Master's thesis

NTNU
Norwegian University of Science and Technology
Faculty of Economics and Management
Dept. of Industrial Economics and Technology Management

Henrik Ombudstvedt
Julie Sildnes

Open Business Data: How Private Companies Can Extract Value From Opening Their Data

Master's thesis in Industrial Economics and Technology Management
Supervisor: Øystein Moen
June 2020

NTNU
Norwegian University of Science and Technology

Henrik Ombudstvedt
Julie Sildnes

Open Business Data: How Private Companies Can Extract Value From Opening Their Data

Master's thesis in Industrial Economics and Technology Management
Supervisor: Øystein Moen
June 2020

Norwegian University of Science and Technology
Faculty of Economics and Management
Dept. of Industrial Economics and Technology Management

NTNU

Kunnskap for en bedre verden

Preface and acknowledgments

This master thesis is conducted as a part of obtaining a Master of Science in Industrial Economics and Technology Management at the Norwegian University of Science and Technology (NTNU). The thesis was written in the spring of 2020 and is a requirement for specializing in the field of Strategy and International Business Development. The idea of exploring open business data was a result of the authors' interest in the topic as well as the recent relevance in Norway. We hope our thesis contributes to increase the understanding of open business data. Specifically, we hope managers find our framework and findings inspirational to initiate open business data initiatives.

The thesis was written under the supervision of Professor Øystein Moen. We would like to thank him for guidance and support in the process. We truly appreciate his inputs and sharing of knowledge, which has helped us in forming our thesis. Lastly, we thank our case companies DNB, Telenor, DNV GL, Cognite, and Think Outside, as well as The Norwegian Data Protection Authority and Kongsberg Digital for contributing with valuable data to our analysis and taking the time to participate in interviews.

Trondheim, June 5, 2020

Henrik Ombudstvedt

Julie Sildnes

Abstract

The exponential amounts of data companies gather from customers and operations form a basis for extracting value through sharing and selling data. Open business data (OBD) is a term used to describe how private organizations share data with other parties through various arrangements, subject to restrictions that businesses decide to put in place. The European Commission estimated the global data economy to be valued at €829 billion in 2025 (European Commission, 2020b), pointing the massive value potential related to opening data both for companies and societies.

In the last decade, the focus in the literature has mainly been on Open Government Data (OGD), exploring how governments can open up their data to their citizens, while the private sector has been given less attention. OBD is still a scarcely studied field in the literature, and scholars argue that private organizations are lagging behind. Despite the great assumed underlying values, few studies in the literature support managers in extracting them.

The purpose of this study is to provide insights into how companies can approach OBD initiatives through an analysis of the market and decision making of Norwegian companies, and proposing a decision support framework for managers. In the context, we present how the characteristics of data distinguish it from more traditional resources, and the value potential related to it. The conceptual part of the study explores the literature on OBD, supported by open data and OGD theory. Then effectuation-based decision making is combined with OBD literature in the proposition of a decision support framework for managers of OBD projects. A multiple case study, based on interviews, is used to provide an empirical foundation to discuss the characteristics of the market and decision making and evaluate the framework.

The OBD market is found to be immature and having several prominent barriers. We especially highlight the challenges related to finding good use cases, and valuating and pricing data and data products. Through five case studies, we identify prominent use of effectuation decision making processes in the companies. An intuitive decision support

framework is therefore found to be based on effectuation theory and consisting of three main steps: 1) assessing organization and data, 2) experimentation and validating demand, and 3) evaluation of drivers, barriers, and organizational changes. Implications of our research suggest that managers with general aspirations of creating value from data should follow the proposed framework when approaching OBD projects. In specific, they should look into their data resources and experiment to validate the demand for their data. Furthermore, policymakers should help educate both suppliers and users of data, as well as contribute with infrastructure where it is possible. More research is needed to keep up with the developments of OBD, i.e by looking into how consumer privacy and security are maintained along the way. In addition, as we find few examples of OBD initiatives in literature, studies identifying and studying success stories are warranted.

The study contributes to OBD literature, an area of research that is scarcely studied. As far as we know, the study is the first to explore effectuation-based decision making in relation to OBD. By placing OBD in the literature and presenting an overview of relevant topics such as ecosystem, infrastructure, drivers and barriers, the thesis is a valuable contribution and foundation for further research.

Keywords: Open business data, decision support framework, open data

Sammendrag

De eksponentielle datamengdene dagens selskaper samler inn fra virksomhet og kunder danner grunnlag for å hente ut verdi gjennom deling og salg av data. Åpen forretningsdata er et begrep som brukes for å beskrive hvordan private organisasjoner deler data med andre parter gjennom forskjellige ordninger, underlagt begrensninger som virksomheter bestemmer seg for å få på plass. EU-kommisjonen estimerte i 2025 den globale dataøkonomien til å bli verdsatt til 829 milliarder euro (European Commission, 2020b), og pekte på det enorme verdipotensialet knyttet til å åpne data fra selskaper og offentlig sektor.

Det siste tiåret har fokuset i litteraturen hovedsakelig vært på åpning av data fra offentlig sektor, mens åpning av data fra privat sektor har fått mindre oppmerksomhet. Åpen forretningsdata er fremdeles et lite studert felt i litteraturen, og forskere hevder at private organisasjoner henger etter. Til tross for de store antatte underliggende verdiene, er det få studier som forsøker å hjelpe ledere i å hente de ut.

Hensikten med denne studien er å gi innsikt i hvordan selskaper kan tilnærme seg åpen forretningsdata-initiativer gjennom en analyse av det eksisterende markedet og hvordan beslutninger i selskaper tas i dag, for foreslå et beslutningsrammeverk for ledere. I konteksten presenterer vi hvordan kjennetegnene til data skiller det fra mer tradisjonelle ressurser, og det underliggende verdipotensialet. Den konseptuelle delen av studien utforsker litteraturen om åpne forretningsdata, støttet av teori fra åpen data. Deretter kombineres effektiviseringsbasert beslutningstaking med åpen forretningsdata-litteratur for å foreslå et beslutningsrammeverk for ledere. En casestudie, bestående av fem selskap, brukes til å gi et empirisk grunnlag for å diskutere kjennetegn ved markedet, beslutningsprosesser og å evaluere rammeverket.

Markedet for åpen forretningsdata er funnet å være umodent og ha flere fremtredende barrierer. Vi trekker spesielt frem utfordringene knyttet til verdsettelse av data og å finne gode brukstilfeller. Fra casestudiene identifiserer vi fremtredende bruk av effektiviseringsbaserte beslutningsprosesser i selskapene. Et intuitivt beslutningsrammeverk

er derfor funnet til å være basert på effektiviseringsteori, og består av tre hovedtrinn: 1) vurdering av organisasjon og data, 2) eksperimentering og validering av etterspørsel, og 3) evaluering av drivere, barrierer og organisasjonstilpasning. Studiene våre antyder at ledere med generelle ambisjoner om å hente verdier fra data, skal følge det foreslåtte beslutningsrammeverket når de skal tilnærme seg prosjekter tilknyttet åpen forretningsdata. Spesifikt, bør de eksperimentere for å validere etterspørselen etter dataene sine. Videre bør offentlige beslutningstakere bidra til å utdanne både selskaper og brukere av data, samt bidra med datainfrastruktur der det er mulig. Mer forskning er nødvendig for å følge utviklingen av åpne forretningsdata, spesielt på hvordan forbrukernes personvern og sikkerhet opprettholdes underveis. I tillegg er det behov for studier som identifiserer og studerer suksesshistorier, som kan inspirere ledere.

Studien bidrar til litteratur på åpen forretningsdata, et forskningsområde som er lite studert. Så langt vi vet, er studien den første til å utforske effektiveringsbaserte beslutninger i sammenheng med åpne selksapsdaata. Ved å plassere åpen forretningsdata i litteraturen og presentere en oversikt over relevante temaer som økosystem, infrastruktur, drivere og barrierer, er oppgaven et verdifullt bidrag og et grunnlag for videre forskning.

Nøkkelord: Åpen forretningsdata, beslutningsrammeverk, åpne data

Contents

List of Figures

List of Tables

1 Introduction and research question

The omnipresence of technology in today's society produces immense amounts of data, creating opportunities which can benefit citizens, private and public sector. In recent years, there has been much focus on that the value of data can be realized and amplified when shared, a concept referred to as open data (Herala et al., 2018). Skogli et al. (2019)'s prognosis show that Norwegian data based value creation might reach 300 BNOK by 2030, and in fact pass the oil and gas revenues, thus having the potential of becoming Norway's "new oil." The Norwegian government has taken note of the opportunities, and will in the autumn of 2020 release a report on how they can facilitate for the Norwegian data economy to grow to it's potential. However, data sharing is often associated with concerns on individual's privacy and security, and requires careful consideration to ensure it is done within legal and ethical frameworks. Companies that are able to seize the opportunities of data sharing in a right way can create a competitive advantage in their industry or even disrupt it. Mobile apps that use location data to limit the spread of the global Covid-19 virus in the spring of 2020 has shown a powerful example of how data sharing also can benefit the society.

The main focus of open data literature has been on how governments can increase transparency and give back data to the public (Herala, Vanhala, et al., 2016). Private sector organizations have mainly been viewed as potential users of this data (Buda et al., 2016; Immonen et al., 2014b), i.e. in creating data driven business models (DDBMs) (Hartmann et al., 2016). However, some researchers have recently sought to examine how private organizations stand to benefit from providing open data, referred to as open business data (OBD). Private sector organizations are lagging behind in the field of opening data, and there is a need for literature on the topic to give insights to practitioners approaching initiatives (Buda et al., 2016). According to Herala, Vanhala, et al. (2016), open data will not reach its full potential until private companies engage, and emphasizes the need for strategies and policies for private companies.

The purpose of the thesis is to provide useful insights for managers, policymakers and

scholars on the topic of OBD. We seek to combine literature on OBD and effectuation decision-making theory, together with a case study on five Norwegian companies to evaluate the state of the OBD market, and provide a decision support framework for managers looking to extract value from their data. Our research question is the following:

RQ: How can companies reap the benefits of open business data?

