NCS (Wintershall DEA, n.d).
	Supply-base operator	NorSea is a private company founded in 1965. It operates nine bases and provide services to the energy industry on the NCS (NorSea, n.d).
	Transportation/ Distribution company	Bring is a part of Posten Norge AS and is one of the largest logistics companies in Norway. It was founded in 2005 and serves both individuals and businesses throughout the Nordics (Bring, n.d).
	Service company	Halliburton operates drilling – and production services in various oilfields. It is an American company founded in 1919 and is one of the largest suppliers of products and services to the oil and gas industry (Halliburton, n.d).
	Service company	Weatherford is an American company founded in 1941. It is one of the largest oilfield service companies across the globe and is present in more than 90 countries (Weatherford, n.d).

SWIRE OILFIELD SERVICES	Supplier of offshore containers	Swire is the world's largest supplier of offshore containers and has been operating since 1979. Swire oilfield services operate in all major oil and gas regions throughout the world (Swireos, n.d).

Table 1 - Presentation of companies interviewed

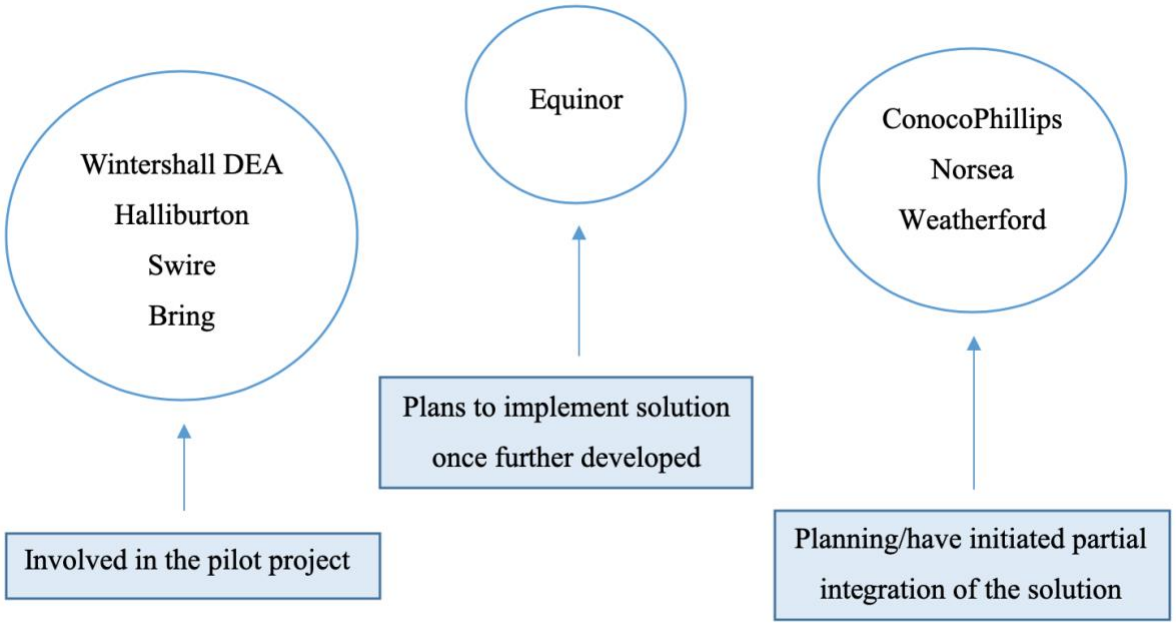

Figure 4 - Overview of the association with LogisticsHub for companies interviewed

3.0 Theoretical background

This chapter outlines the general material and concepts related to the research question of the thesis. It presents the basics of data sharing, related economic trade-offs, and spillovers. A general perspective of the efficiency of the supply chain is given, as well as the supply chain model outlined by the Norwegian Petroleum industry.

3.1 Data

Data has substantial potential to provide benefits. As both data and oil have intrinsic value and must be refined to exploit their full potential, it is discussed whether data can be referred to as the new oil. When data is made open and re-usable, it enables organisations to collaborate in other ways (The World Bank, 2019). However, too often it is discussed how an organisation is able to exploit its own data, while the biggest flaw is that the greatest opportunities come from merging multiple datasets. But to what extent are data shared between organisations? There are many possible options as shown in figure 5, between the two extremes of totally open and totally closed data. Closed data is when data holders use the data to optimise internal processes or deliver services based on internal data that are value-added. Open data, on the other extreme, are shared openly for free. Between the two extremes, there are business models built on the trading of data like joint ventures and data reselling (BigDataCoe, 2016).

Figure 5 - Different options of shared data from closed to open

(OpenCageData, n.d)

Closed data is often sensitive information and is important for the competitive advantage of a company, thus it is not shared openly. Even though there are benefits related to the competitive advantage by keeping data internally due to its perceived value, there are several issues related to closed data. It can be time consuming and difficult to navigate regarding the restrictions on usage, access, and storage of such data. Users of closed data often have to negotiate and agree on specific and complex terms regarding conditions of such data, which makes it costly for companies (OpenCageData, n.d).

Traded/shared data is found in the middle of figure 5. According to Jeff Kelly, Wikibon's lead data analyst, it is through merging and sharing of data that value is achieved. Building on the initiative of the European Commission, "Free Flow of Data", adopting a shared/traded data policy can be achieved by companies through partnerships like joint ventures or joint projects. There is also the possibility to resell raw data. In this case, the buyer often structures and analyses the data, extracting value to the end-user. This is often done in organised marketplaces specialised in trading of data. Despite the value in sharing data, this is not often adopted by

companies as bottlenecks are preventing the flow of such data. This is often caused because of companies' business strategy, the difficulty of valuing data, interoperability, and legal issues related to re-selling and re-use of data (Osimo, D., 2016).

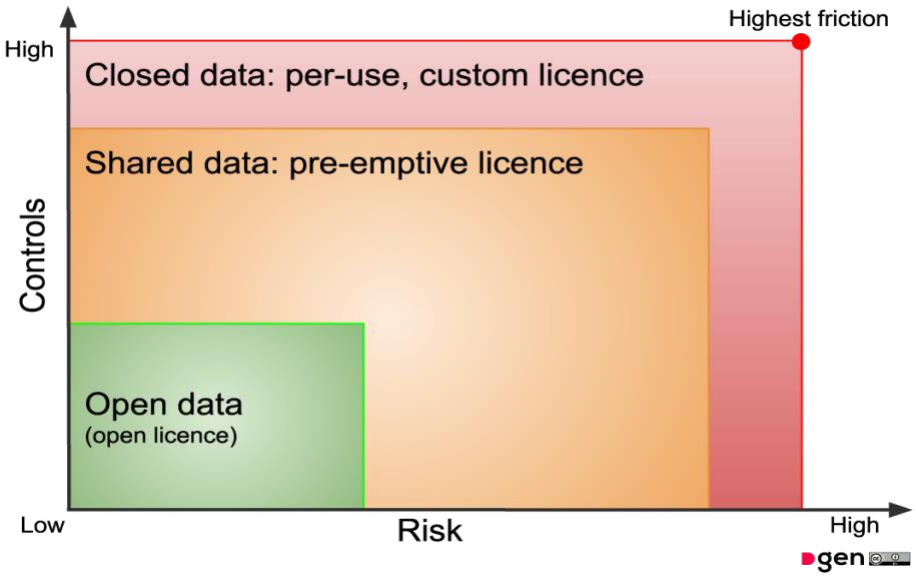

Figure 6 - Control vs. risk trade-off in data sharing

(Starks, G., 2019)

Figure 6 outlines the control vs. risk trade-off related to data sharing. Companies adopting a closed data policy must maintain a high control and monitoring of their data, and the data concerned is often company sensitive information. Thus, the leakage of such data can have severe consequences. In a shared data situation companies find themselves in the middle ground between open and closed data, and the risk and control factors are moderate in this case. Open data policy is often data that is publicly available, and thus is at low or no risk to a business and there is no need to monitor the usage of this data as it is already available.

A key motivation with open data is to encourage value creation in society by using the data in new ways and new contexts. Open data can provide the basis for new commercial activities, and they can enable new products and services that are enriching and efficient. Data is a raw material that has a clear link to new information and knowledge. Without data it is not possible to build information, and without information there is no knowledge (European data portal, n.d.).

3.1.2 Interoperability

Interoperability is an important concept of shared and open data, as interoperability is the ability of different systems and organisations to work together (inter-operate). The ability to interoperate different datasets where several components work together is key in the successful sharing of data. Interoperability and the possibility to combine different datasets together help to develop more and better services and products, which is fundamental when developing large, complex systems consisting of different components (Open data handbook, n.d).

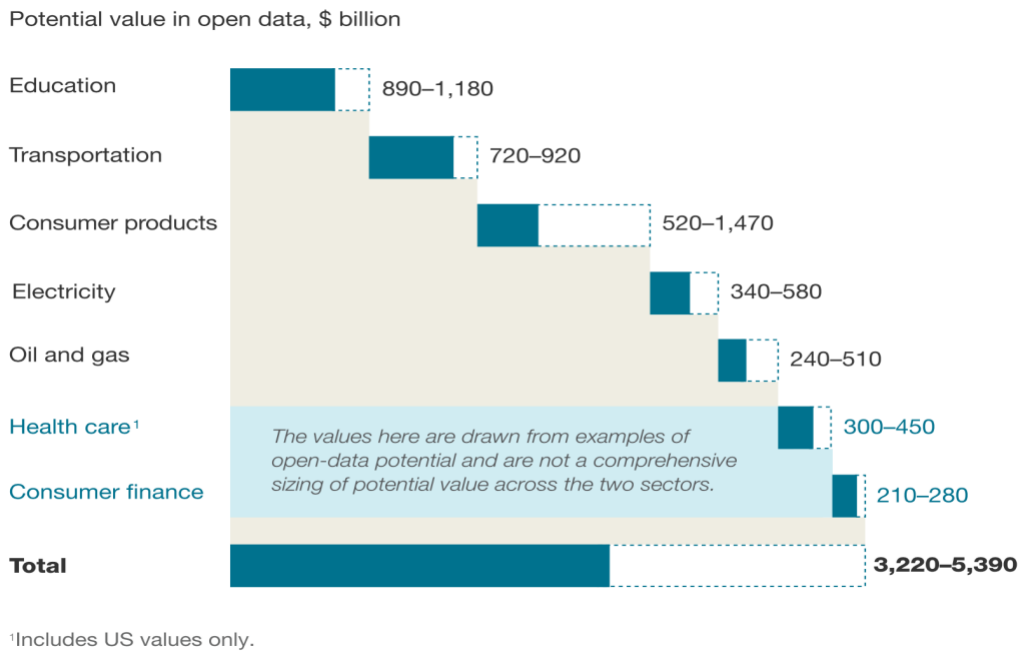

Figure 7 - Potential value of open data in different sectors

(Manyika et al., 2013)

According to a McKinsey report from 2013, open data has the potential to create three trillion dollars a year of value in seven areas of the global economy, which can assist businesses to define new products and services and improve the efficiency and effectiveness of operations. In their report, McKinsey states that the oil and gas industry can generate 240-510 billion dollars in additional value as a result of open data, as shown in figure 7 (Manyika et al., 2013). Open data can be used as an instrument to improve innovation and replace traditional decision-making approaches. However, to be able to take advantage of open data, investments in technology and expertise are required. It is also important to establish standards to speed the flow of data. Open

data also enhances the impact of big data by creating transparency, exposing variability, and allows for experimentation (Manyika et al., 2013).