There are several ways of addressing this, and we will do so through answering the following subquestions:

1. Which strategies do Norwegian companies follow and which barriers do they face?
2. What characterizes their decision-making processes?
3. How should companies approach open business data?

In order to answer our research questions, we have structured the paper in the following way. We begin with setting the context of the thesis, exploring the value potential and characteristics of data as a resource. Then we will go into the theoretical underpinnings of OBD and strategic decision making. Based on this, we will outline a decision support framework for managers approaching OBD initiatives. We will then explain the methodology used, and point out the limitations of our study. The next part is a case study, consisting of five Norwegian companies currently working with OBD initiatives. Further, the research question and subquestions will be addressed in the discussion based on the theoretical and empirical insights gained. Lastly we present conclusion and implications for managers, policymakers and research, before we outline our final remarks.

2 Context

In this section, we will set the context of the thesis by introducing key concepts on data and how value can be extracted from it. Firstly, important characteristics of data, which have implications for how to work with and capture value from data are presented. Secondly, we look broadly into the value potential of the data economy. Lastly, we give an overview of the current state of the Norwegian data economy, before summarizing.

2.1 Data characteristics

Data has been widely accepted as a resource for over three decades in the literature of information management (Eaton & Bawden, 1991). Since then, many have explored and compared its properties with the properties of traditional resources (Cleveland, 1982; Eaton & Bawden, 1991; Levitin & Redman, 1998). Data has several characteristics that set it apart from e.g. raw materials, factories, and machinery. In this section, we will introduce some of the characteristics of data that affects how one can extract value from data. We will not distinguish between data and information, as the terms and meanings are used interchangeably (Eaton & Bawden, 1991).

Intangibility

The most distinctive characteristic of data is its intangibility (Levitin & Redman, 1998). This entails that data cannot be touched, described, or valued exactly.

Shareable

Data is shareable and transportable in a virtually instantaneously way (Cleveland, 1982). Data can easily be shared with numerous recipients and used for many applications simultaneously (Levitin & Redman, 1998; Cleveland, 1982). This property is not valid for other traditional resources and proposes both opportunities and challenges not pertinent for the management of traditional resources (Levitin & Redman, 1998). As data easily can be duplicated and shared, ownership is often a liquid concept. It is difficult to regulate the use of data, which is the reason for the increasing awareness of privacy.

Multi-sourced

Unlike many other resources, data is generated by a tremendous number of sources (Levitin & Redman, 1998). Typically, the data is produced by sensors and radars or is human-made, i.e. customer transactions or movements. The data used by companies is often aggregated from several sources and contextualized, requiring standardization and coherent connection. Having multiple sources can lead to bad quality as one bad data source can spread and affect numerous others, and consequently, it can be hard to hard to know the quality of the data you have in hand.

Non-consumable

Data is non-consumable (Levitin & Redman, 1998; Eaton & Bawden, 1991). When data is shared, the amount does not diminish. Further, Levitin & Redman (1998) argue that it does not decrease in value by sharing. This does however has some exceptions, e.g. stock tips will be less valuable when shared with many people. Another example is data closely tied to a company's competitive advantage.

Renewable

New data results from everyday business, often at astounding rates. The spontaneous nature, the rate, and the degree of data renewal are far greater for data than for any other resource (Levitin & Redman, 1998).

Versatile

Data can be used for a variety of purposes. Levitin & Redman (1998) argue that data is versatile in the way that it can be useful for various situations and applications. Versatility also opens for misuse of data, occurring when data is illegitimately used for a purpose it was not collected for.

Hard to valuate

While the valuation of traditional resources is regulated by market forces and well-established accounting practices, the valuation of data is challenging (Levitin & Redman, 1998). Brokering of data is a less mature business area, and as data is intangible and versatile, Eaton & Bawden (1991) argue that the value of it is impossible to determine

in advance. Its value depends upon the context and use by particular users on particular occasions (Belisssent, 2018).

Dynamically stored

Data differs from traditional resources in the sense that it is dynamic, and can both increase and compress in size (Eaton & Bawden, 1991; Levitin & Redman, 1998). The cost of storing data is low and place-efficient, implying that one can store large amounts of it. Thus, oversupply is expensive not so much because of waste storage, but because is diverts management attention and makes needed data more difficult to find.

Fragile

Data is fragile, as it can easily be overwritten or lost (Levitin & Redman, 1998). Data is also prone to leakages (Cleveland, 1982), which is particularly critical for sensitive data such as information on private individuals. To secure the data, companies need to have systems and cybersecurity strategies in place to prevent loss or unauthorized access.

That data is shareable, non-consumable, and versatile opens up for a range of cooperation and business models where data can be exploited by numerous actors simultaneously. That data is hard to valuate is closely related to it being versatile, and is one of the biggest challenges of extracting value from data. Bad quality due to lack of standardization, incoherent connection of sources or overwriting of cells can make the data completely useless, or require a lot of resources to clean before it can be used. Thus, the characteristics themselves, as well as the combination of them, pose challenges for the management of them.

2.2 Value potential

A big motivation for exploring the topic of extracting value from data is the, often mentioned, huge untapped value potential. In February 2020, the European Commission estimated the European data economy to be valued at €829 billion in 2025, from €301 billion in 2018 (European Commission, 2020a). This follows from a global data volume increase of 530%, from 33 zettabytes in 2018 to 175 zettabytes in 2025. They state that

data is at the core of economic development:

> Data is the lifeblood of economic development: it is the basis for many new products and services, driving productivity and resource efficiency gains across all sectors of the economy, allowing for more personalized products and services and enabling better policy making and upgrading government services. It is an essential resource for startups and small and medium-sized enterprises (SMEs) in developing products and services. The availability of data is essential for training artificial intelligence systems, with products and services rapidly moving from pattern recognition and insight generation to more sophisticated forecasting techniques and, thus, better decisions. (European Commission, 2020b)

To extract the most of the stated potential, The European Commission argue that data should be available to all; citizens, public and private companies, big or small, startup, or giant (European Commission, 2011).

However, the quantification of data economy's impact on value creation and employment is still in an early phase of the economic literature (Skogli et al., 2019), but some pioneering studies have been conducted. Menon Economics, a Norwegian consulting company, have examined some of these methods and tried to valuate the Norwegian data economy on request from The Confederation of Norwegian Enterprises (NHO) in late 2019 (Skogli et al., 2019). Menon Economics base their evaluation of the Norwegian data economy on the studies conducted in other countries and says that is reasonable to believe that Norway is similar to the UK, Ireland, Netherlands and Germany in regards to the data economy's share of the country's total BNP. Given the method of the studies, Menon Economics argue that even though these countries had a great variety in digital development and open government data, these were still considered to have the same impact of the data economy, namely 4% of the BNP and 3% of the workforce. Concluding, Menon Economics estimates the Norwegian data economy to create value corresponding to 150 billion NOK, and employment corresponding to 100 000 jobs (Skogli et al., 2019). In a future scenario where Norwegian business has been able to better reap the underlying

potential of data through innovation, with a yearly average growth rate of 5%, Menon Economics estimates the Norwegian data economy to create value corresponding to 250 billion NOK in 2030 (Skogli et al., 2019). The next part will go deeper into the current state of the Norwegian data economy.

2.3 Norwegian data economy

The starting point for open public data in Norway came in 2011 with the announcement of guidelines saying that all public agencies should strive to make their raw data publicly available in readable formats, which are now available at the website www.data.norge.no (DIFI, n.d.). Examples of data sets from the public sector are weather data from the Norwegian Meteorology Institute, traffic information from the Norwegian Public Roads Administration, and data on electric charging stations from Enova (DIFI, 2019). Closer collaboration between the public and private sector, which is the purpose of initiatives like this, is in line with Skogli et al. (2019)'s recommendations on how to extract value from the data economy.

Report to the Storting on the Norwegian Data Economy

In December 2019, then minister of digitalization, Nikolai Astrup, stated that the government will make a report to the Storting on data driven economy and innovation (Regjeringen.no, 2019). The report will go into various topics exploring how the government best can facilitate a thriving Norwegian data economy and is planned to be finalized autumn 2020. Astrup said that until that point, all efforts have been focused on getting the public to share data, in order to help private companies benefit from them, but that it's now time to explore whether private companies should have to share their data to the best interest of the public (Bjørkeng, 2019). Astrup emphasized the potential value in the data: "If we manage the data in the right way, data driven innovation can become one of the most important drivers for economic growth."

Astrup pointed out the prominent dilemma on how to balance private ownership rights and the common good (Regjeringen.no, 2019). As an input to the work on the report, exploring these and similar matters, there has been put together an expert group with

representatives with a variety of interests, including from private and public companies, research institutes, and legal advisement. This group delivered an expert report in April 2020 (Gjørv et al., 2020).

One success story for sharing of data in Norway is the oil and gas industry database Diskos. Diskos was initiated in 1995 by The Norwegian Petroleum Directorate together with the largest Norwegian oil companies at the time (Oljedirektoratet, 2019). Since then, it has collected data from seismic explorations, done by and shared with around member companies on the Norwegian continental shelf (Oljedirektoratet, 2019). The chances of oil discovery increase with the amount of available raw data (Skogli et al., 2019). The discovery of the enormously valuable Johan Sverdrup field in the North Sea is claimed to be made possible due to the Diskos database (Skogli et al., 2019). Astrup pointed to this as an example of the importance of data sharing in Norway (Bjørkeng, 2019).

The Norwegian Data Protection Authority

Important and central matters on the topic of data exploitation are the legal and ethical aspects. These are treated by The General Data Protection Regulation (GDPR), a legal framework that sets guidelines for the collection and processing of personal information from individuals in the EU (European Commission, n.d.). The Norwegian Data Protection Authority (DPA) is the public authority, supervising that authorities, businesses and individuals follow data protection legislation, including GDPR (Datatilsynet.no, n.d.). One of their main tasks is to protect the individual right to privacy (Datatilsynet.no, n.d.).

On April 22. 2020, we interviewed the director of chief at the Norwegian DPA, Bjørn Erik Thon, about their view on the report to the Storting, and the emerging data economy in general. Thon gave the government an input statement on the ongoing work on the report. One of his recommendations was to create a regulatory sandbox: "When building a data driven economy, it is important to have places were companies can test data, and even cross lines without there being consequences, before entering the market with the solution." Thon said that they have for a long time seen a trend of the increasing willingness to sharing among Norwegian citizens. He explained that most consumers

today expect that their data is used for something and that they will receive something return, in form of improved products, services, or offers. The consumers do however want to know what their data will be used for, and Thon explained that they are more willing to share with Norwegian companies than international.

What the data collected will be used for is one of the most important aspects when the Norwegian DPA reviews companies' use of data, Thon explained. Further, Thon said that they see an increase in companies looking for ways to capitalize on their data. He elaborated that his perception was that the companies mostly do so through business models and constellations, rather than through sharing with other companies. Sharing of customer data between companies prompt some additional legal issues, according to Thon. "It is important that these collaborations are not undermining the consumer's privacy rights. The customers must consent to their data being shared, but when several companies are involved, it can be hard to keep track of who has access and if they are complaint," Thon stated.

As we have seen in economical studies, and as stated by Gjørv et al. (2020), no one is disputing the enormous potential of the data economy. The Norwegian government has started processes to explore how they best can regulate for a thriving data economy. These ongoing developments show that extracting value from data is a relevant and important topic.

3 Theoretical background

The theoretical background is intended to give a foundation for discussing the research question and subquestions proposed in Section 1. To do this, we have divided the theoretical background section into three main parts.

The first part will explore the theory on OBD. The second part will outline the strategic decision-making theory of effectuation and causation. We will argue why this theory is relevant for companies with OBD initiatives, and this will form the basis for analyzing the decision making in our case study. The third part combines the two first parts to outline a decision support framework for managers approaching OBD initiatives.

3.1 Open business data

This section places the concept of OBD in literature and explores relevant and supporting theories on open data, open government data and data sales, to get an understanding of the topic. Next, we define the OBD term and outline the ecosystem actors, infrastructures, and data markets. Then, drivers and barriers faced by companies that explore OBD initiatives will be presented, before outlining OBD strategies.

3.1.1 Supporting theory

Open data

Although they are one of the primary users of governmental open data sets, private sector companies themselves are not very active in opening the massive amount of data they produce (Buda et al., 2016). Only in recent years, private companies have begun to make their data available to others (Manyika et al., 2013), and the literature on the field is young and relatively scarcely explored (Kitchin, 2014; Richter & Slowinski, 2019; Say, 2013; Herala, 2018). OBD can be said to be a part of the more explored and mature literature on open data, which is a term used by scholars to describe freely sharing of data.

Several sources (Bonina, 2013; Hammell, 2012) refer to opendefinition.org's definition of

open data. The newest definition on this website is currently "Knowledge is open if anyone is free to access, use, modify, and share it - subject, at most, to measures that preserve provenance and openness (The Open Definition, n.d.). The notion of the underlying opportunities of data, and opening data, was advocated through what Kitchin (2014) describes as "The open data movement". Kitchin (2014) elaborates: "The movement is built on three principles: openness, participation, and collaboration (...). That through transparency, sharing, and working together, the value of data for society can be realized. It aims is to democratize the ability to produce information and knowledge, rather than confining the power of data to its producers and those in a position to pay for access." In other words, the concept of open data is that publicly founded data provides greater returns and create more wealth through downstream output when shared, rather than kept closed (Herala et al., 2018).

Open government data

The theory on open data is mainly focused on open government data (OGD), which has increased in interest during the last ten years (Herala et al., 2018). OGD is a term used to describe how governments publish data openly to the public (Herala, 2018). Many governments, both inside and outside the EU have taken note of the opportunities related to open data (Waller, 2011). The US, under the leadership of President Barack Obama, was one of the front runners, stating in 2009 that they would start a transparency strategy, implying an unprecedented openness in the government (Huijboom & van den Broek, 2011). Inspired by that, many governments have followed, and put "open data" on their agenda, including European countries (Huijboom & van den Broek, 2011; Juell-Skielse et al., 2014). OGD theory is particularly relevant when exploring drivers and barriers for opening data.

Huijboom & van den Broek (2011) compared five countries (Australia, Denmark, Spain, UK, US) open data initiatives, and identified their motivations and challenges. They found three main motivations for governments to take on open data strategies: 1) increase democratic control and political participation, 2) foster service and product innovation, and 3) strengthen law enforcement. In a white paper report on the Digital Agenda of

Norway, Kommunal- og moderniseringsdepartementet (2016) present three arguments for why opening public data is important for the society. The two first arguments are corresponding to the first two found by Huijboom & van den Broek (2011), namely to create a transparent and democratic society, and that opening data can lead to more innovation and efficient public processes, i.e through open innovation processes. Open innovation is rooted on an assumption that knowledge is widely distributed, and that one must identify, connect to, and leverage external sources at the core of innovation (Chesbrough et al., 2006). Thirdly, Kommunal- og moderniseringsdepartementet (2016) argue that open government data allows private businesses to develop new services, products, and business models founded on access to public information. These business models are by some scholars referred to as data driven business models (Hartmann et al., 2016).

Several scholars argue that open data will drive growth and have an enormous value potential in the society (Hammell et al., 2012; Manyika et al., 2013) However, Huijboom & van den Broek (2011) state that there are big uncertainties related to how to measure the effects of government open data strategies, and that studies show ambiguous results (Huijboom & van den Broek, 2011). They explained that governments often refer to more general and macro-economic studies on open data to justify their open data strategy. Despite this, many policy makers admit that the precise economic impact of the strategy remains unclear (Huijboom & van den Broek, 2011), and several researchers point out that there is a lack of research on the value created of open data initiatives and open innovation (Pedersen, 2020; Herala et al., 2018).

Data sales

A main driver for several private organizations is gaining new revenue streams. Several different fields of literature cover aspects that are relevant for the commercialization of data. Scholars within the field of data driven business models (DDBMs) discuss how companies use data as a key resource in their business models (Hartmann et al., 2016; Ombudstvedt & Sildnes, 2019; Bulger et al., 2014). A subset of DDBMs monetizes data directly by selling data or data-based services (Ombudstvedt & Sildnes, 2019). In order words, these businesses open data in exchange for monetary benefits. The data can i.

e business data gathered from own operations and customers, sometimes combined with other data sources to provide additional value. Other scholars study various aspects that are relevant for OBD, including data sales (Rantala et al., 2020), pricing of data, and data markets (Heckman et al., 2015; Fricker & Maksimov, 2017), and revenue models (Schuritz et al., 2017).

3.1.2 Definition and ecosystem

Defining open business data

The open data trend is clearly present in the public sector, in contrast, open data in the private sector has gained less attention both by practitioners and scholars (Buda et al., 2016). According to Buda et al. (2016), the main difference between the private and the public sector is that many private companies seek new revenue streams from their data. To fully understand how private companies can extract value from data, we must draw on concepts from both open data and data sales. We will now look into a definition of OBD that combines these views, where the focus is that data is being shared in exchange for various benefits, including monetary.

Hammell (2012) and Jaakkola et al. (2014) have definitions of OBD that reflect the open data perspective. They claim that OBD is data produced or collected by the private sector and published freely and openly, subject to restrictions that individual businesses decide to put in place. This view, therefore, excludes data monetization. In contrast, Manyika et al. (2013) argue that data sets range from completely open to completely closed related to four characteristics, where cost is one of them. Similarly, other scholars (Buda et al., 2016; Hammell et al., 2012; Jaakkola et al., 2014; Herala, 2018) use the notion of open business data to describe data being shared or sold by private companies. Kitsios et al. (2017) seem to agree with this, including businesses that sell data in their open data ecosystem. Thus, scholars have different views on what OBD covers, and there is a need for an established, broad, definition of OBD (Buda et al., 2016).

We argue that data sales is an important part of OBD, and thus should be reflected in a definition. Combining views of the mentioned scholars, we propose a definition that will

be used throughout this thesis:

> "Data that has been produced or collected by the private sector and shared in an open or closed ecosystem, subject to restrictions that businesses decide to put in place."

Ecosystem actors

The OBD ecosystem is central in understanding how businesses can extract value from data. There exist several descriptions (Buda et al., 2016; Ponte, 2015; Hammell, 2012; Kitsios et al., 2017; Immonen et al., 2014a; Bulger et al., 2014) on what an open data ecosystems look like, with overlapping actors and relationships.

Buda et al. (2016) present a comprehensive description of the OBD ecosystem that we will briefly present to get an overview and make it easier to discuss the different actors. There are seven actors in the ecosystem: data suppliers, other businesses, public institutions, academia, citizens, non-profit organizations, and citizens. The private organizations supplying data are the keystone players in an ecosystem, see Figure 1. The figure shows examples of how the ecosystem actors can interact with each other. Data suppliers can have a data driven business model, according to Bulger et al. (2014). They argue that many organizations may generate data of intrinsic value to others in their ordinary course of business, even though they do not specialize in supplying data. For instance, many firms have data about their customers that is of value to marketers.

All the other actors can be interpreted as users of the OBD. In Buda et al. (2016)'s ecosystem, other businesses" may consist of partners, competitors, suppliers, complementors, non-partners, or business consumers consuming services and products of the supplier of OBD. The users of the data may establish DDBMs themselves by using the data as a part of their value offering (Hartmann et al., 2016). Public institutions may influence the ecosystem not only by using the data, but also imposing regulations on what data that organization must open, or data they must be careful when opening, i.e data related to privacy or security. They can also act as a neutral third party, establishing infrastructure for the data.