3.2 Barriers to Open Data

The majority of the EU28+ countries have started to develop a basic approach to navigate towards sharing data, nevertheless, several companies are struggling with a number of barriers. In the European Data Portal's (EDP) report from 2017, barriers encountered by both data publishers and re-users of open data are brought together. The barriers discovered in EPDs report were often found to be related and dependent on each other. Barriers are distinguished between political, organisational, legal, technical, and financial domains. For companies to cope with the barriers, it is important to get insights into each other's needs by opening up the dialogue between data publishers and data re-users (Berends, Carrara, Vollers, Fechner & Kleeman., 2017, p. 3).

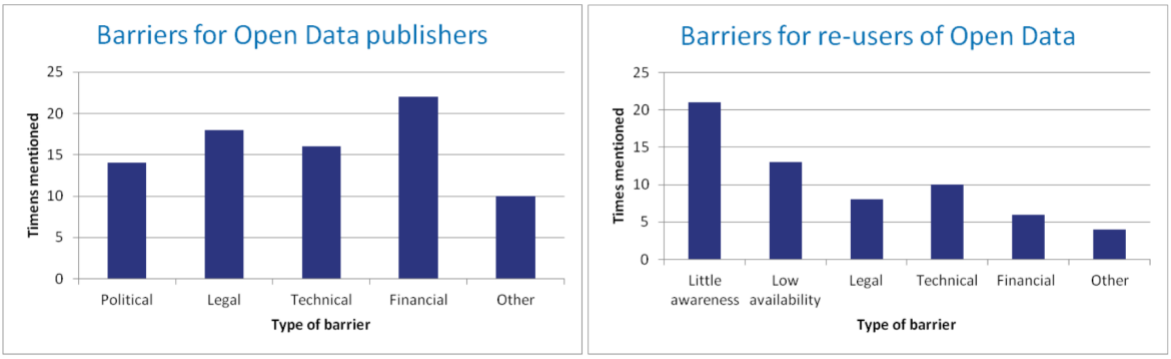

Figure 8 - Overview of Barriers for Open Data Publishers and Re-Users

(Berends et al., 2017, p. 8)

Figure 8 displays that the financial barrier is mentioned by 71 % of the countries and is therefore considered as the most important barrier that hampers the publishing of open data. It is also evident that political, technical, and legal barriers play a vital role, as they are mentioned by at least 45% of the European countries engaged in the survey. When it comes to barriers faced by re-users of open data, it is clear that lack of awareness makes it difficult for re-users to exploit the benefits of open data. Unlike the data publishers, re-users consider the financial barrier as one of the least important barriers. The low availability of data also shows the potential for improvement for the data publisher (Berends et al., 2017, p. 8).

Political Barriers

Politicians are in a position where they determine the priority of open data. Also, in the private sector, managers may be unwilling to invest in exploring the potential of open data because of the lack of proven benefits. One of the political barriers is linked to the lack of political will, as open data is not the top priority for a politician. This can be explained with unfamiliarity with neither the definition or value of open data. The fear of losing control over data is a cultural challenge that prevents organisations from sharing data. An important aspect of the implementation of an open data policy is therefore to manage cultural change. Open data should be considered as an integral part of the day-to-day activities instead of an extra activity. This is a result of politicians and managers not being aware of the benefits of open data (Berends et al., 2017, p.10).

Organisational Barriers

Organisational barriers question the way the internal and external organisation constrain the publication and use of open data and touches upon the skills required to work with open data. The internal structure of organisations should incorporate open data as an integral part of the existing operational process. To do so, it is essential to include external elements, like interaction and cooperation between the various organisations. Open data should be integrated as a part of "business as usual". Otherwise, negotiations and considerations become organisational challenges. For instance, some managers may consider it as a loss of value to have their data published on a common data platform instead of on their platform where they can reach out to selected data users (Berends et al., 2017, p. 12). Lack of skills needed to operate with open data is another barrier. First of all, it is required to have the technical knowledge to ensure a smooth data release process. But if there is a lack of analytical skills, the organisation will not be able to take advantage of the published data. By this, organisations need both technical, statistical, and analytical skills in addition to business knowledge and domain knowledge to deal with open data barriers (Berends et al., 2017, p. 13).

Legal Barriers

Open data legislation, open data policies, and licenses are all legal barriers. First of all, a clear and specific framework must be developed. It is also important that the appropriate license is applied. The intention with a license is to inform potential users with certainty that they can access, use, and share the data for a wide range of purposes. Open data without a license is still "publicly available", but the user can not access, use, or share the data under copyright or database laws. If the license is not open, data cannot be used freely and the purpose of sharing data vanishes (Berends et al., 2017, p. 16-17).

Technical Barriers

Technical barriers focus on platforms and infrastructure in addition to the importance of technology. These types of barriers prevent publishers and users from working efficiently with open data. Technical barriers are categorised into quality, availability, metadata, format, and standardisation. The data is published in different structures and in different formats, which leads to unnecessary amounts of work and quality control. When it comes to data quality, there is great potential for improvements. Data is often only available in PDF format, which is a non-machine readable format. An often used explanation regarding the low quality of open data is that the preparation of open data is not a priority. Different formats, languages, and licenses restrict companies in re-using data, and in combination with a lack of standardisation, it is difficult to develop permanent solutions to re-use open data. Especially lack of datasets in machine readable formats is a problem because it hinders standardisation and automated processing of the data (Berends et al., 2017, p. 17-22).

Financial Barriers

When it comes to business, it is all about money. Data retrieved from shared data can be transformed into economic value by either improvement of their already existing operational process or the development of new services and products. According to European Data Portal, the cost saving for EU28+ in 2020 is estimated to be 1.7 billion euro in total. But at the same time, financial barriers are one of the most important barriers for publishers. Since there is no clear evidence documented on the benefits of publishing open data, it is difficult for administrations to justify the loss of revenue and establishing a clear link between their results and data sharing. The financial funding of an open data policy is also a barrier, combined with the perception that it can be hard to justify the cost of publishing data (Berends et al., 2017, p. 22-23).

Awareness Barriers

To realise the potential of sharing data, both data publishers and data users must be convinced of the possible benefits. As the public awareness of open data is relatively low, this works as a barrier for publishing and re-use of data. Open data is an abstract issue with unclear benefits, which is one of the reasons for low awareness. The drivers and benefits of data sharing are not clear or universally shared within organisations. It is also shown that companies are not familiar with what data the data publisher has, at the same time as the data publisher does not know what data companies want. Therefore, awareness needs to be raised regarding the value drivers and benefits of open data, the availability of datasets, and the specific needs of open data re-users (Berends et al., 2017, p. 24).

3.3 Data Sharing and Competition

Sharing information with competitors can be perceived as a radical move, but recent research focuses on the benefits of information sharing with competitors. Information sharing, in some cases, is found to be a value enhancing activity. Knowledge has often been perceived, in organisational theory, as an important element of competitive advantage. Thus, it should stay within the company. But, as Botelho, an assistant professor of organizational behaviour at Yale, wrote in an article: " It brings to light the possibility that at certain times knowledge is also valuable outside the firm" (Botelho, 2018a).

Competitors have always served as an important source of information when it comes to maintaining a competitive advantage. Thus, the management has usually urged for information to stay within the company. Scholars have highlighted knowledge sharing among competitors, pointing out platforms where similar firms in different geographic locations share detailed knowledge openly. There are various motivations for knowledge sharing between firms. Like the mutual understanding between competitors where one expects direct reciprocity, geographical distance eliminating the cost of losing competitive advantage, and in slow moving industries there are potentially low costs related to sharing. And new forums of information continue to appear that facilitates knowledge sharing (Botelho, 2018b).

In Botelho´s (2018b) research, he developed and used data from an existing digital platform where he aimed at testing the hypothesis of why companies might share information with competitors. Botelho found that information sharing improves performance and adds value in certain situations, but sharing information is a strategic decision that has to be carefully considered (Botelho, 2018b). Other researchers have pointed out a potential cost of knowledge sharing among competitors, which is the cost of losing competitive advantage. But, Botelho believes this cost can be minimised by facilitating sharing.

In 2017 the European Commission researched data sharing and re-use in business-to-business (B2B) in the European Economic Area (EEA). This was motivated by the EU initiative "Building a European data economy", as digital data is considered crucial for economic development, innovations, technology advancements, competitive business environments, and society in general (European Commission, 2019). The study aimed at quantifying data shared and re-used in EEA, identifying missed opportunities as a result of data absence, determining challenges, and identifying success factors. The study found that four in ten companies share some of their data and the same amount re-use data from other businesses. Data marketplaces exist as intermediaries serving as an extra layer of trust when sharing information and the technical enablers create digital solutions needed for data sharing. The research also highlights the different motivations for data sharing which concurs with the ones mentioned by Botelho (2018b) (Aranut, Pont, Scaria, Berghmans & Leconte, 2018, pp. 90-96).

3.4 The Value Potential of Sharing Logistics Data

The Munich Maersk

The Munich Maersk is a container ship that was built in 2017 and can be described as a technological marriage between information and transportation. The ship weighs 214 000 tons and can carry 20 000 containers. Considering this, it only requires a crew of 28 to sail from port to port and only one crew member is needed to supervise the loading and unloading of containers. Thus, The Munich Maersk is an exception in the shipping industry and is viewed as one of the best ships in the world. It clearly shows what can be done and is way ahead of other companies. In the 1990s container ships could only carry 5000 containers, but after the economic slowdown following the global financial crisis the ways of doing logistics were challenged. The key to success was not new equipment, but new ways of handling data. Logistics is about knowing where hundreds of millions of items are and where they are going (TheEconomist, 2018).

As discussed in an article in TheEconomist, the international business of moving goods from factory to factory requires more than just items from local factories to doorsteps. But in return, it accounts for 90 percent of the global revenue of the logistics industry, which means that new business models for logistics will partly determine how much world trade can grow and define who the winners and losers will be. When a firm wants to transport components to retailers or through their supply chain, they have two options - express delivery services like DHL Express and FedEx or containerised freight. In the article, it says that, according to BCG (Boston Consulting Group), the international cargo industry enjoys revenues of $2.6trn a year, of which a large portion goes to middlemen. The disadvantages in the industry can be seen in the amount of paperwork. The containers on Munich Maersk generate piles of documents, which leads to delayed vessels and aircraft as the paperwork often arrives later than the goods it follows. The costs of these delays are tremendous. The UN estimated that if paperwork is made digital and online, it can shorten the time it takes to export goods by up to 44%, reduce the cost of exporting goods by up to 31% and boost exports by as much as $257bn a year. A recent survey conducted by Freightos found that two-thirds of the American importers who responded experience over a

quarter of their deliveries from abroad to arrive late. 42% responded that the paperwork facilitating shipment occupies more than two hours of their time and as many as 83% said that it is difficult to track items. It is easy to get frustrated by the thought that Amazon Prime manages to deliver from its warehouse to your doorstep at a set time, but it is not possible to do the same with air and sea freight. One reason for this is regulations and institutional obstacles. Looking back to 2008, a UN convention wanted to establish electronic documents in international shipping as required by law, but the agreement must be approved by 20 countries, and by 2018, only 4 countries had ratified the agreement (TheEconomist, 2018).

It also appears in the article from TheEconomist that poor communications are another reason to blame. In America, trucks travel empty more than a quarter of the time, which means wasted capacity equal to 200 000 trucks traveling 1000 km per day without cargo. But the industry is constantly evolving, and companies prioritise spending more money on logistics. Amazon, the world's largest online retailer, spent $25bn on logistics in 2017. Maersk, one of the world's largest container-terminal firms, plans to digitise paper bills of lading once they secure the blockchain technology needed. Already in 2018, they presented a digital "Maersk Line Operating System" to standardise shipping data, which seems to be highly influential. If containerised shipping can be made flexible and responsive, the repercussions will exceed the field of logistics. Together with smart data management and good data analytics, the industry could lead the way to the future (TheEconomist, 2018).