Academia may use the data to develop new applications or present interesting research on the topic (Perkmann & Schildt, 2015). Non-profit organizations may use the data for their own purposes, or they can help in the processes of opening up the data. Citizens can be driven to join the ecosystem by i.e. identifying business opportunities and contribute to innovation. Media as an ecosystem actor can impact the supplying organization by negative or positive publicity.

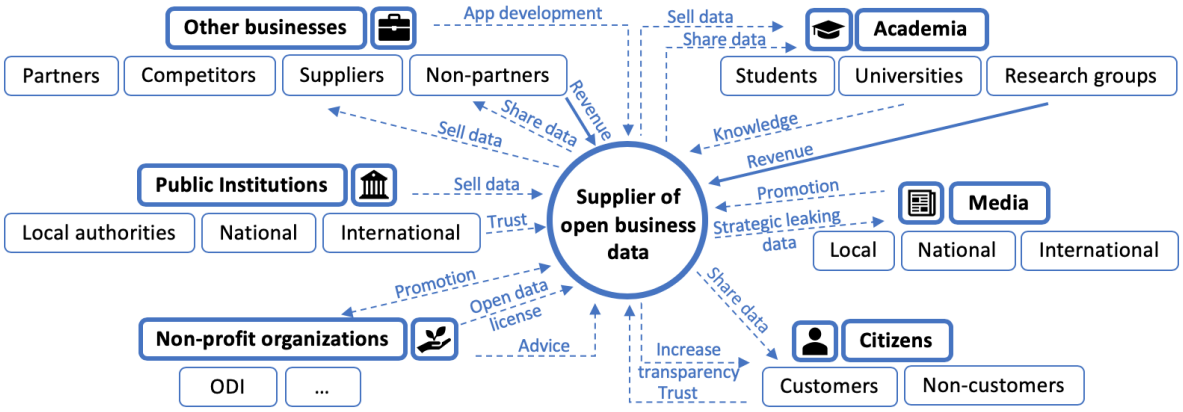

Figure 1: OBD ecosystem inspired by Buda et al. (2016)

OBD infrastructures

There are several ways that a data supplier may choose to open data to connect with the users. Buda et al. (2016) mention three ways; on the company's website, on a platform service, or at a data market place (Buda et al., 2016). In this context and further in this thesis, "infrastructures" are interpreted as channels or utilizes that enable exchanges of data between suppliers and users (Zuiderwijk et al., 2014; Immonen et al., 2014a; Janssen et al., 2012).

If companies build their own infrastructure and publish the data directly on their website or platform, they remain the maximum level of control on the data set, knowing who has access (Buda et al., 2016). However, this may require large investments in development and maintenance, including the development of platform and user tools, commercialization of the data, and customer support. An alternative is to use existing platforms, operated by others.

Another way is to interact through a data marketplace. Fricker & Maksimov (2017) define a data marketplace as a platform on which a data set can be offered by providers and accessed by users. According to Fricker & Maksimov (2017), often cited examples are Microsoft Azure Marketplace, Xignite, Gnip, Aggdata, and Cvedia. The data products on such marketplaces can be repositories, APIs, or subscriptions of either static or live streams of data (Fricker & Maksimov, 2017). These platforms enable providers to monetize the intrinsic value of data sets (Kushal et al., 2012). An efficient data market could facilitate impactful advancements, where innovative companies could grow faster and more efficiently due to access to data of high quality and quantity (Heckman et al., 2015).

Muschalle et al. (2012) argue that there is an increasing interest in data markets for all kinds of data, public as well as private, to create enterprise and consumer value, and state that there is a growing number of data providers. On the other hand, Heckman et al. (2015) stated that the marked for selling data among interesting parties is failing. One of the reasons for this is, according to Heckman et al. (2015), that data trading happens through informal partnerships or private agreements. Other challenges include lack of an option and futures market, which could send signals to what kind of data that is in demand and lead providers in the direction of producing this data (Heckman et al., 2015). Muschalle et al. (2012) and Heckman et al. (2015) agree that a challenge for data markets is to develop incentives for suppliers to be transparent in the pricing. According to Heckman et al. (2015), this can lead the data market to be a market of lemons, as the provider may best know the value of the data, leading to significant information asymmetry.

3.1.3 Drivers

For ecosystem actors to interact with each other, it is not enough that there exist infrastructures to connect them, there also need to be sufficient drivers for suppliers to approach OBD initiatives. Several journal articles (Huijboom & van den Broek, 2011; Janssen et al., 2012; Zuiderwijk et al., 2012, 2014; Huttunen et al., 2019), conference papers (Herala, Vanhala, et al., 2016; Jaakkola et al., 2014; Kitsios et al., 2017; Buda et

al., 2016), consultant reports (Hammell, 2012; Manyika et al., 2013; Skogli et al., 2019) and expert reports (Gjørv et al., 2020) outline and discuss what they believe to be the most important drivers and barriers of sharing and selling data. Most of these are from an OGD or user perspective. While some of the drivers from OGD might be relevant for OBD, Jetzek et al. (2013) argue that "when governments become open, the mechanisms that affect value generation and appropriation move beyond the traditional buyer-seller relationships: thus connections between the public and the private, as well as the social and the economic begin to emerge," thus indicating that the drivers of OGD differ from OBD. A few scholars (Hammell, 2012; Buda et al., 2016; Herala, Vanhala, et al., 2016) have looked at the drivers from the perspective of private companies as the suppliers of the data. In this section, we will outline the drivers we consider to be the most relevant for private companies, based on literature from OBD, but with supplementary aspects from OGD and data sales which we find relevant.

Buda et al. (2016) divide drivers of OBD into four categories: 1) gaining new revenue streams, 2) community building, 3) internal business improvement, and 4) publicity and PR. We find these to be intuitive and covering all relevant drivers, and will, therefore, use this categorization further. We argue that innovation is included in all of the above categories, as innovation can be defined as improvements around products, processes, marketing and organizational improvements (OECD.org, n.d.).

Gaining new revenue stream

Revenue streams represent the main difference between drivers for OGD and OBD, as previously mentioned. Private companies can gain new revenue streams through establishing DDBMs (Hartmann et al., 2016), and was the most mentioned driver by the OBD experts in Buda et al. (2016)'s research. These business models can be built on selling data directly or providing other services or tools on top of data (Hammell, 2012).

Community building

By opening up data sets to their ecosystems, organizations can reap benefits of community building, such as improved collaboration models, contract setups, and new product and service innovations (Herala, 2018).

A relevant concept of building a community is "coopetition". Coopetition entails that firms do not solely either collaborate or compete with certain stakeholders, but that they do both simultaneously (Bengtsson & Kock, 2000; Nalebuff et al., 1996; Gnyawali, 2001). This implies that firms also collaborate with their competitors, aiming to achieve improved performance and innovation results (Ritala, 2001). By doing so, the costs of innovations can be shared between stakeholders. According to Say (2013), shared pain or risk can incentivize organizations to such collaboration. For instance, insurers can share data with each other to prevent fraud in the ecosystem, benefiting all actors. Further, coopetitors can benefit from each other's complementing resources, at the same time as the competition aspect puts pressure on the further development of services (Bengtsson & Kock, 2000). Hannah & Eisenhardt (2018) have explored cooperation between firms in ecosystems, and argue that successful firms balance cooperation and competitions and that firms that only focus on one of the two concepts can lead to low long term performance.

In Section 3.1.1 we shortly introduced open innovation that can result from OGD. The principle of open innovation is to acknowledge and exploit that, as Janssen et al. (2012) say: "groups of people can generate better ideas than the smartest people can do on their own." Competitions and hackathons are examples of how private organizations can seek open innovation from OBD (Herala, 2018). Such actions can help to connect data science abilities with people that have domain knowledge (Rantala et al., 2020). Juell-Skielse et al. (2014) have explored why individuals participate in open innovation and found a wide array of motivations. Through surveying 39 participants in OGD competitions, they found that some had commercial interests, while fun and enjoyment, alongside intellectual challenge, scored high. Thus, such competitions can also serve as arenas for talent acquisition for companies. Juell-Skielse et al. (2014) argue that when organizations want to tap into outside development capabilities through such initiatives, they need to recognize the spectrum of motivations and work to support the motivations corresponding to the aim of the competition.

Data sharing with the ecosystem can also facilitate benchmarking activities (Hammell,

2012; Manyika et al., 2013). According to Manyika et al. (2013), one-third of the estimated potential value from open data comes from benchmarking. Companies can for instance benchmark their vendors by looking at how they solve problems on a data set. Gjørv et al. (2020) outline the opportunities for business models related to emission standards and benchmarking, providing data sets to help industries to meet the standards.

Internal business improvement

Internal business improvement is mentioned by Buda et al. (2016) as a key driver, but less discussed by other actors in the field of open data. Buda et al. (2016) argue that organizations can improve their data management in processes of opening up data, and at the same time get help from the crowd to identify mistakes in their data sets.

Publicity and public relations

One of the most discussed drivers of OGD is transparency (Janssen et al., 2012; Manyika et al., 2013; Zuiderwijk et al., 2014). Several scholars (Manyika et al., 2013; Zuiderwijk et al., 2014; Herala, Vanhala, et al., 2016) also point to this as an important driver of OBD. OBD can help businesses build trust in society by showing compliance and being transparent. A goal can be to increase the public understanding of the company's sustainability or decrease the consumer confusion in a complex market, by empowering them with information (Herala, Vanhala, et al., 2016). Benefits such as attracting new customers and strengthening the brand image can also result from this (Buda et al., 2016).

3.1.4 Barriers

The same scholars discussing the drivers of OGD, OBD and data sales, mentioned in Section 3.1.3, also present barriers. In contrast to the drivers, where there are significant differences from OGD to OBD, a lot of the barriers are similar. Buda et al. (2016) argue that the barriers can be split into three main categories; related to the data itself, the process of opening data, and the usage of data. Similarly to their categorization of drivers, we find the categories to be logical and easy to use, and will thus use them to present the barriers.