McKinsey - 25 years from now

In 2017 TT Club, a leading insurance and risk management company in transportation and logistics conducted a report on the container transport industry together with McKinsey & Company. Their research includes perspectives of suppliers and customers to the container transport industry and projections for the industry over the next 25 years. The research is based on interviews of container liner operators, terminals operators, port authorities, freight forwarders, container lessors, financial intermediaries, suppliers of digital solutions to the transport and logistics industry, e-commerce companies, and law firms, among others. As a summary, the report highlights six potential sources of future value creation over the next 25 years as shown in figure 9.

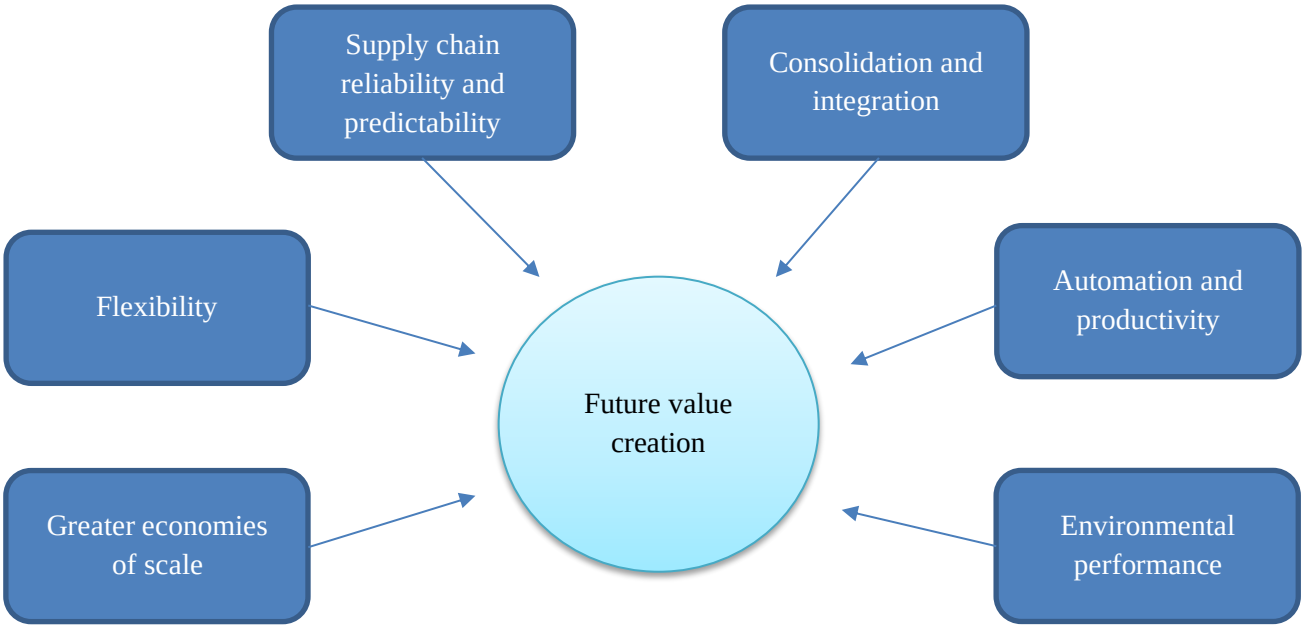

Figure 9 - Overview of the six potential sources of value creation

(McKinsey, 2017)

The report raises important questions considering the real sources of value creation in the future, who will end up as the winners, how today's industry leaders can constantly evolve to exploit the opportunities, whether players will become more vertically integrated and if "digital natives" will reshape the industry. It is a clear consensus that digital data and analytics will be important contributors to value creation in the future. Until now customers only request transport capacity between two locations (from container liners, terminals, and intermodal providers), but from now on they will expect transparency throughout the value chain and guaranteed delivery at a specific time, priced less than today. Companies that can not provide this will struggle to survive. Around half of container ships arrive at least 12 hours late like stated in TheEconomist, and this imposes a cost on downstream players. It leads to unpredictability at the terminals where employees are out of work for long periods and then congested at times when multiple ships arrive at the same time, and trucks have to wait for late cargo. The inefficiencies of the current value chain could act as an invitation to players who believe they could manage it better (McKinsey, 2017, p. 57).

TT Club and McKinsey's report states that, due to the growth environment, industry players within container transport have expected reasonable returns. But in the last two decades, the average player has struggled to return its cost of capital. Of course, there are some exceptions, where top performers in the industry returned 14% on average. Simultaneously, digital inventions, data, analytics, and automation leads to new opportunities and threats for the industry in the future. Customer expectations of container transport are also being radically reshaped by innovations in last- mile logistics, as end-consumers come to demand delivery at a given date. This will result in increased demands on the container transport industry. But for all the investment in digital, data, and analytics, it is not clear if customers will pay for additional services (McKinsey, 2017, p. 26-29). It is clear that the industry's future is unpredictable, but TT Club and McKinsey's report highlights three things players in the container transport industry can do today to prepare for the next 25 years: focus more closely on the end consumer, digitise radically and continuous drive of innovation and experimentation (McKinsey, 2017, p.77).

3.5 Supply Chain - Data Sharing

Information sharing in the supply chain can occur in different forms, but the most common form is to share inventory levels between partners across the supply chain. In such situations, inventory and communication are perceived as economic substitutes, according to Milgrom & Roberts (1988). Sharing information on inventory levels can reduce double stocking and serve as a safety net, which has the potential of lowering costs and increasing efficiency across the supply chain.

One way to address the problem of inefficiency in the supply chain is to apply echelon-based inventory management. This is, under particular assumptions, the optimal solution. The echelon inventory combines the inventory at the retailer and its downstream partner and incorporates it as a part of a digital system. With this system, companies can achieve near optimal cost-efficient inventories, as the production rate will adjust according to the inventory levels. Through this initiative, the upstream companies can keep track of the inventory levels and produce accordingly, and the downstream companies can increase their efficiency and service. Sharing information across the supply chain is witnessed in different industries in different forms. A relationship between buyer and vendor is typically characterised by the buyer sharing their inventory levels with the vendor whereas their responsibility will be to manage the inventory level according to certain guidelines (Lee & Whang, 2000). NOROG has developed an initiative for the Norwegian Petroleum industry, called Virtual Inventory. The initiative stems from a sharing economy programme on the NCS and aims for actors to share critical materials used in operations, and serves as a marketplace for sales of surplus materials. This can potentially reduce “downtime” at platforms, as the actors more easily can access critical equipment by sharing inventory levels between the players in the industry (Internal communication NOROG, *Project Brief: Virtual Inventory).*

A supply chain with access to global information would dominate any other, but the challenges are locating cost-effective information platforms and implementing them across the supply chain. It is a difficult task to achieve a well-coordinated supply chain making decisions on global information. Like in any other information sharing situation, an equilibrium has to be found to secure the risk-return trade off and how much information can be shared without the risk of losing competitive advantage.

3.5.1 Standardised Supply Chain on the NCS

The Norwegian Government and Norwegian Oil and Gas industry have identified a set of opportunities for improvement in the current supply chain model in the petroleum industry. After the significant drop in oil prices in 2014/2015 followed by the high operating margins, the goal is to get the margins down to the same level as in 2000. Advancements in information technologies and IoT (Internet of things) are facilitating this change. A joint industry guideline has been developed and originates from the Konkraft 2018 report. The current supply chain model is identified as follows:

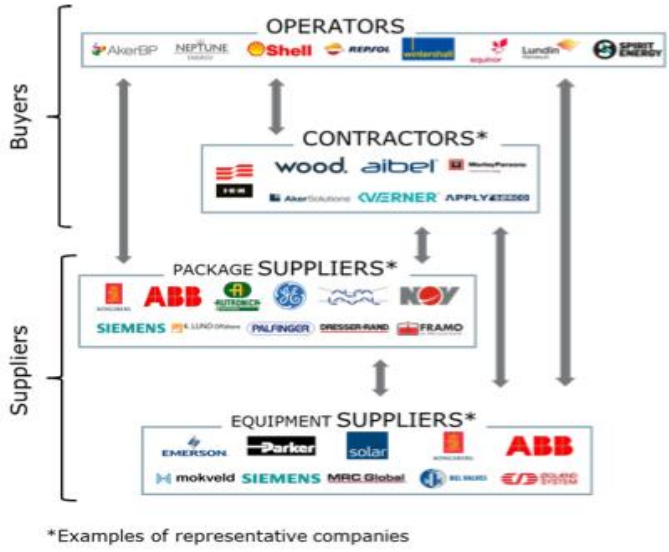

Figure 10 - Current supply chain model

(Norwegian Oil and Gas Association, The Federation of Norwegian industries, 2019)

The current supply chain model is flawed due to a set of different reasons. The model is unpredictable in terms of the buyers, ineffective due to lack of collaboration across the supply chain, too much non-value adding activities, the inefficient processes result in higher cost levels, and vulnerable margin conditions provide a difficult environment for contractors and suppliers to succeed in. The desired future model overcome these challenges and looks like this:

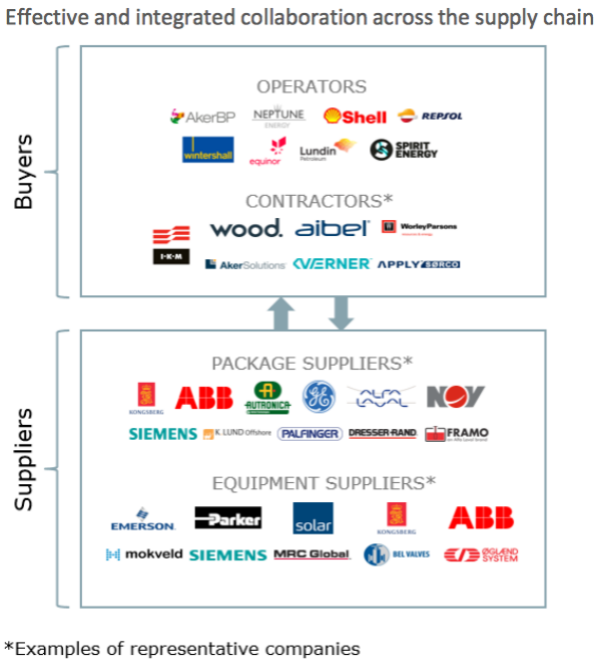

Figure 11 - Future supply chain

(Norwegian Oil and Gas Association, The Federation of Norwegian industries, 2019)

Figure 11 displays an improved supply chain model as there is a standardised delivery process. The desired future model has a predictable group of buyers and suppliers. Both the operators and contractors, as buyers, engage in standardised screening processes when selecting the optimal supplier for project delivery. This is done through EPIM JQS, an industry platform, which facilitates a fair and standardised selection process for both package and equipment suppliers. As it avoids company specific requirements in contracts and information, it is open and available for all the suppliers in the selection process. By eliminating several links which the information has previously gone through, it provides a more efficient supply chain model, as the flow of information is streamlined.

Further, the future model enables suppliers to be more active and engaged in optimising the activities across the supply chain where smart design serves as a standardised solution and enables cost-benefit analysis of production deviations. Operators and contractors aim at closing the gap between standardised systems and firm specific solutions, there will be a commitment to a quality management plan enabling predictive and efficient delivery, and risk is transparent throughout the supply chain and should be placed where best suited and mitigated. Standardised contracts ensure transparency across the supply chain and mitigate the risk of default (Norwegian Oil and Gas Association, The Federation of Norwegian Industries, 2019).

This joint industry guideline is an initiative by the players on the NCS as well as the Norwegian Government to maintain and strengthen the competitiveness of the NCS. This is just one example of ongoing digitalisation and efficiency improvement projects in the oil and gas industry, where sharing data between the players in the industry is considered crucial to innovate the industry.

4.0 Methodology

This chapter describes the measures taken to gather reliable data and information, and the methodology applied to answer the research question. It outlines the weaknesses and strengths of the specific method chosen, describes the collection and analysis of data, and outlines the rationale for choosing the method described.

The main objective for writing this master thesis is to understand how data sharing of logistics information affects companies in the oil and gas industry, and whether it impacts business value. This will be examined in the context of the specific case of LogisticsHub. LogisticsHub is an industry initiative on sharing logistics information in the oil and gas industry, and by studying this case it allows the research question to be supported by empirical evidence.

This thesis aims to understand the incentives companies have for sharing data, and whether sharing logistics information between the actors in the supply chain affects business value. To shed light on this topic interviews with the relevant companies involved in the LogisitcsHub project were conducted, as this allowed for an interactive discussion about data sharing. LogisitcsHub facilitates information sharing between players in the oil and gas industry and specifically aims to streamline the supply chain. To gain a comprehensive understanding of the issue, interviews were organised with companies throughout the supply chain. In total eight companies served as participants in the research and the following actors were represented; *Operators* (Equinor, Wintershall DEA, and ConocoPhillips), *suppliers* (Halliburton and Weatherford), *supply base* (Norsea), *container owner* (Swire), and *transporter* (Bring).

4.1 Methodological Approach

To answer the research question of this thesis a qualitative study in the form of interviews was carried out, as this is a common method used when studying a specific phenomenon or concept (Johannessen, Tufte & Christoffersen, 2010, s. 99). Qualitative research methods provide valuable insights by examining and analysing detailed reports from selected informants. Collis, Hussey & Hussey (2003) claim that due to the natural environment the analysis stems from in qualitative methodology, it provides a stronger basis for the study of the phenomenon and thus, supports the rationale for conducting qualitative research. The paper aims to capture the informant's thoughts and scepticism regarding data sharing in business situations and more specifically in the case of LogisticsHub. By conducting interviews, the informants have the opportunity to express their incentives for participating in the project, as well as worries and concerns. Thus, the interviews form the basis of further discussion around the topic of data sharing in business situations and what the economic drawbacks and advantages are.

4.2 Data collection - Interviews

To examine the research question interviews allowed for an open and detailed description from the informants. The reasoning for choosing interviews as a choice of method rather than a questionnaire is that the informants can easier describe complex issues and nuances within the given theme. By interviewing informants from eight different companies connected to the LogisticsHub project, it gives the paper a broad view from the entire supply chain and makes it possible to draw a link between the reports from the informants and the economic incentives related to the LogisticsHub project. The interviews were organised as semi constructed interviews, which allows the researcher to ask follow-up questions, if necessary (Johannessen, et. al., 2010, s. 136-137). The questions were divided into different themes and were asked in a specific order. The themes were *Awareness & Strategy, Business value, Barriers,* and *Technology & Digital Maturity.* The questions selected were the ones believed to bring the most valuable insights, even though there is always the possibility of certain key points being left out due to not including the perfect set of questions. Nevertheless, these questions deemed most suitable at the time to answer the addressed research question of this thesis.

As the aim of qualitative studies is to get as much knowledge as possible about a specific phenomenon, the choice of informants is not random (Johannessen, et. al., 2010, s. 106). In this paper, the informants were strategically selected in cooperation with NOROG. The individuals interviewed are the ones believed to have the most comprehensive understanding of LogisticsHub, and how their specific company will be affected post-integration. The reason for the different actors being unevenly represented is simply due to the scope of LogisticsHub today. The companies interviewed are the actors mainly involved in the project, thus only those could offer useful insights to the research question in the context of LogisticsHub. Still, only one person was interviewed on behalf of each company and one can not assume that the responsiveness of the informants would be identical if another set of representatives was chosen. However, in this specific case, this was the most appropriate way of conducting the interviews given the limited devotion of time by the companies as well as the scope of the thesis. The informants served as representatives for the company in which they are employed, and the sample size is deemed appropriate for the paper given the scope of a master thesis. Each company throughout the supply chain is represented by at least one informant, which allowed all actors in the supply chain the opportunity to voice their opinions on LogisticsHub and data sharing in business situations. The interviews were recorded in compliance with the informants, with the notion that the recordings would be deleted after being transcribed. Transcriptions of the interviews can be found in the appendix.

4.3 Analysis of the Qualitative Data

In qualitative analysis, the findings are analysed by identifying certain themes, topics, ideas, and opinions that are repeated by several informants. After collecting the data and structuring it by the themes following the interviews, the main inputs were extracted into a table displaying highlights, which further provided the basis for the analysis and discussion of the findings. Connections between patterns in the results and the theory were then established, and the overall factors affecting business value were analysed in relation to the relevant background material and the research question.

Due to the COVID-19 virus and the extraordinary situation, companies in the oil and gas industry have taken a hit. A drop in the oil prices has left the companies in a vulnerable position and resources are being used in risk management and dealings with this new situation. This has unfortunately affected the interview situations and the responses in the interviews, as projects such as LogisticsHub are not prioritised at this time. Several of the informants mentioned the COVID-19 virus and how it affects the project and especially further implementation in the industry negatively. Thus, it is believed that the virus and its ripple effects have influenced the findings and results of this research.

4.4 Validation and Shortcomings

Validation in qualitative research is, according to Johannessen et al. (2010), how and if the researcher's approach and findings accurately reflect the overall goal of the study and if it is transferable to real life. The interview questions were carefully selected, and it was perceived that the informants would possess the relevant knowledge to answer the questions adequately. Despite this, the questions selected still leave room for the possibility that if another representative from the company had been interviewed the response might have been different. To gather as much information as possible during the interviews, the questions were openly formulated, which leaves room for the possibility that the questions might have been interpreted differently by the various actors.

As mentioned in the sections above, individuals served as representatives for the companies, which provided multiple layers to the companies' expressed standpoints when one informant is speaking on behalf of the whole company. One can not rule out the possibility of the informants' personal opinions and experiences being reflected in the interviews, as there is always a matter of uncertainty regarding the possible personal bias. This is an important aspect and a significant drawback of the qualitative research method. There is also the possibility of not presenting the findings objectively due to the researcher bias. The researcher can also be biased by thoughts and reflections when analysing the interviews and making generalisations. Due to the awareness of these drawbacks, this was closely monitored throughout the process. However, one can never fully rule out the possibility of such bias (Hammarberg, Kirkman & de Lacey, 2015, p. 499).

Further, given that the research question of this thesis aims at investigating a specific case it is not possible to directly transfer the results to other projects due to the uniqueness of every situation, and the limited number of informants makes it difficult to justify generalisations. Nevertheless, it can be useful for other companies to witness the response to industry initiatives and draw important lessons for equivalent future projects in the oil and gas industry, and perhaps in other industries as well.

5.0 Analysis

This chapter is organised in line with the thesis structure presented in the methodology section (4.0). The analysis consists mainly of four parts. First, a summary of the interviews is presented where the main inputs are given and summarised in tables that form the basis for further analysis. Then follows the analysis and discussion of findings, where the relevant theoretical background (3.0) will be used to support the findings. A cost-benefit analysis is then composed, before an overall discussion of the parts presented are included at the end.

5.1 Summary of the Interviews

In this section, a summary of the interviews from this qualitative study is presented. The structure follows the themes introduced in the interviews and the summary are sorted accordingly before presented in tables displaying highlights of each theme. The interviewees reflect the beliefs and thoughts of the companies interviewed regarding data sharing and the structuring provides the basis for further analysis.

5.1.1 Awareness & Strategy

The questions based on awareness and strategy are important due to the project's mandate and goals. When initiating a project, it is essential to be aware of the purpose of the project. Therefore, the candidates were asked three questions regarding this topic. In the first question concerning why the companies chose to join the pilot project, the operators have different intentions, although they all agree that the industry has improvement potential within the area of logistics. As Wintershall DEA is the initiator of the pilot project, they aimed to assemble the industry on a joint platform. The project had been running for a long time without any significant results or actions, so Wintershall DEA decided to initiate the pilot as a joint industry initiative. Equinor, on the other hand, does not want to implement the solution LogisticsHub, but rather a neutral ground for sharing logistics information to increase visibility and predictability around offshore operations. They also mention another dimension where logistics resources can be utilised more efficiently and reduce the traffic on Norwegian roads, whilst also cutting CO_2

emissions. Increased visibility through cooperation on sharing standardised data in standardised formats enables companies to plan their operations in advance and hence optimise the use of resources. ConocoPhillips is one of the first companies to implement the solution and they believe that this is an important initiative for the industry. From the supplier perspective, both Weatherford and Halliburton demand better tracking of the equipment they send and receive. For Weatherford, this means that they more easily can plan maintenance of equipment and thus reduce overtime and cut costs. Halliburton struggles with the same problems as Weatherford, and with their contribution to the project they aim to cover the "black hole" in the supply chain. Swire was asked to join the project at an early stage and accepted to gain more knowledge about the LogisticsHub project. Norsea is one of the first adopters of LogisticsHub. For Norsea, the main reason for getting involved in the project was the opportunity to better prepare resource planning, improve operational flow, and improve services for their customers. As a base company, Norsea is in the middle of the value chain. Therefore, things are often unpredictable, which means that they experience a lot of re-prioritising and changes. LogisticsHub will lead to improved planning, increased efficiency, and freeing capacity. Both Norsea, Wintershall DEA, and ConocoPhillips state that the industry needs a tool like LogisticsHub. Bring has also been involved from the start by sharing information for a long time, but the information has not been utilised, thus it has not contributed to any value. When Wintershall DEA started the pilot project, Bring wanted to be a part of it because they saw it as a decent way to share information between actors. A common denominator for all the players is increased visibility and efficiency, which will lead to more predictability, better allocation and exploitation of resources, and reduced costs.

The next question considers the objective of implementing LogisticsHub in the companies. Naturally, the actors have different goals and objectives in the project because they serve different roles in the supply chain. It is also expected that they formulate specific goals within their business area, as this is essential to succeed with a project. The main objective of Wintershall DEA was to test the solution and examine whether it is worth implementing and further develop. Without LogisticsHub every company needs their own interface to share information, but if the industry agrees to use LogisticsHub, Wintershall DEA states that the players in the supply chain do not have to create a new interface. It is commonly known that

Equinor is the biggest player in the oil and gas industry, and other companies tend to wait for an initiative from Equinor. In this case, Wintershall DEA wanted to invert the normal and push the suppliers to test the solution. As Equinor participated as an observer in the pilot project, they aimed to see what quantified effects the pilot caused. In the interview, it appears that Equinor focuses on neutral ground, rather than the solution LogisticsHub provides. Because of the differences in dimension when running a pilot project with one base company and one transporter, compared to operating seven different bases on 39 installations, Equinor prefers to talk about neutral ground. They believe that only if data is shared on neutral ground the various players in the value chain will have access to the data through their existing user interfaces, and not if LogisticsHub is used, at this time. As mentioned in the above question, Equinor also requests increased visibility, traceability, and predictability across actors. The goal of implementing the solution is to enable resource optimisation to achieve cost-effective operations, reduce climate footprint, and avoid adverse events - in both logistics operations, energy exploration, and recovery operations. For ConocoPhillips, it is not crucial to join LogisticsHub as it might be more beneficial for newly established companies, as they consider their internal solutions as sufficient. However, they still believe that LogisticsHub will add value to all players, including themselves, and want to join the project to support the industry. For both Weatherford, Halliburton, and Swire the goal is to know when their equipment arrives as it provides tangible value in time and money. By having better tracking information on their equipment, they will be able to plan maintenance, which will enable them to use the equipment more effectively towards their customers. Norsea has two aspects by implementing the solution - serve better quality and increase efficiency, and thus become a better supplier. They consider that LogisticsHub is built on neutral ground, which means that it is not a commercial actor that owns the solution. In this case, they refer to neutral ground differing from how Equinor refers to it. Customers demand visibility, and Norsea considers it critical for the industry to implement a solution like LogisticsHub. Sharing information electronically will improve work processes, which is the main reason for Bring to implement LogisticsHub. As a transporter, they receive information on bookings manually. By digitising it, it will eliminate sources of error and reduce the use of resources.