Barriers related to the data itself

One of the most mentioned barriers related to open data in general is related to data quality (Buda et al., 2016; Huijboom & van den Broek, 2011; Bonina, 2013; Hammell, 2012; Jaakkola et al., 2014; Janssen et al., 2012; Kitsios et al., 2017; Gjørv et al., 2020). In particular, scholars discuss finding suitable sources of data (Jaakkola et al., 2014; Kitsios et al., 2017), identify the correct data (Janssen et al., 2012), bringing the data up to correct standards (Huijboom & van den Broek, 2011; Janssen et al., 2012) and maintaining it there (Hammell, 2012; Jaakkola et al., 2014). A lack of data competency proves a barrier for initiating open data initiatives (Janssen et al., 2012; Jaakkola et al., 2014).

Barriers related to the process of opening data

Scholars discuss several barriers related to the process of opening data, including legal issues (Buda et al., 2016; Say, 2013; Huijboom & van den Broek, 2011; Bonina, 2013; Skogli et al., 2019; Janssen et al., 2012; Kitsios et al., 2017; Manyika et al., 2013), quantification of benefits (Buda et al., 2016; Say, 2013; Kitsios et al., 2017; Hammell, 2012; Huijboom & van den Broek, 2011), security (Huijboom & van den Broek, 2011; Skogli et al., 2019; Janssen et al., 2012), infrastructure (Bonina, 2013; Jaakkola et al., 2014; Janssen et al., 2012; Kitsios et al., 2017) and data market (Heckman et al., 2015) and problems valuating the data (Heckman et al., 2015; Muschalle et al., 2012; Belisssent, 2018).

The legal issues have multiple aspects, and are related to privacy concerns (Say, 2013; Huijboom & van den Broek, 2011; Bonina, 2013; Skogli et al., 2019; Janssen et al., 2012; Kitsios et al., 2017; Manyika et al., 2013), commercial confidentiality (Say, 2013), ownership of the data (Skogli et al., 2019; Jaakkola et al., 2014; Janssen et al., 2012; Herala, 2018) and legal leeway (Gjørv et al., 2020). Barriers related to legal issues can be resource consuming, and thus resulting in companies being hesitant to explore the opportunities of open data, and taking conservative approaches to data management. Another costly aspect of data management is system architecture and cybersecurity strategies required, due to the fragile nature of data, as described in Section 2.1.

One of the important barriers for private companies to open their data is that there are often unknown rewards for OBD (Herala, 2018). The data does not have value in itself, but becomes valuable when used (Janssen et al., 2012) which makes it hard to quantify. Herala (2018) argues that there is an absence of benchmark initiatives for the private sector to evaluate the value potential and use cases from OBD. Rantala et al. (2020) elaborate that a major challenge is to identify customer value and customize each data-based innovation so that it generates value for every customer.

Assessing the value and price of the data sets is a challenge when selling data (Heckman et al., 2015; Muschalle et al., 2012). Belisssent (2018) argues that you cannot determine the value until you know how the data will be used. The existing valuation approaches to data are unsatisfying because they do not assess the value potential of the assets itself, according to Heckman et al. (2015). Heckman et al. (2015)'s research, based on how other digital assets are traded, identified three main categories of parameters that effect the value of data, and challenges related to these. The first category covers parameters related to the customer value of data, including ROI for the customer, the savings in terms of time, effort and money, and the level of ownership. These are dependent upon the seller knowing the demands of the customer, and are difficult to quantify and model (Heckman et al., 2015). The second category spans qualitative parameters such as the age of the data, credibility, accuracy, quality, and format. These parameters are dependent upon standards, which are often not developed. The third category is directly measurable costs related to the data sets for the provider. They include the of collection, storage, and other operations, as well as add-on services to process the data. These costs indicate the minimum price that a seller can offer the data sets to a buyer. However, as the cost of collecting data has a low impact on buyers of data, this argument may not be sufficient to justify price (Heckman et al., 2015). All in all, there are significant challenges related to existing methods of valuation, making it hard for providers of data to set prices that seem reasonable for users.

An infrastructure is needed to make the data available to customers, as mentioned in Section 3.1.2. In this section, we identified barriers related to loss of control over the data,

resources needed to create an own platform or tools, and the failure of indicating what data is in demand. According to Gjørv et al. (2020), one of the problems of infrastructure is that the actor incurring the costs of sharing data is often not the one benefiting the most. For this reason, Herala (2018) argue that the open data community should not ask companies to open data without a sufficient tool for easy publishing. According to Zuiderwijk et al. (2014), several open data portals and infrastructures have been developed to explore the potential of open data. However, little research has been conducted on these, and what kind of essential components they should have in helping to realize the advantages of open data (Zuiderwijk et al., 2014).

Barriers related to the usage of data

Even if the data is of good quality, and the process for opening the data is figured out, there may still be barriers related to the usage of the data. These barriers relate to negative publicity (Buda et al., 2016; Hammell, 2012; Kitsios et al., 2017), protectionism (Buda et al., 2016; Say, 2013; Perkmann & Schildt, 2015), problems in the capacity and motivation of users (Jaakkola et al., 2014; Janssen et al., 2012; Perkmann & Schildt, 2015) and a need for processes to deal with user input (Janssen et al., 2012).

Negative publicity can result from breaking ethical guidelines or law regulations and needs to be taken into account when publishing data. The barrier of protectionism consists of several parts, including lack of trust in the ecosystem (Gjørv et al., 2020), the risk of cannibalizing the existing charging model (Huijboom & van den Broek, 2011; Hammell, 2012; Janssen et al., 2012), loss of competitive advantage to competitors and a general risk-averse culture (Janssen et al., 2012; Perkmann & Schildt, 2015). As a result of this, in a competitive environment, it is an intuitive strategy to keep one's card close to one's chest.

Another barrier related to the use of data is differences in interest and understanding of OBD between suppliers and users. Perkmann & Schildt (2015) describe as a challenge that academic scientists may lack the motivation to address problems posed by private companies. They further propose that a mechanism to address this challenge is for the OBD company to allow multiple goals to exists, both industrial and academic interest,

and thus increasing attractiveness for scientists as it allows them to pursue their own goals. A problem when facing users in general is that there may be a lack of technical capability for using the data or recognizing opportunities, as pointed out by (Gjørv et al., 2020).

3.1.5 Strategies

Buda et al. (2016) present four main strategies to follow when implementing an OBD initiative, shown in Figure 2. They are characterized by two dimensions; price and openness.

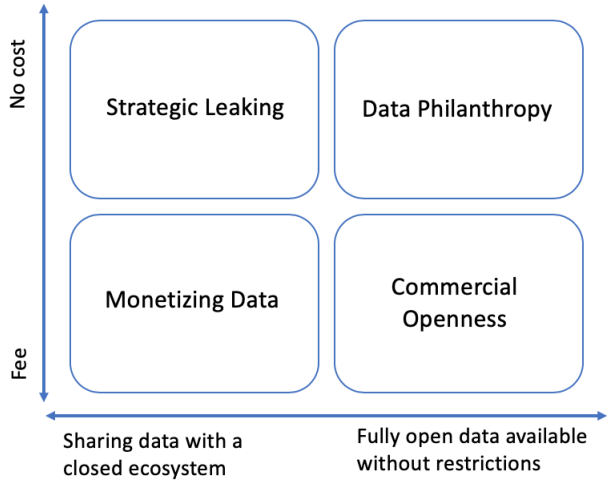

Figure 2: OBD strategies inspired by Buda et al. (2016)

The four strategies are "Strategic leaking," "Data philanthropy," "Monetizing data" and "Commercial openness." The following explanations are obtained from Buda et al. (2016). Strategic leaking is a strategy where data is opened up at no cost to a target audience. The company knows whom the data might be valuable to, and expect an impact from these. Data philanthropy is a strategy where the company publishes data mainly for public benefit and relations. The data opened will usually have limited value to the company and the users. Monetizing data is a strategy that makes data, data products, or services based on data available to a pre-defined audience. The main benefit is monetary. The last category is Commercial openness. It is similar to monetizing data, but the users can

be anyone in the ecosystem, even competitors. Buda et al. (2016) emphasize that it is possible to combine and experiment with each of the categories.

3.1.6 Summary of OBD theory

To summarize the theory, we see that much focus is given to open data in the public sector by both the practitioners and scholars, but limited attention has been given to the private sector.

Theory suggests that the drivers of businesses differ from the ones sought by governments. It is especially evident that companies mainly seek revenue streams by opening up data (Buda et al., 2016), which contradicts the traditional definition of "openness" in open data. Based on this, and the use of several scholars, we have seen it necessary to include data sales in a new proposed definition of OBD.

Many drivers for OBD, in addition to monetary, have been identified, such as transparency, innovation, benchmarking, internal business improvement, and publicity and PR. Several of these benefits come from being a part of a larger ecosystem, and thus the value creation can happen in many ways and is highly dependant upon the different actors. Despite the many opportunities for creating value, the theory points to a lack of success stories related to OBD, both in literature and the business world. One of the prominent barriers that seems to be a lack of understanding of the value potential, from both suppliers and users. The lack of success stories and lack of understanding can, therefore, become a viscious circle. Notably, many of the scholars present drivers and barriers based on assumptions rather than observations (Herala, Kasurinen, & Vanhala, 2016), thus more case studies are needed to provide a realistic view of their importance.

Furthermore, as presented in Section 2, data has special characteristics that differentiate it from other resources. The versatility of data might be one of the reasons why it is hard to gain an understanding of its value potential. As it has many applications, it may be hard to pinpoint the best in each given case. The versatility aspect of data, together with lack of understanding potential also causes the pricing to be a prominent barrier, as its value is depending on what it is used for.

Recent studies suggest businesses have not come far in reaping benefits from OBD (Herala, 2018). Moreover, it seems that inefficient marketplaces and problems related to infrastructure may slow down the development of the market as a whole, also making it difficult to identify and connect with the users to find good use cases of the data. From this, one can draw the conclusion that the OBD market seems immature.