In the last question regarding awareness and strategy, the interviewees were asked how they will contribute to the success of the solution. It appears consensual that the entire industry must be involved to succeed with LogisticsHub. Wintershall DEA initiated the pilot project and further wants to participate in the development of the solution. They emphasise the importance of LogisticsHub to be implemented as a joint industry initiative, so the suppliers can see the value of the solution. Equinor is mentioned by several companies as an important driver, and they are also aware of the responsibility they bear to succeed with the solution on neutral ground. If the project is to succeed, Equinor states that it is important to agree on what data format to share information on. ConocoPhillips wants to participate with internal knowledge and Halliburton is working on adapting the solution. As Weatherford is an American company, they are more critical to sharing data. LogisticsHub is a potential expense, but they still see the value of such a project in the Norwegian industry. Despite this, they believe the solution must be implemented as an obligation for the industry if it is to succeed. Swire, Norsea, and Bring have done what is deemed as required and invested time in sharing data. Bring additionally wants to take part in the further development of standards and data protection.

Highlights - Awareness and Strategy
• Wintershall DEA initiated a pilot project to gather the industry on a common platform. ConocoPhillips believes that this initiative is needed in the industry. • Equinor does not want to implement LogisticsHub, rather a solution on neutral ground. They want to optimise the use of resources and thereby reduce the traffic on Norwegian roads and cutting CO_2 emissions to reduce costs. • Suppliers demand easier tracking of the equipment they send and receive, to achieve better planning of maintenance thus reduce overtime, and cut costs. • For Norsea, the main reason for getting involved in the project was the opportunity to better prepare resource planning, improve operational flow and improved services for their customers. • A common denominator for all the players is increased visibility and efficiency, which will lead to more predictability, better allocation and exploitation of resources, and reduced costs. • All the players have different objectives for implementing the solution, whereas Wintershall DEA wanted to initiate a solution where companies do not need to create a new interface to share logistics information. • Equinor states that only if data is shared on neutral ground the various players in the value chain will have access to the data through their existing user interfaces. • For Weatherford, Halliburton, and Swire the goal is to know when their equipment arrives because it gives tangible value in time and money. • Norsea aims to serve better quality and increased efficiency, and thus be a better supplier for their customers. • Sharing information electronically will improve work processes, eliminate sources of error, and reduce the use of resources, which is the main reason for Bring to implement LogisticsHub • It appears that it is consensual that the entire industry must be involved in order to succeed with LogisticsHub.

- In general, all the players want to contribute to the implementation of LogisticsHub in the industry by adapting the system, do what is required and invest time in sharing data.
- Weatherford are critical to the solution, as they are an American company and considers LogisticsHub as just a potential expense.
- Equinor consent to the responsibility they bear if LogisticsHub succeeds in the industry.

5.1.2 Business Value

The questions concerning business value is an important aspect of the project, as variables of business value are usually considered and analysed before initiating a new project. Within the theme of business value, there are five questions included. In the first question regarding how LogisticsHub will affect the companies' business value the operators concur. Increased efficiency of the supply chain will lead to cost reduction, as the suppliers will accomplish better control of their equipment and can offer better contractual terms. Equinor also mentions the value of trust, environmentally friendly operations, predictability, and the influence on the decision-making process. Equinor believes that the project of sharing logistics data will be most valuable for container owners, smaller operators, and base suppliers. Both Wintershall DEA, ConocoPhillips, and Equinor mention that improved tracking information for the suppliers will have ripple effects throughout the contracts and eventually lead to lower cost of services offered by the suppliers. From the supplier perspective, LogisticsHub is believed to bring value through more effective operations. Planning of maintenance in advance will lead to better and more efficient warehouse stock, thus being able to offer lower prices. Weatherford also states that LogisticsHub will reduce the need for overtime as they can plan their operations better because of the tracking information the solution provides. For Swire, being a supplier of offshore containers, the project will benefit their planning of rentals, especially due to better tracking on outbound containers. As they have a rental percentage of approximately 80%, only a small efficiency improvement will have an economic impact on the company. By implementing LogisticsHub Norsea will be able to increase the efficiency of their operations, increase their delivery precision to the platforms, and thus freeing up time to spend on more value-enhancing activities. For Bring the main impact on business value will be digitising manual tasks, which will reduce manual errors and further benefit operations.

In the second question asked, whether the business value will be impacted beyond the supply chain, Wintershall DEA and ConocoPhillips agree that the LogisticsHub project will increase their business value beyond the supply chain. As the project facilitates collaboration on loading and transportation it will affect company operations. Equinor, on the other hand, believes that the set-up of the solution today will give insignificant value beyond the supply chain. But, an extension of the solution could have such potential. As for the suppliers, they both agree that

LogisticsHub will provide value throughout the company. Less planning of operations and lower prices in the long term will have effects on the very foundation of the companies. Swire states that through increased efficiency of operations, they will be able to lower the number of cargo carriers. Therefore, LogisticsHub will have a direct effect on accounting and investment decisions, thus providing business value also beyond the area of the supply chain. Norsea believes that LogisticsHub will affect the business value throughout the company, but solely their Norwegian operations with the assumption that the solution gets implemented as an industry initiative. For Bring the business value will be affected due to superior customer experience. By implementing LogisticsHub they can provide improved services on tracking information for their customers, thus giving value to the company beyond the supply chain.

When asked if LogisticsHub will provide any specific benefits all the operators answered that collaboration on the loading and transportation, as mentioned earlier, will have a positive effect on operations. By collaborating on the loading of trucks and boats they will achieve greener operations, as they can decrease the number of trucks on the Norwegian roads. This contributes to safer roads and safer society in general. They all agree on the benefit of reduced costs of operations, as the suppliers are expected to lower the cost of services in the long term. ConocoPhillips also mentioned fewer data systems in operations and superior data as a benefit. Whereas Equinor highlights predictability around operations as the most important benefit, through predictability they avoid “waste” of resources in operations. Both Weatherford and Halliburton state that optimising use and maintenance of equipment is the biggest benefit to be reaped from LogisticsHub. As rental of equipment is a key part of their business, only a 5-10% decrease in maintenance work could have big economic effects for the companies. Swire, on the other hand, says as they are so far down the supply chain there will not be as many benefits for them as for others. Norsea mentions planning as one of the main benefits related to LogisticsHub and increased efficiency through planning will contribute to transparency in the value chain. For Bring the main benefit resulting from the LogisticsHub project is reduced customer inquiries, as instead of asking Bring where their goods are, they can simply track their shipment in LogisticsHub. In turn, this frees customer service time for Bring and benefits their customer experiences.

The companies interviewed were also asked about the cost of implementing LogisticsHub. There was a lot of uncertainty regarding the answer to this question. The companies have not carried out a complete cost analysis of the entire project, and in the interviews, it became evident that they do not have a useful overview of the cost to present at this time. However, all the operators mention the cost of integration, the use of new tools, and training. But they emphasise that these are small costs looking at the bigger picture. The suppliers also highlight costs related to the integration of data systems. Weatherford says that the cost of implementation might be NOK 200K-300K, but they do not know for sure yet. Halliburton has been a key driver of the LogisticsHub project from the beginning and states that due to the close follow up of the project, they will have higher costs related to LogisticsHub than others as they have used a lot of resources on the project and have paved the way for others. But, like Weatherford they do not know the exact cost of the project at this time. For Swire it is believed that the cost of implementation will be approximately NOK 200K-400K in addition to the cost of operational integration. They believe that the benefits of LogisticsHub will not exceed the costs for another two to five years. Norsea does not have any estimations on the costs yet but says the costs will be related to integration and investment in new tools and systems. But this is something that the company would have done regardless of LogisticsHub as it provides isolated value to the company. The biggest cost is the number of hours used in the development and support of the project, but Norsea is confident that this pays back in the long run. For Bring the biggest cost was taken years ago, as they have been a part of the project for several years. However, they do say there will be some costs related to the follow-up of the project and the continuous development of sharing safe and reliable data. But, like the others, they do not have any specific numbers to share at this time.

LogisticsHub is an industry initiative proposed by NOROG, and a condition for its success is that all the companies implement the solution. Therefore, the companies interviewed were asked whether they believe more detailed tracking information will benefit all the players in the industry. The operators all believe that the industry will benefit from a more detail-oriented insight regarding the inbound and outbound flow. But ConocoPhillips points out that sensitivity concerning business critical information must be taken into consideration. Logistics is not the operators' core business, but for other players it is, and they might not be as willing to share the

information. This must be accounted for moving forward with the execution of LogisticsHub. Weatherford believes that the industry will benefit from a better flow of logistic information, as it eliminates manual processes of re-telling information to one another by email or phone. Halliburton agrees, but because of their internal system, it is indifferent to them. Norsea is positive and states that this is undoubtedly good for the industry, as long as the majority gets on board. Swire believes that better insight of tracking information will reduce costs, where especially the operators and supply bases will benefit from it. Bring mentions the same concerns as ConocoPhillips, that sharing is good, but it is important to be aware of how much to share and who has access to the information being shared.

Highlights - Business Value

- LogisticsHub will affect the business value of the operators through increased efficiency of the supply chain, which will have ripple effects such as lower costs.
- Equinor highlights greener operations, predictability, and better decision-making process as a positive effect to the business value.
- Halliburton, Weatherford, Swire, Norsea's business value will be affected through superior planning and maintenance of their operations.
- Collaboration on loading and transportation is facilitated by LogisticsHub and will have a positive effect on the operator's operations and society in general.
- LogisticsHub provides value throughout the companies and affect areas beyond just the supply chain, like accounting, investments, environment and customer service. However, Equinor believes that it will give insignificant value outside of the supply chain.
- ConocoPhillips mentions better interoperability and fewer data systems as a benefit from implementing LogisticsHub.
- Lower cost of services from the suppliers is believed to be achieved in the long run and will benefit especially the operators.
- There is a lot of uncertainty regarding the cost of implementation, as no quantifiable results or prognoses have been carried out.
- The main cost of implementation will be cost related to IT, interoperability between systems, support of the project, and some training. In the long run all the companies believe the gains will exceed the costs.
- Sharing logistics information is viewed positively in the industry, but sensitivity of critical business information must be taken into consideration when deciding what data to share.

5.1.3 Barriers

When moving forward with a project it is useful to be aware of its barriers to understand and overcome them, and to ensure a straightforward and easy implementation of LogisticsHub. For this reason, the companies were asked about barriers related to the implementation of the project, whether the solution has any faults and their thoughts on sharing information.

The companies interviewed were asked what kind of challenges they had during the implementation of LogisticsHub. Mostly all the companies mentioned challenges related to IT, data integration, system interoperability, and the cost of overcoming these challenges. Still, a few other hick-ups were mentioned. ConocoPhillips says that due to the current situation with the virus and the low oil prices it is difficult to prioritise the project and to get funding for implementation. Weatherford states that the lack of numbers of return on investment is a challenge. As they do not have any numbers to give to the decision makers of the company, it is difficult to fully integrate the solution as they are an American company. They also mention the negative impact of the virus. Norsea highlights the importance of the operators agreeing on the outcome they want from LogisticsHub. As they say, that will make it easier for everyone else in the supply chain to get on board.

In light of the implementation of LogisticsHub, the companies were asked if they believe the solution will have any effect on their work processes. The operators have slightly different answers to this question. Wintershall DEA believes that there will be changes, eventually, but mostly for the suppliers as they will get more responsibility from the operators. ConocoPhillips agrees that the changes will mainly affect the suppliers, and states that for them it will not affect their work processes. Equinor says that a better data flow would allow the possibility to analyse deviations, which will have an impact on the decisions being made in the company. The suppliers interviewed have conflicting answers. Weatherford believes there will be changes due to increased predictability of planning and maintenance, and manual processes regarding emailing and calling will be eliminated. Whereas Halliburton says that as of today there will be no changes in their work processes. The same goes for Norsea, but they believe that if the majority of the industry implements the solution as planned, there will be changes. For both

Swire and Bring there will not be any specific changes in how they work, except Bring mentions continued focus on digitisation and standard formatting.