3.2 Effectuation and causation

This section will introduce the theory on effectuation and causation, which will be used to analyze the decision making in companies in the discussion. The theory is chosen as it may prove relevant to use effectual decision making in environments where there are a lack of artifacts such as defined marketplaces and customers, as the literature on OBD in Section 3.1 indicates. In addition, the theory could successfully integrate several widely accepted strategic decision-making models (Vorontsova, 2016). According to Vorontsova (2016), it could encompass process-oriented vs result-oriented strategy (Imai, 1986), emergent strategy vs deliberate strategy (Mintzberg & Waters, 1985), exploration vs exploitation (Levinthal & March, 1993) and disruptive vs incremental innovation (Bower & Christensen, 1996) into one broad-focused model for entrepreneurs logic.

The theory of effectuation is relatively young and was first introduced by Sarasvathy (2001) with the focus on entrepreneurship. It has since been used to analyze various decision-making processes, such as internationalization (Andersson, 2011; Kalinic et al., 2014; Nummela et al., 2014) and product innovation (Berends et al., 2014; Brettel et al., 2012). Several scholars (Berends et al., 2014; Kalinic et al., 2014; Werhahn et al., 2015; Svensrud & Åsvoll, 2012; Matalamäki et al., 2017) have recently connected the effectuation theory to existing companies (Matalamäki et al., 2017), which makes it applicable to all of our case companies. We will briefly explore the history of effectuation and causation as well as outline the characteristics that will be used to separate between the two in our discussion.

Difference between effectuation and causation

Sarasvathy (2001) founded the effectuation theory to explain the creation of new firms in circumstances where there is no existing artifacts and contexts such as competing firms, markets, and economies. She describes the difference between causation and effectuation processes. According to Sarasvathy (2001), causation processes take a particular effect as given and focus on selecting between means to create that effect, while effectuation processes take a set of means as given and focus on selecting between possible effects that can be created with that set of means. The effectuation logic is based on the notion

that "to the extent we can control the future, we do not need to predict it" (Sarasvathy, 2001).

To give an illustration for when the two different decision-making processes are most suitable, Sarasvathy (2001) used an example of starting a restaurant. She said that if the entrepreneur clearly wants to build a specific restaurant, she presumably will be better off using causation processes than effectuation. "But if she has only the generalized aspiration of building a successful business of her own with relatively limited access to resources, she should consider effectuation processes" (Sarasvathy, 2001).

Further, Sarasvathy (2001) outlined five principles of effectuation, commonly used by other scholars (Wiltbank et al., 2006; Read, Dew, et al., 2009; Read, Song, & Smit, 2009; Chandler et al., 2011; Brettel et al., 2012; Dew et al., 2009), although with different interpretations (Vorontsova, 2016). The principles are means over goals, affordable loss, stakeholder commitments, exploitation of contingencies, and controlling of unpredictable future. Chandler et al. (2011) have created measures based on these principles, explained in the next part.

Measures of effectuation and causation

Chandler et al. (2011)'s measures allow to differentiate between causation and effectuation logic. They interviewed several hundred firm founders and proposed a conceptual framework. With over 700 citations, according to Google Scholar in May 2019, this is one of the most most widely acknowledged frameworks within the effectuation theory and is used on both new ventures and established companies (Matalamäki et al., 2017). A table of the measures are attached in Appendix A.3. Firstly, we will look at the measures of causation, followed by four dimensions that differentiate effectuation from causation; experimentation, affordable loss, pre-commitments, and flexibility.

Causation

The measures proposed for causation were related to analyzing long-run opportunities and selection based on best returns, developing a strategy to take advantage of resources and capabilities, designing and planning strategies to meet objectives, doing competitive

analysis, having a clear and consistent vision of where the business wants to end up and planning production and marketing efforts.

Experimentation

Effectuation approaches have a focus on short-term experiments to identify business opportunities in an unpredictable future versus causation approaches which seek prediction of an uncertain future by defining the final objective upfront. Relevant measures are such as how many different products or business models have been tried and if the service is different than how it was conceptualized.

Affordable loss

Effectuation approaches focus on projects where the loss in a worst-case scenario is affordable versus causation approaches where the focus is on the maximization of expected returns. Relevant measures are such that the company has not committed more resources or money that they could afford to lose. Vorontsova (2016) argues that affordable loss also includes risk associated with reputation, time, and accessibility, not only monetary terms.

Pre-commitments

Effectuation approaches have an emphasis on pre-commitments and strategic alliances to control an unpredictable future versus causation approaches which focus on business planning and competitive analyses to predict an uncertain future.

Flexibility

Effectuation approaches focus on the exploitation of environmental contingencies by remaining flexible versus causation approaches that focus on the exploitation of pre-existing capabilities and resources. Relevant measures of flexibility include the degree to how the business evolved as opportunities emerge, the degree of adaption to the resources available, the degree of taking opportunities as they arose.

Relation to uncertainty and co-existence

Some scholars in the field seem to agree that effectuation-based decision making is the

prevailing approach in conditions characterized by uncertainty (Sarasvathy, 2001; Nummela et al., 2014; Chandler et al., 2011; Andersson, 2011). Harms & Schiele (2012) are some of the few opposing this. The subject is problematized by Colclough et al. (2020) as uncertainty can be said to be a central part of any decision making, and thus they claim that there exists a misconception of the origins of the two approaches.

The theory of effectuation can further be classified as following a dichotomy logic, dividing effectuation and causation into two, mutually exclusive, groups. Although the nature of the decision-making process often is presented with a dualist approach, many scholars agree that causation and effectuation can co-exists (Sarasvathy, 2001; Nummela et al., 2014; Colclough et al., 2020; Harms & Schiele, 2012). For instance, causation processes can ensure that the venture predicts what is predictable, while effectuation possesses secure flexible responses to changes in the business environment (Matalamäki et al., 2017).

Proposition: Effectuation-based decision making in OBD initiatives

Looking at the theory presented in this section we see that the theory is mostly used on new ventures and entrepreneurship. However, as mentioned, several studies have found the theory to be relevant to established and even large companies. The theory of effectuation was originally established for circumstances where there is a lack of context and artifacts such as markets and competing firms. We argue that this fits with characteristics of the OBD marked, summarized in Section 3.1.6. The theory also showed an absence of success stories, which might indicate that companies approaching OBD do not have defined models to follow. Thus, we anticipate that companies have more generalized aspirations of creating value from data, rather than clear goals. By this, we propose that companies approaching OBD initiatives use effectual decision making to a larger degree than causation. To see whether our proposition is correct, we will conduct an analysis of the case companies in the discussion. We will use the measures proposed by the acknowledged validation study conducted by Chandler et al. (2011), together with the characteristics outlined by Sarasvathy (2001).

3.3 Open business data decision support framework

Theory on OBD is much focused on the drivers and barriers and lacks guidelines for how managers can approach OBD initiatives. Buda et al. (2016) have proposed a decision support framework seeking to help businesses approach OBD initiatives, but we argue that it has several weaknesses that must be addressed. In this section, we will combine theory presented in Section 3.1 and 3.2 to develop a decision support framework that better reflects the OBD market situation. The framework, see Figure 3, is intended to be helpful for managers that are looking into how they can extract value from their data.

Step 1: Assessing organization and data

In Section 3.2, we argued that effectuation theory is relevant for decision making related to OBD, especially for organizations that only have a general aspiration of what they want to do with their data. By using aspects of effectuation theory, we can indicate an order of steps in the framework. One of the key aspects of effectuation theory is the notion of taking a set of means given and selecting between effects that can be created with these. Sarasvathy (2001) defines means as physical, human, and organizational resources at the firm level, equivalent to "who am I, what do I have, and who do I know?" at an individual level. Means in organizations pursuing OBD initiatives correspond to company capabilities, data sets, and position in the ecosystem. By starting the decision-making process by assessing the organization's capabilities and data at hand, companies can assess the possible ways they can achieve their aspirations.

Step 2: Experimentation and validating demand

The next step is to experiment with use cases and validate the demand for these in the ecosystem. The output of this step is to have identified drivers, barriers, and required organizational changes related to the different use cases. As a consequence of data's versatility, there may exist several use cases that provide different benefits and barriers. However, a lack of success stories (Herala, 2018; Buda et al., 2016) and understanding the value potential (Manyika et al., 2013) may result in difficulty of predicting what the customer needs are, and the demand for these use cases. Rantala et al. (2020) emphasize the importance of identifying customer needs in data based innovation. Experimentation

is thus crucial early on in the OBD process to identify different use cases, and carefully validate the demand in an iterative process, before committing to opening the data. The need for experimentation is not communicated clearly in Buda et al. (2016)'s framework, but is in line with a typical entrepreneurial mindset, particularly known from Ries et al. (2012)'s "Lean startup". In contrast to Buda et al. (2016)'s framework, we, therefore, argue that businesses should not commit to a driver before experimenting with different use cases that may result in other, more desired, drivers being identified. As presented in 3.1.4, there are major costs associated with preparing and cleaning data for sharing and sales, and thus remaining flexible is also important before committing a lot of resources. If monetary benefits are identified as a potential driver, experimentation could also help to price the data. This second step, experimentation, is in line with Sarasvathy (2001)'s notion of choosing between different effects that can be created with given means.

Step 3: Evaluation of drivers, barriers and organizational changes

The last step is to evaluate the identified drivers and barriers of the validated use cases in order to choose an OBD strategy that fits the organization. Different use cases have respective drivers and barriers that follow with them, although barriers resulting from the OBD market's or data's characteristics are likely to be present regardless of the use case. In this step managers should assess the pros and cons of the various use cases, reflecting upon the prioritizing of the drivers and significance of the barriers for the specific company.

We find that the strategies proposed by Buda et al. (2016), presented in Section 3.1.5, provide a useful outline of possible approaches, and the two dimensions, related to cost and openness, indicate the trade offs related to them. Choosing a strategy where data is charged with a fee, managers must be aware that it might come at the expense of community building benefits such as transparency and coopetition or may hurt customer loyalty. To illustrate, companies wanting to create industry innovation initiatives should be willing to share data freely in order to stimulate engagement from competitors. The degree of openness has trade-offs particularly related to potential reach and control. For instance, increased openness and reduced control may impose higher business risk related

to transparency and competitiveness. Lastly, it is particularly important to ensure the strategy is in line with the company's vision and will not violate the company's values.

Combining OBD theory and key principles of effectuation we have now proposed a new framework for decision making related to OBD. In contrast to Buda et al. (2016), we explicitly present an order of process steps, simplifying the understanding of how a decision process related to OBD initiatives can be. We argue that a decision support framework should reflect practitioners' starting point, which we believe often is an aspiration to create value from the data they possess. This is addressed by starting with an assessment of the organization and available means in step 1. The framework further addresses key challenges related to OBD presented in Section 3.1.3; data's versatility, and the lack of understanding on the value potential, by emphasizing another characteristic of effectuation, experimentation. We argue that these barriers are not sufficiently addressed by Buda et al. (2016). In step 3, we also contribute with exemplifying possible trade-offs that should be taken into account when evaluating drivers and barriers of the different strategies. Lastly, we argue that using relevant strategic decision-making theory strengthens the validity of the framework.

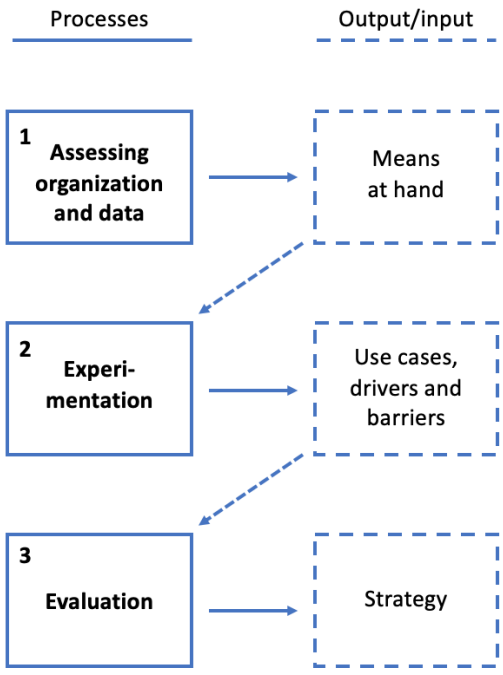

Figure 3: Open business data decision support framework

4 Methodology

This section will present the methodology applied in the context, theoretical background, and case study. Further, we will assess the quality of the study, before looking at the limitations. Figure 4 shows the framework of analysis applied. It will be further be explained in the next section.

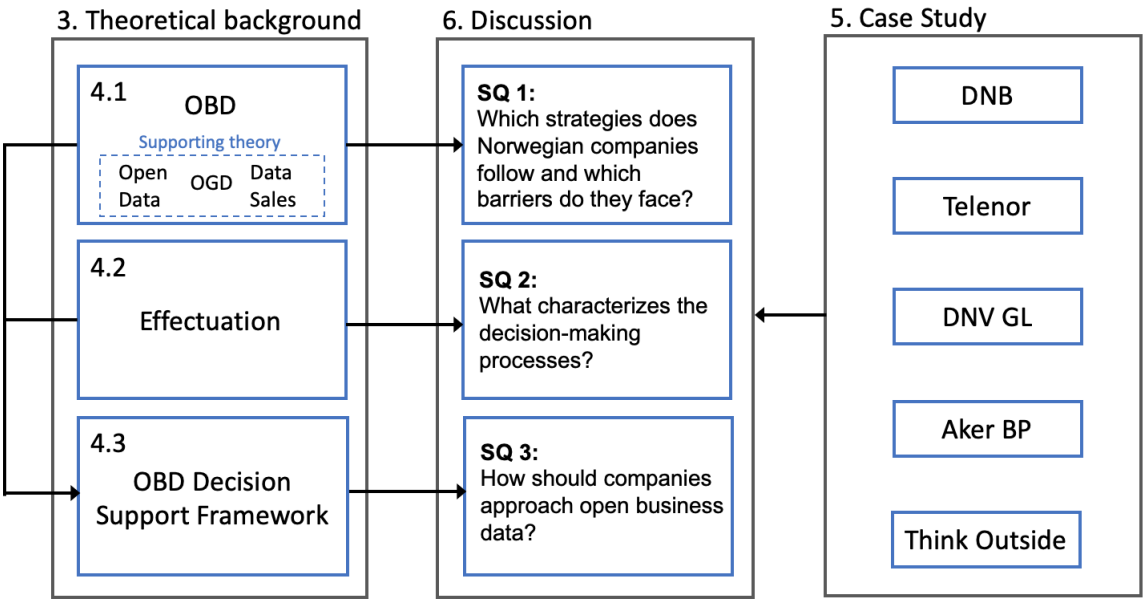

Figure 4: Methodology framework

4.1 Context

The context presented in Section 2 was intended to give insights into data as a resource, as well as an overview of its value potential and the Norwegian data economy. Characteristics of data were presented based on the literature found through a similar method to the rest of the theory, explained in Section 4.2 Recent reports, produced or appointed by trustworthy sources such as The Confederation of Norwegian Enterprises (NHO), and the European Commission were used to give a status overview.

In addition to the mentioned reports, an interview with The Norwegian Data Protection Authority was conducted for the purpose of highlighting some of the most important restrictions on OBD, as well as gain insight into the Norwegian OBD ecosystem by one of

the central actors. The interview methodology was identical to the case study interviews and will be further explained in Section 4.3. The interview guide is attached in Appendix A.2.

4.2 Theoretical background and creation of framework

A thorough theoretical foundation was needed in order to answer the research questions proposed. The main bodies of research we have used are OBD, open data, OGD, data sales, and causation and effectuation. As OBD is a scarcely researched topic, the main part of the theoretical background is based on Open data and OGD literature, complemented with the literature on data sales. The relations between the theories studied are shown in figure 4. Together with the context, these sources formed a foundation consisting of the key factors and concepts to be studied and the presumed relationship between them.

The theory was found through a literature search. Articles were chosen based on relevancy, journal reputation, and the number of citations. We searched within the databases of Google Scholar, Oria, and Scopus. The search was focused on literature from Management Science, and restricted to the articles that were openly available or available through NTNU access. We used both backward and forward snowballing to find relevant articles. Backward snowballing is a method of identifying relevant literature from relevant article's reference lists, while forward snowballing refers to identifying articles that have cited the articles found in the search (Jalali & Wohlin, 2012).

To ensure that we were not overlooking any studies that used different terms for OBD, we used an extensive list of search words and combinations of them in all three mentioned databases; "selling" / "sharing", "data" / "knowledge" / "information", "benefits" / "opportunities" / "drivers", "challenges" / "barriers". As the amount of existing literature on the OBD is relatively small, we used conference papers and reports from leading consultancy firms and expert groups in addition to journal articles. Herala, Vanhala, et al. (2016) have recently done a systematic literature review on why private organizations would want to participate in open data initiatives and what negative effects they have

suffered. This article aimed to find as many articles as possible from all scientific areas where open data has been published, related to both OGD and OBD. Thus this article was helpful in the search of relevant literature. OGD literature was particularly used to find barriers related to cleaning and the use of data, as we believed these are to a large degree overlapping. The literature on data sales was used to complement with the commercial aspects of OBD. A central article on OBD was found to be Buda et al. (2016), a proceeding of a conference paper. They have a focus that is similar to our scope, aiming to build a decision support framework for OBD. The study has been used to categorize drivers and barriers, describe OBD strategies and ecosystem, as well as an inspiration for our proposed framework. One of the authors, Marjin Janssen, is a leading scholar on OGD. This increases the credibility of this paper, despite a relatively low number of citations.

On April 6th, an expert group appointed by the Norwegian government delivered a report on the Norwegian data economy to give input and recommendations to the report to The Storting. This has provided input to our context and theoretical background and has been valuable in regards to validate our findings.

On theories on effectuation and causation, two key articles were used. These were the founding paper of the theory of effectuation by Sarasvathy (2001), together with one of the most cited articles on validating measures of causation and effectuation by Chandler et al. (2011).

Creation of framework

In Section 3.3, we proposed a framework for practitioners approaching OBD. Through the reviewed OBD literature, we found characteristics of the market that indicated that effectuation theory was relevant. The framework was therefore constructed by combining OBD and effectuation decision-making theory, illustrated in Figure 4. We especially used effectuation theory to propose an order of the steps as well as including process steps that incorporate aspects from effectuation way of thinking, such as experimentation and flexibility.

4.3 Case study

Selection of research method

A qualitative multiple case study design was chosen as appropriate to explore OBD in Norway. Five case companies were selected to get a heterogeneous sample of different actors engaging in OBD initiatives. Using several cases strengthens the case study by making it more generalizable, creating breath and contrasts, as well as replicate findings for robustness (Yin, 2009). A qualitative approach was chosen due to the ability to explore more detailed processes related to OBD (Yin, 2009).

Case selection

An important aspect of any case study is to carefully select cases as this defines the generalizability of the findings (Eisenhardt, 1989). We have therefore included both established companies and a startup, as well as included companies from several industries. The OBD initiatives also have a different focus within the case companies. It was natural for us to focus on the Norwegian OBD market, being our native country, due to our knowledge of the market and the accessibility to case companies. The case companies were identified based on search results on data driven business models in Norway, together with our initial knowledge of companies involved in OBD initiatives. Recent news articles made us aware of Telenor (Gundersen, 2019) and DNB's (E24, n.d.) OBD initiatives, and we learned of DNV GL and Kongsberg Digital's initiatives through Skogli et al. (2019)'s report on data based value creation in Norway. Lastly, we were already familiar with Think Outside and Aker BP as OBD actors. All of the companies meet the criteria of being Norwegian founded, as well as having data that they are currently or aiming to sell or share. See Table 1 for an overview of case companies, interviewees' positions, and date of interviews. It should be noted that the interview with CTO Kongsberg Digital, Christian Møller, has been used as background research, and is not included in the analysis.