When asked if LogisticsHub is sufficient as it is, both Wintershall DEA and ConocoPhillips mention that there is no tracking information on pallet loads and operating materials and the content in the containers being shipped is not traceable yet. Integrating these shortcomings in LogisticsHub would improve the solution. Wintershall DEA also says that because LogisticsHub simply affects the flow of data between systems and is not visual, it makes it hard to convince the actors that this is worth their time and money, as most want something tangible to be able to see what they pay for. Equinor says that today's solution focuses on the link between the sender and recipient, but there is a missing link between the good, the operation, and the equipment to be used in the operation. They believe that this can be achieved by redefining the project to sharing on neutral ground, which Equinor has mentioned several times throughout the interview. Weatherford says that the best way of implementing the solution would be to have a collective user interface, instead of everyone having their own, as it is today. Halliburton expresses that LogisticsHub is sufficient as it is, as long as all the player does as agreed. Norsea points out some challenges related to integration and interoperability. Furthermore, Norsea states that the solution requires standardisation of master data to be sufficient and reduce errors. The current solution does not fulfil the entire information need across actors in the supply chain and needs to be developed further to cover those needs. However, their positive spirit is highlighted as they see this as opportunities rather than challenges if moving forward with the project. Swire says that the architecture of the solution might be a bit too massive, making it difficult for the end user to use and points out a few obstacles related to the technical work. Bring also mentions tracking the content in the containers as a shortcoming, and how interoperability between systems is important for LogisticsHub to work as planned. They also say that the tracking of outbound shipment is insufficient as there are too many manual processes as of today.

The last question on barriers was if the players believe that the information they share can be used by others and compromise their competitive advantages in the industry. The operators agree that as logistics is not their core business, sharing logistics data does not affect their competitive advantage in any way. As their competitors are the ones producing oil, releasing information on logistics is not relevant and does not seem harmful to the business at this time - although an assessment should always be carried out on what kind of data to release in different events, according to Equinor. For Weatherford, it is dependent on what kind of data they are obligated to share due to contractual terms. But as long as their data are not shared outside contracts, such as with other suppliers, they are positive. If not, they will not share their data unless it is a requirement. Halliburton, on the other hand, does not express any concerns related to sharing data. Norsea is positive about sharing as well and believes that on the contrary that sharing logistics information is an advantage for the entire industry, as long as there are sufficient frameworks regarding what to share. Swire is a bit more sceptical as they are concerned about sharing data on their fleet. If the data they share becomes available throughout the supply chain it is a disadvantage for them. However, the contractual terms of LogisticsHub are supposed to consider this, still, Swire is also concerned with the reports on the project being released by NOROG and what might be included in those. Thus, they are determined not to be naive as protection of the data they share is very important. They believe that whether LogisticsHub as an initiative will improve the competitiveness of the industry can not be determined yet, as the consequences, in the long run, are not transparent at this time. Bring says that sharing such tracking information will not affect their business negatively as it does not contain any business sensitive information. But they point out the importance of data safety as they do not want any unauthorised to get access to the information in fear of terror attacks and other unforeseen events. The safety of Bring's drivers is important and they do not want to compromise it in any way.

Highlights - Barriers

- Challenges related to the implementation of LogisticsHub are mainly related to IT, data integration, and system interoperability.
- COVID-19 and the low oil prices is mentioned as a challenge by ConocoPhillips and Weatherford.
- Lack of numbers on return on investment is a challenge for Weatherford, making it difficult to prioritise and get funding for the project.
- The operators agree that LogisticsHub will mainly affect the work processes of the suppliers, and not so much theirs. Equinor however, sees that better flow of data could impact analysis and decisions in the long run.
- Weatherford believes their work processes will be affected through efficiency and manual processes that will be eliminated. Halliburton, on the other hand, does not believe there will be changes to their work processes at this time.
- Norsea states that changes will happen in their workflow once the majority of the industry implements the solution.
- Shortcomings of LogisticsHub are lack of tracking on pallet loads, operating materials, and content in the containers. The solution needs further development of standardisation and clarification of some processes.
- The majority of the companies do not believe their competitive advantage will be affected by sharing information in LogisticsHub.
- However, Swire, Weatherford, and Bring highlights protection of company sensitive information in this situation and the importance of having sufficient frameworks in place, regarding sharing data and user rights.

5.1.4 Technology and Digital Maturity

Implementing a new project often requires new technology. The company must be digitally mature enough to undertake the project. If a company is not digitally mature, it can cause problems in the process of implementing new solutions. To map the companies' technology and digital maturity, they were asked if they need new skills or knowledge to exploit the opportunities LogisticsHub provides. It appears that the minority of companies believe they need new skills or knowledge. However, both Equinor and Wintershall DEA believe that they need both new skills and knowledge. Wintershall DEA plans to implement LogisticsHub on a larger scale and in order to take advantage of the solution they need to train their suppliers. They believe it will be beneficial if the suppliers see the benefits of LogisticsHub without it being imposed on them by the operators. Whether Weatherford needs to develop new skills and knowledge is uncertain, while Swire believes they eventually will be mature enough to implement LogisticsHub. ConocoPhillips, Halliburton, Norsea, and Bring all agree that they do not need new skills or knowledge. As an operator, ConocoPhillips believe they have a responsibility to the other players and consider it as important to fully understand the solution and the consequences for especially the suppliers, as they are vulnerable in bad times.

The companies were asked about their willingness and ability to use LogisticsHub. Willingness is defined as the culture of the company, while the ability is competence, skills, and knowledge (WalkMe Team, 2017). Both willingness and ability are a prerequisite to succeed with a project, and the project could easily fail if there is no motivation for it in the industry. Wintershall DEA and Equinor consider their willingness and desire to implement LogisticsHub as present, but they both need to work on their ability. This is in line with what they replied in the above section, where both Wintershall DEA and Equinor believe they must develop new skills and knowledge to take full advantage of LogisticsHub. In general, ConocoPhillips evaluates their willingness and ability as sufficient and states that a good IT department facilitates solid solutions that contribute to easier implementation of projects like LogisticsHub. But, due to the COVID-19 virus ConocoPhillips' operations are affected and therefore, the implementation and development of LogisticsHub are put on hold. Wintershall DEA also mentions this as the reason for the slow-down of the project. The operators in the industry are both willing and able to implement LogisticsHub, but ConocoPhillips believe that other players, like the suppliers and the

transporters, are not as happy with the solution. They might see it as a cost and have a fear of losing their competitive advantages. This is confirmed by Weatherford, who considers their ability as sufficient, but the willingness is pending because it is not a requirement and it entails costs. As it has not been implemented in the entire industry yet, they say it should be presented as a requirement for the industry. Halliburton and Bring do not use LogisticsHub directly, they only “feed” and extracts information to use it in their existing systems. It does not appear that a lack of willingness and ability will be a problem. However, Swire also prefers to use existing systems, but their willingness and ability are not as present. Norsea are aware of the potential value LogisticsHub can provide, but they don’t consider the industry’s ability as sufficient as of today.

As the last question, the companies’ attitudes towards similar future projects were tested. Through the interviews, it became clear that there is a consensus that everyone wants to contribute in the future and that the industry needs more initiatives like LogisticsHub. NOROG is given a central role in the implementation of LogisticsHub and several companies demand requirements before they believe the solution will succeed. It is also a general desire among the companies that they want to be at the forefront of new, similar initiatives in the future.

Highlights - Technology and digital maturity
• ConocoPhillips, Halliburton, Norsea and Bring all agree that it is not necessary to develop new skills or knowledge. • The operators express a responsibility towards other players to understand the solution and its consequences. Both Wintershall DEA and Equinor believe that they need new skills and knowledge. • Whether Weatherford needs to gain new skills and knowledge is uncertain, while Swire believes that they eventually are well equipped to implement LogisticsHub. • Wintershall DEA and Equinor consider their willingness and desire to implement LogisticsHub as present, but they both need to work on their ability. • ConocoPhillips evaluate their willingness and ability as sufficient due to their IT department. • Wintershall DEA and ConocoPhillips mention that their willingness to continue with the project is paused because of the COVID-19 virus. • Weatherford considers their ability as sufficient, but the willingness is pending because LogisticsHub is not a requirement and it entails costs. • It does not appear that willingness and ability will be a problem for either Halliburton or Bring, but Swire questions their willingness and ability. • There is a clear consensus that everyone wants to contribute to similar projects in the future and that the industry needs more initiatives like LogisticsHub. • It is a general desire among the companies that they want to be at the forefront of new, similar initiatives in the future.

5.2 Analysis of Findings

In this section the findings from the qualitative study are discussed in relation to the theoretical background material and the research question. This chapter follows the structure of the previous chapter and is organised according to the themes in the interviews.

5.2.1 Awareness and Strategy

Several organisations and websites specify guidelines for how to succeed with a project. If a project is to provide business value, it should be successful. A common factor that describes a successful project is to be aware of the benefits the company wants to achieve by implementing the project. In this case, it is therefore important that the industry is aware of why they chose to join the pilot project. When this is clearly defined, it is easier to understand why this particular project has been selected and how it will bring value to the industry and the different companies. It also works as a guideline for further implementation of the project, which facilitates success (Metier OEC, 2016).

Based on the interviews and personal experiences with LogisticsHub, it is plausible to assume that the oil companies are not doing anything before it is required. This may be one of the reasons why the project is not fully integrated in the supply chain, after its development in 2013. It is also perceived that projects and decisions in general are moving slowly in the industry. The oil industry is a cyclical industry, which means that it can be characterised by full throttle in upturns and complete halt in downturns. This emphasises the importance of highlighting the benefits of implementing the project, especially in this challenging time.

During the pilot project a set of success factors, for successful integration, has been identified by NOROG in their business case. Roles and responsibility are identified as one of the success factors (Internal communication, Wintershall DEA business case), as this is clearly defined in the project. Equinor is mentioned as an important driver of the project, a responsibility they consent to bear. It is also stated by the other companies that it is advantageous that Equinor has decided to join the LogisticsHub project. In line with the pilot project, NOROG has prepared a business

case where it is stated that Equinor has decided to use LogisticsHub. This is expected to lead to a domino effect as they operate 80% percent of the market. In other words, it is expected that all their container owners, suppliers, transporters etc. will start the implementation of LogisticsHub (Internal communication, Wintershall DEA business case). From the interview with Equinor it is unclear whether they want to implement LogisticsHub, as they prefer to talk about neutral ground. Equinor communicates a different message than previously given, which may be problematic as it is essential that all the actors in the supply chain implement the project. It is difficult to collaborate as a joint industry to implement a project when the companies involved are not aware of how the other companies relate to the project. It appears that the communication among the companies is not sufficient, but due to the ambiguous statements related to LogisticsHub and neutral ground, it is not possible to conclude whether this will be a problem for the further implementation in the industry.

Involvement at all levels is also important for successful implementation (Internal communication, Wintershall DEA business case). Based on the interviews and statements from the participants, there is a mutual understanding that the entire supply chain must be involved to succeed with LogisticsHub, which provides a good basis for further implementation. It is also stated that the players want to contribute to the implementation of LogisticsHub by adapting to the system and do what is required. Despite this, scepticism is also expressed, especially among the suppliers. Weatherford is critical to the solution as they consider it as just a potential expense, which may be an opinion they share with companies beyond the ones interviewed. This underpins the theory about awareness barriers (3.2), which states that it is essential that both data publishers and data users are convinced of the possible benefits to realise the potential of sharing data. Therefore, it is important that the companies involved are aware of the possible benefits, as an in-depth understanding of the goal and the LogisticsHub solution is defined as a success criterion (Internal communication, Wintershall DEA business case). This is an area with improvement potential and carrying out a business case outlining quantifiable results would be beneficial for further implementation of the project. If the benefits of implementing the project is made clear, the project will establish a solid foundation for further implementation. Companies in the oil and gas industry tend to focus on “what’s in it for me?”. As in depth-understanding of the goal and the LogisticsHub solution is one of the success criteria, it requires the companies

understanding of every aspect of the solution. Implementing LogisticsHub as a collaboration project is another success criteria (Internal communication, Wintershall DEA business case). To accomplish this, the companies must be aware of their role in the market and be willing to understand their competitors' position.

From the findings, it is clear that the companies have different intentions with implementing LogisticsHub, but in general, it must somehow create value for the business. A common denominator for all the players is increased visibility and efficiency. If all the players on the NCS use LogisticsHub, cooperation in the industry will become more predictable. This will lead to improved planning, allocation, and exploitation of resources. The pilot project has demonstrated that LogisticsHub will be beneficial for all actors in the supply chain (Internal communication, Wintershall DEA business case), given that the set of success factors is met. But since the project only includes selected actors, it is difficult to reflect the real utilisation of the solution before all actors in the supply chain are involved.

LogisticsHub revolves mainly around the different players demanding to know when their equipment arrives. This will also lead to a domino effect, as the solution is supposed to streamline the entire supply chain from the container being hired, shipped to the supplier, loaded with equipment, transported to the supply base, sent by boat to the drilling rig, and finally transported back the same route (Internal communication, Wintershall DEA business case). Thus, increased visibility and efficiency through LogisticsHub will not only affect the individual business, but also the entire industry and the community.

As mentioned by Equinor, it is possible to reduce logistics resources through visibility and predictability. Increased visibility enables companies to plan their operations in advance. If the different players know when the equipment arrives, it is possible to utilise working capital, plan maintenance of the equipment, and thus reduce overtime and cost. The pilot project conducted by Wintershall DEA has proved that lack of information has been the main challenge when improving logistics in the supply chain (Internal communication, Wintershall DEA business case). But, if the different actors get information about where their equipment is located at all times, it will be of value. If the operators are aware of when the equipment arrives, they can

improve utilisation of the resources on the platforms. For the suppliers, tracking of equipment will result in superior planning of maintenance and provide a better basis for efficient use of equipment. If the CCU owners know where the containers are located, mainly when they will arrive, they will have the opportunity to improve the planning of the needs of their customers. For base companies, it is possible to increase efficiency concerning when they receive and forward the containers to serve better quality and increase customer satisfaction. It will also be valuable to see if the containers arrive before or after the estimated time of arrival. There appears to be great improvement potentials in the transporting of containers. Due to poor communication, several trucks are running empty. If transport companies get the information they need, it is possible to reduce logistics resources used (in this case trucks), and thereby reduce the traffic on Norwegian roads, and cut CO_2 emissions. It will also improve work processes, eliminate sources of error, and remove manual processes. Increased visibility through arrangement on sharing standardised data in standardised formats, enables companies to plan their operations in advance and hence optimise the use of resources. This is expected to provide value in different forms to the companies involved.

5.2.2 Business Value

Business value is an important aspect of every organisation, as it is the subjective measure that states the worth of a business looking at both intangible and tangible assets (Financial-dictionary, n.d). Business value is not only affected by the explicit cash inflow and outflow in a company, but also takes into account activities such as brand recognition, employees, intellectual property, and contracts. In classical organisational theory, it is taught that the main goal of every business is to maximise value for shareholders, thus one can argue that every activity a company engages in is done on the basis of maximising business value.

From the findings in the research, it becomes clear that lower cost or lower operating margins is a clear motivational benefit for implementing LogisticsHub for the companies involved, which has been the overall goal in the industry ever since the drop in oil prices in 2014/2015. By initiating the project, the companies believe their business value will be affected through efficiency, standardisation, and greener operations which are all favourable factors for their business value. As LogisticsHub facilitates collaboration through data sharing, companies see the value in cooperating on loading and transportation. This will likely affect the entire company's operations, and not just through lower costs related to shipping and cargo. The findings indicate that with such cooperation, the companies involved can achieve reduced environmental impact of operations and the ripple effects arising can be attracting new customers, support from the Norwegian State/Government (tax incentives), positive reputational effects, boosting staff morale, and driving innovations, which are factors all potentially having positive effects on business value.

Interoperability, as mentioned in chapter 3.1.2, is key when sharing data. Fewer data systems and improved integration are favourable for businesses, as it allows them to allocate resources more efficiently, improve innovation, and replace traditional decision-making processes. This was suggested by ConocoPhillips as a benefit from the LogisticsHub project. This concurs with the McKinsey report (2013) stating the immense value data sharing can generate given the assumption of interoperability (ch. 3.1.2). There is a mutual understanding between the companies in the supply chain where one expects direct reciprocity when sharing logistics data. The findings indicate that the project is believed to generate the most value when implemented

throughout the industry, which is also the goal of the project. Sharing logistics information will likely contribute to lower operating margins, innovation, increased quality of analysis and decision-making processes. Several of the findings related to benefits and gains moreover concurs with the goal for the standardised supply chain model resulting from the Konkraft report (ch. 3.5.1).

Impacts on business value can be both positive and negative, where an aspect having a negative effect on business value could be costs. From the study, it becomes transparent that the possible costs of sharing logistics data are related to IT, interoperability, supporting the project, and sharing business sensitive information. Interoperability appears to be both a benefit and a cost related to data sharing. The oil and gas industry's lack of interoperability, due to the development of company specific solutions rather than collaboration on common platforms, has proven to be a costly challenge in recent years. In this specific case study, sharing logistics information seems to be unproblematic for the majority, but it becomes transparent that some of the companies have a fear of losing competitive advantage by sharing such data if it could potentially have a negative effect on the business value. As displayed in figure 6, sharing information involves risk, and equilibrium has to be located by the companies when facilitating data sharing in order to secure value maximisation, as well as protection of sensitive business information.

In this specific case study, the findings suggest that sharing data on logistics does have an impact on business value, both positively and negatively. Although the findings likely suggest a positive impact on business value for the majority, this needs to be further evaluated in context with the other findings before reaching a conclusion. The results also suggest that LogisticsHub likely contributes not only to the individual companies but also to the entire industry, which is also stated as a goal of standardising the supply chain behaviour on the NCS (ch. 3.5.1).

5.2.3 Barriers

Barriers are faced by all companies in various situations and represent the obstacles businesses have to overcome. Financial, knowledge, and persistence barriers are usually faced in most industries, but in this specific case study the barriers the companies face are related to data sharing and thus include political, organisational, legal, technical, financial, and awareness barriers (ch. 3.2). In the LogisitcsHub case, the companies involved share logistics data with one another and release data that was previously kept internal. They are moving towards a shared/traded data policy and several of the barriers mentioned in chapter 3.2 apply also in this case as shared/traded data has some characteristics resembling an open data policy.

The findings indicate that most of the companies face technical barriers, especially in the implementation phase of the project. Standardisation, format, and availability seem to be an issue for some of the actors and these types of barriers constrain the efficient usage of data (ch. 3.2). It affects the workflow and employs costly resources, which potentially results in an increase in the cost of the project. The financial barrier is a common issue for most businesses and there is no exception in this case study, as some of the companies experience difficulty of securing funding for projects like LogisticsHub. Despite McKinsey's estimated cost savings in the petroleum industry through digitalisation, this is a barrier that is present for several companies and hinders the project's success. The lack of evidence and reliable data makes it difficult for businesses to justify the costs related to the project. The findings mainly show that the companies involved lack an overview of the total costs and benefits related to the project, and this might be the very reason why some of the companies involved encounter the financial barrier. This is closely related to the awareness barrier as some companies have trouble realising the potential benefits of sharing data. In this study, it appears that the majority of the companies see and highlight the benefits of sharing logistics information, but the ones that struggle have an explicit focus on the costs. Although this study focuses on a set of eight different companies, it becomes clear from the respondents that they believe awareness is a key barrier for implementation in the rest of the industry and also an assumption for the project's success.

From the respondents, it becomes evident that a few actors have concerns related to sharing logistics data, as it might affect their competitive advantage in the industry. This, however, varies for the different companies, as for the operators their core business is not logistics, whereas for others it is. Thus, releasing data on logistics information is a sensitive subject and important to acknowledge to ensure the success of LogisticsHub. This is an example of an organisational barrier (ch. 3.2), as it is the organisation itself that internally and externally constrains the sharing of data. However, the findings indicate that most of the companies do not have serious concerns related to sharing logistics information and the impact on their competitive advantage. Most of the companies are aware of these barriers and underline the importance of having the correct licenses and contracts in place to ensure a smooth and efficient flow of data, in order to prevent legal frameworks acting as a barrier instead of an enabler (ch. 3.2). As noted earlier in the paper, COVID-19 appears to be an extraordinary obstacle business have to overcome at this time. The companies experience delays in the implementation of LogisticsHub and the businesses are forced to prioritise other activities. To what degree it eventually will affect LogisticsHub is difficult to determine at this time, but it will undoubtedly affect both the implementation and further development of the project.

In this case study, the companies reveal several barriers potentially affecting the efficient sharing of logistics information between the players. But as the project is in its initial phase of implementation for most actors, it is unclear whether the barriers will have a significant negative effect on LogisticsHub, as the findings include assumptions by the companies interviewed. The respondents convey some as potential barriers in the future, whereas some are present also at this time. Whether the effect of the barriers will have an overall effect on the companies' business value has to be further evaluated in context with the benefits, as it is the combination of the benefits and costs that will shape the outcome of the project and the final effect on business value.

5.2.4 Technology and Digital Maturity

Adapting to ever more digital market environments and taking advantage of digital technologies to improve operations is an important goal for almost all modern businesses. Nevertheless, few companies are able to make the fundamental changes necessary to achieve this goal. There may be several reasons for this, including that the company is not digitally mature or that they are not able to take advantage of the benefits of digitalisation (Netlife Research, 2014). Digital maturity is defined as organisations that use digital work methods and technologies to improve processes, engage the workforce, and drive new business models (Deloitte, 2019). Poor management, lack of structure, no strategy, and low competence are usually indicators of digital immaturity (Netlife Research, 2014).

If a company is not digitally mature, it can cause problems in the process of implementing a new project. From the findings, it appears that most of the companies believe they can take advantage of the opportunities that LogisticsHub provides and do not need to develop new skills or technologies. However, the operators express a responsibility towards other actors to understand the solution and believe their organisation needs both new skills and technology. This is an important enabler for the project to be implemented in the industry, as actors have to do more than only invest in their own projects to succeed. Implementing LogisticsHub as a collaboration project is also mentioned as success criteria (5.2.1), and it is important to cooperate with other competitors and evaluate their own role in the market.

It is familiar that people tend to overestimate their own skills and knowledge. It is therefore possible to question that the minority of the companies believe they need new skills or knowledge, when the project has been running since 2013 and is still not implemented in the industry. The more extensive digitalisation is in a company, the higher the demands on employees mastering digital tools are. But there are even greater demands on the willingness and ability to change (WalkMe Team, 2017**)**. As the operators believe they need to develop new skills and knowledge due to the project, it concurs with both Wintershall DEA and Equinor stating they need to work on their ability. But it is noteworthy to mention that the operators in general consider their willingness as sufficient, since the operators, especially Equinor, are important drivers of further implementation. Despite this, it is alarming that some of the

companies consider their willingness as pending, as the project is not a requirement and entails costs. McKinsey has estimated that the petroleum industry could cut costs with NOK 30-40 billion through digitalisation, thus it is obvious that there is a great potential and the companies should invest time and resources in their willingness and ability to digitise. COVID-19 is cited by some companies as one of the reasons why their willingness to continue with the project is paused. But due to the potential cost savings projects like LogisticsHub should get even more attention in times of crises where cost savings are essential to survive.

The companies express the importance of projects like LogisticsHub and other data sharing initiatives, and the findings indicate a positive attitude for projects enabling future sharing in the industry. This attitude suggests that the companies comprehend the value potential in these types of projects, and through further digitalisation and innovation they all want to participate in the continuous development of the industry. The standpoint of the actors is crucial for implementation and success of the project as mentioned earlier and relates to the awareness and organisational barriers (ch. 3.2). Their promising outlook on LogisticsHub and similar initiatives related to data sharing could contribute to the companies' business value.

5.3 Costs and Benefits of LogisticsHub

An email was sent out to all the companies interviewed where they were asked to specify their answer to the questions related to costs and gains of the project, as this was a bit unclear from the interviews. The research question of this paper examines how the business value is affected by data sharing enabled by LogisticsHub. This section further examines how the companies are affected taking a closer look at the quantifiable costs and benefits of the project.

When initiating a new project, it is common practice to analyse the project to determine if the project is worth pursuing or not. A method frequently used is the NPV method, which evaluates projects or investments based on the expected cash flow. Thus, it was expected that the companies involved in LogisticsHub would have conducted a similar analysis of the costs and benefits before implementation. However, from table 2 and the interviews, it appears that the minority of the companies have a clear overview of their costs and benefits related to implementation and further operation of LogisticsHub. This is surprising as it makes it difficult to know whether it actually is a valuable project, or whether the companies simply believe it is. As mentioned in the earlier sections, awareness regarding the costs and benefits of LogisticsHub is an important criterion for success. In the interviews, the companies elaborate on potential costs and benefits, but few numbers are supporting their statements. The findings also suggest that the scepticism regarding the project among some actors might be overcome by having specific numbers to back their arguments. Hence, it would be advantageous to present estimations regarding the actual cost of implementation and further operational costs along with the estimated savings moving forward. It is through such an analysis it becomes evident whether the project or investment is profitable. In the oil and gas industry, as with other industries, no one wants to engage in a project unless they know it is profitable for the business as they always seek value maximising activities, and it is not common practice to pursue a project based on hazy assumptions regarding costs and benefits.

Table 2 displays estimations of the annual costs and benefits, received from the companies in this study, related to LogisticsHub. The costs are mainly related to the first year of integration. At first glance, there is a majority of empty cells, which is unfortunate. However, it also conveys an important message from the companies that do not have quantifiable costs or benefits. This indicates a lack of overview form those companies, as they do not know whether the project is actually profitable for their business and if it is expected that the benefits will exceed the costs, as the costs are usually greater in the initial phase. Even if the companies can not quantify the costs and benefits of LogisticsHub, it appears throughout the interviews that the different companies have some sort of opinions about the costs and benefits. As stated in 5.1.2, a common denominator for all the players is increased visibility and efficiency, which will lead to more predictability, better allocation, and exploitation of resources. This is considered as clear benefits and will also contribute to reduced costs. Regarding the companies' opinions related to costs, there is greater uncertainty compared to the stated benefits. The main costs related to LogisticsHub is expected to be the cost of implementation related to IT, interoperability between systems, support of the project, and some training. Therefore, the majority of companies believe that the gains will exceed the costs in the long run.

The costs of the project displayed vary between the companies, as Equinor seems to have the biggest cost of NOK5.5 million and Bring the lowest of NOK137 500. When studying the benefits there are few numbers to observe. This does not necessarily mean that the benefits of implementing the project are equal to zero, but rather that the companies do not have current estimations of benefits. Weatherford has estimated benefits equal to costs of NOK1.5 million, whereas Bring has benefits exceeding the cost by NOK70 500. Halliburton does not have a specific number at this time, but they believe when the project is in full implementation, they could reduce their lifting cost (X) by 15%.

	Equinor	Wintershall	ConocoPhillips	Halliburton	Weatherford	Norsea	Swire	Bring
Costs	5500K	2809K	1000K	-	1500K	-	200K	137.5K
Benefits	-	-	-	X*(1-15%)	1500K	-	-	208K
Benefits – Costs	-	-	-	-	-	-	-	70.5K

Table 2 - Estimated costs and benefits related to LogisticsHub

From the table, it is evident that the companies have not quantified the costs and benefits related to implementing LogisticsHub, but from the interviews it appears that the benefits are likely to be large enough to offset the costs in the long run. The costs and benefits associated with implementing the project affect the different companies' incentives and disincentives for sharing logistics information. But still, the findings indicate that the companies are positive to LogisticsHub, despite the drawbacks mentioned in the interviews. Although this is not reflected in table 2, it is important to take into consideration that these numbers are rough estimates.

From both a business point of view and a theoretical it is hard to believe that the companies interviewed have made so vague or no attempts to quantify costs and benefits, as it is common practice to evaluate projects based on cost-benefit analysis. With this in mind, it is possible to question whether this is actually the case or if the companies simply do not want to reveal the information in this study. The companies might see those results as business sensitive information and chose to keep it internal. However, it is an unfortunate situation as quantifiable results could potentially speed the implementation of LogisticsHub in the industry. A situation without an overview of costs and benefits is not sustainable in an industry that operates with low margins at the time and is always seeking value maximisation and cost reductions where possible. The difficult environment of the industry ever since the drop in oil prices in 2014/15 has affected many businesses, and it is as important now as ever to reduce operating margins and engage only in profitable projects. Thus, it is surprising that several companies seem to lack a complete overview of the costs and benefits of LogisticsHub.

5.4 Discussion of Findings

This section outlines the discussion of the analysis outlined in section 5.2 and 5.3. A connection has been established and the main incentives and disincentives for sharing data, in the LogisticsHub case, are presented. Further a closer evaluation of the recurrent patterns is discussed in relation to the research question before closing in on the concluding remarks.

Table 3 displays the key incentives and disincentives for sharing logistics data in the oil and gas industry. Like stated in earlier sections there is tremendous value potential in the area of logistics in the industry, as this has been neglected in the past. Now, however, this area is prioritised by several companies as they see the potential for reducing their operating margins through collaboration and sharing logistics information between the players in the supply chain.
The companies interviewed have highlighted predictability, visibility, and efficiency as important drivers of the project. This has proven to be a key motivation for most of the companies, as well as the potential spillovers it will have throughout the supply chain. As LogisticsHub facilitates collaboration, the companies have the opportunity to consolidate shipping and cargo, thus reducing the number of trucks and achieving greener operations. Further the superior tracking information enables resource optimisation and is frequently mentioned by the companies as a key incentive for sharing logistics information.

Even though the findings in the analysis suggest that the companies are positive to data sharing, there are still some drawbacks being mentioned throughout the analysis, which affects the companies' incentives for sharing logistics information. As elaborated on in section 5.3, costs and benefits impact the companies' incentives for initiating the project and sharing data. The arguments supporting data sharing lack quantifiable results, which is problematic for some actors. Further the implementation costs, as well as challenges related to integration could potentially halt the project and serve as a disincentive. Some actors also find themselves in conflicting situations as they want to share logistics information, but are concerned about losing their competitive advantage if doing so. There is a notion of rejecting the solution as it has shortcomings at this time and is therefore of reduced value to the business. The unfortunate situation companies find themselves in due to the COVID-19 virus and the significant drop in oil prices at this time also affects the project negatively.

Key incentives	Key disincentives
⇒ The industry has improvement potential within logistics ⇒ Assemble the industry on a joint platform to facilitate cooperation ⇒ Reduce the traffic on Norwegian roads and thereby cutting CO_2 emissions ⇒ Increased visibility, predictability, and efficiency ⇒ Track equipment to optimise use of resources	⇒ Challenges related to IT, data integration, system interoperability, and the cost of overcoming those challenges ⇒ Difficult to prioritise the project and get funding for implementation due to the current situation with the virus and low oil prices ⇒ Not an overall agreement and overview of costs and benefits related to the project ⇒ Lack of willingness to share data, due to fear of losing competitive advantage ⇒ General shortcomings in the solution

Table 3 - Overview of key incentives and disincentives

To reach an evaluation of whether these incentives for data sharing in the end have an impact on business value, they need to be assessed in relation to each other. Based on the theory and interviews, it is possible to state that sharing logistics information in some ways impacts the business value, both negative and positive. As discussed in section 5.3, it is difficult to conclude whether it is the negative or positive effects that is most significant. Since a complete analysis of costs and benefits related to each actor in the supply chain are absent, it is challenging to conclude who reaps the most benefits from the solution, but it is possible to draw some general conclusions. From the findings and the incentives/disincentives presented it seems likely that the companies' business value is affected.

Whether it is the incentives or disincentives that are the most impactful may vary for the different companies in the supply chain, as they experience these benefits and barriers to different degrees. Most of the actors believe that LogisticsHub will provide business value beyond the area of supply chain. There is also a common belief among the operators, suppliers, and base company that the solution is needed in the industry. Suppliers and CCU owners are perceived as the most critical actors, but they still see the importance of the project as they have committed to join the pilot. In general, all the companies are positive regarding the implementation of LogisticsHub in both the industry and for the individual companies. But there is an underlying scepticism as the project is not completed - a scepticism that may be linked to an absent analysis of costs and benefits.

As sharing logistics information through LogisticsHub seems to impact the entire company operations, it may have positive spillovers that can benefit the entire supply chain. However, as already mentioned, it is uncertain whether it has an overall positive or negative impact on companies' business value. For the solution to be profitable for all the players, the benefits must be of greater value than the costs. The companies indicate more benefits related to the project than disadvantages, which is anticipated as the companies interviewed have committed to the solution. This may also be an indicator that the project has a greater positive impact on the industry as a whole, rather than negative. However, this is not supported by quantifiable results, thus, making it difficult to reach a clear consensus on the impact of business value.

6.0 Concluding Remarks

Case literature and theory suggest an extensive value potential for data sharing as data is considered crucial for future economic development, innovations, technology advancements, competitive business environments, and society in general. This is building on the assumption that data sharing between companies does not compromise their competitive advantage. By investigating if data sharing between companies in the oil and gas industry has an impact on business value, and more specifically studying this issue through the case of LogisticsHub, it provided a real-life example of how the companies' business value is affected. Interviews with the companies involved in the LogisticsHub project, representing the entire supply chain, provided a further basis for the analysis of the issue in relation to the background material and the research question. The results indicate an impact on business value through increased efficiency, visibility, superior planning, greener operations, and consolidation of cargo. These effects are consumed to differing degrees by all the actors involved in LogisticsHub. But it also entails costs related to IT, interoperability, and training affecting business value. Thus, it is complicated to state whether there is a positive or negative effect on the individual companies. The majority convey benefits to be greater than costs, even though there is a lack of quantifiable results to support this statement. The results claim that data sharing between the players in the oil and gas industry does have an impact on business value. From an industry perspective, the results suggest a likely positive impact on business value given the assumption of full integration in the industry.

Data sharing is a highly relevant subject of study for most industries and businesses today. The potential impact on business value is a key factor that has to be taken into consideration when establishing frameworks for data sharing within and between organisations. Thus, data sharing deserves more attention by managers, organisations, and policy makers as they have the ability to enable safe and reliable sharing of data throughout the industries.

As this study examines a specific case it is inappropriate to generalise the results beyond this situation, given the uniqueness of every situation. The sample size of the study might affect the results as a larger sample could provide stronger evidence for the results. For further research, it could be advantageous to study the subject of data sharing and the value potential for businesses

in other industries and cases, including a larger sample, to establish empirical evidence serving useful for policy makers and managers in the facilitation of data sharing.

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Appendix

The transcribed interviews are available on request