Table 1: Case interviews

Company	**Interviewee position(s)**	**Date**
Cognite	Director of Product Management	05.03.2020
DNB	Senior Project Manager & Director of Data Transformation	10.03.2020
DNV GL	Head of Digital Sales & Product Manager	12.03.2020 & 31.03.2020
Think Outside	CEO	17.03.2020
Telenor	Business Developer	24.03.2020
Kongsberg Digital	CTO	01.04.2020
Norwegian PDA	Director	22.04.2020

Data collection

The data collection method chosen was open-ended interviews (Yin, 2009). These interviews offer richer and more extensive material than data from i.e surveys and can help to reveal case study interviewees' perception of the reality (Yin, 2009). This perceived reality was seen as important to describe the OBD market in Norway. In each of the case companies, we tried to get interviews with the key person(s) for the OBD project, as this provides value (Yin, 2009). The interviewees were therefore business developers, product or project manager, CEO, or other managers.

The interviews were semi-structured and sought to address the research question proposed in Section 1. The interview guide attached in Appendix A.1 was used as a basis. However, some parts were adjusted to better suit each case company. In agreement with the interviewees, the interviews were recorded, transcribed, and sent back for approval, before conducting the analysis. Due to the Covid-19 virus, some of the interviews had to be over video conference. All interviews lasted around one hour. For DNV GL, a follow-up interview was made to supplement the first interview in some aspects. For the case of Aker BP, a detailed whitepaper (Cognite, n.d.-b) on The Open industrial Data project was used as in addition to the interview with the Cognite Product Manager, Katrine Tjølsen.

Data analysis

The first step of the analysis process was to code the transcribed interviews. Main categories used to classify the interview transcripts are listed below:

1. company information
2. driver
3. barrier
4. strategy
5. decision making
6. thoughts on open data

After the coding, we analyzed the case companies in-depth in regards to the three subquestions of the paper. Next, we compared similarities and differences among the case companies. Lastly, we looked at all companies under each of the subquestions in order to formulate our larger observations. The method for analysis is presented in Figure 4. To answer subquestion 1, we analyzed the elements coded as strategy, drivers, and barriers on the background of theory found in Section 3.1. In order to answer the second subquestion regarding decision making in the world of OBD, we conducted a study to compare the expected and actual patterns, in line with what Yin (2009) calls a pattern-matching procedure. We looked at the parts coded as decision making and analyzed them based on Sarasvathy (2001)'s characteristics and Chandler et al. (2011)'s measures for effectuating and causation. In the last subquestion we used the case companies to evaluate the proposed framework from 3.3, adding key aspects to consider.

4.4 Quality of Research

For any kind of study, it is important to consider the quality of the research. As our study is conceptual, a type of qualitative study, subjective descriptions and interpretations are naturally a part of the research. Golafshani (2003) seeks to understand the use of reliability and validity, commonly used in quantitative research, as concepts to test the quality of qualitative research. She argues that trustworthiness is crucial for ensuring

both reliability and validity. Lincoln & Guba (1985), much cited, suggest that one can divide trustworthiness into four measures: credibility, dependability, transferability, and confirmability. These measures are therefore used in the processes of evaluating the quality of our research in the next parts.

Credibility

Credibility is defined as the quality that something has to make people believe or trust in them (Oxfordlearnersdictionary.com, n.d.-b). According to Patton (1990), credibility in qualitative research depends on the richness of the information gathered and the analytical abilities of the researcher. Hoepfl (1997) and Patton (1990) argue that credibility can be enhanced through triangulation, which is a procedure to search for convergence among multiple and different sources of information, according to Creswell & Miller (2010). Triangulation is important to control for bias and establishing valid propositions (Mathison, 1988).

In our research, we have applied triangulation of sources by collecting information from the databases Google Scholar, Oria and SCOPUS, and information sources such as published journal articles, newspaper articles, books, conference papers, expert reports, and consultancy reports. We have aimed to extract information that is supported through multiple sources and sought to find articles from acknowledged journals, as well as evaluating the number of citations.

The field of study in question is young and constantly evolving, thus we have also included both conference papers and works that have few citations to ensure that we gain an updated view. We have sought to conduct data triangulation by using data sources such as company websites, in addition to the interviews, to cross-check where possible. Especially valuable have articles and white papers been to strengthen the observations made through the case study, and the expert report (Gjørv et al., 2020) been to validate our findings related to the Norwegian OBD market.

Dependability

Dependability can be defined as the quality of being able to be relied on (Oxfordlearn-

ersdictionary.com, n.d.-c). Lincoln & Guba (1985) propose the use of an inquiry audit to enhance the dependability of qualitative research. An inquiry audit includes using a reviewer, often with experience and knowledge in the field, to examine the research process and product for consistency.

During our research, we have been supervised by Øystein Moen, an experienced researcher at the Institute of industrial economics and technology management at NTNU. He has followed and guided us in our processes of carrying out this study. Furthermore, we have sought to be transparent and explained our choices made throughout the paper.

Transferability

Transferability can be defined as the fact that something can be moved from one place to another (Oxfordlearnersdictionary.com, n.d.-d). This is closely linked to the gathering of empirical data. The conceptual part of our study facilitates transferability. Our literature study covers OBD in wide terms, and we thus argue that the theoretical content in our paper is highly transferable to other countries. Our case study is conducted on solely Norwegian businesses, in the Norwegian ecosystem and may, therefore, be subject to bias. In Section 4.3, we argue that the chosen case companies facilitate generalizability. That said, the Norwegian market is characterized by being immature. The drivers, barriers, strategies, and framework found may, therefore, be better suited for organizations in a similar immature market as these have. Then again, we believe that this is the case for many OBD markets, increasing the relevancy and transferability of the thesis.

Confirmability

Confirmability can be defined as the quality of showing that something is definitively true or correct by proving evidence (Oxfordlearnersdictionary.com, n.d.-a). Lincoln & Guba (1985) link confirmability in qualitative research to the degree of which the researchers can demonstrate neutrality in the research. This may include explaining and showing the choices made through the process i.e in terms of an audit trail. An audit trail is a documentation of the research process through i.e journaling and memoing, keeping a log of all activities (Creswell & Miller, 2010). By this, readers can evaluate if the choices made seem reasonable.

Throughout our research, we have presented the choices made, examples where possible, and sought to be transparent. Our findings are aligned with many of the findings of the Gjørv et al. (2020), conducted by an expert group with representatives from the Norwegian private and public sector, and thus strengthens our confirmability. Moreover, we want to emphasize that this study is conducted independently of any third parties, and without any external incentives.

4.5 Limitations

Having evaluated the quality of the study in terms of credibility, dependability, transferability, and confirmability, we argue that the study is of sufficient trustworthiness. However, the study is still subject to important limitations. Related to the theoretical background, we cannot guarantee that we have not missed out on any relevant articles. However, we have followed a structured approach to identify relevant literature, and used triangulation of sources where possible, as mentioned in Section 4.4. Especially in the literature on OBD, we found that many of the drivers and barriers were based on assumptions rather than empirical evidence and case studies (Herala, 2018). This may have had an effect on our perception of the OBD market, and consequently the construction of our framework in Section 3.3. That said, our own empirics indicate that the proposed framework is suitable for practitioners in the OBD market.

In the case study, we have sought to describe the OBD market in Norway based on five companies. Even though we have argued that the case companies to a certain degree are diversified within sectors and size, there may still be significant variations in the Norwegian OBD market in general. Especially the fact that four of the companies, DNB, DNV GL, Telenor, and Aker BP are among the biggest in Norway may impact the generalizability of our findings. We have sought to overcome this by studying other sources, especially the expert report (Gjørv et al., 2020), to confirm our perceptions of the market.

Furthermore, the case study approach is based on a single interview with limited representatives from the companies. Thus, the findings are influenced by each of the interviewees'

perceptions of reality, and potential bias due to their area of expertise and tasks. Despite this, the credibility of the responses is strengthened due to the fact that we have interviewed key persons related to the project, as mentioned in Section 4.3. Some of the focus in the interviews was on the history of the project, and thus the responses are also subject to recall bias (Learning Hub, n.d.). This is especially relevant to the analysis of the decision-making processes, discussed in subquestion 2. We have argued that the decision making observed are a consequence of characteristics data. However, we cannot exclude that other factors may influence the decision making, such as the immaturity of the market or entrepreneurial characteristics of several of the initiatives. This is further discussed in Section 6.2. Furthermore, effectuation theory is used on large companies by a only handful of scholars, as pointed out in Section 3.2. Despite indications that the theory is relevant, a solid foundation in literature is still lacking.

The fact that the companies are still developing their OBD initiatives, makes this field of research an emerging one. Therefore, our case study and thesis only provide a snapshot of the current status of the OBD market in Norway.

5 Case Study

We have conducted a case study based on interviews with representatives from five case companies. The companies are Norwegian, from various industries, all having initiated OBD projects. Four of the companies are established corporations that are big actors in their respective markets (DNB, Telenor, DNV GL, and Cognite), while Think Outside is a startup. The cases will be presented individually in this section, before being further analyzed in Section 6.

5.1 Case 1: DNB

Interviewees:	Time and place:
Merete Magnussen, Senior Project Manager Ine Oftedahl, Director of Data Transformation	March 10th, 2020, DNB Oslo office

- Industry: Banking
- What data they want to open: Customer transaction data
- What they want to achieve: Create value for existing B2B customers
- What the status is now: Exploring the opportunities of creating an analytics dashboard

DNB is one of the biggest and most known banks in Norway. Their internet banking services had 1.5 million users by September 2019 (DNB, n.d.). DNB are renowned for innovating their services, e.g. the mobile payment service Vipps, and they were in 2019 awarded as the second most innovative company in Norway, by the innovation magazine Innovasjonsmagasinet (Innomag.no, n.d.).

Initiation of project and three-year strategy

In September 2019, DNB went public with plans of selling statistics and analysis based on their customer's transaction data. They commented that they had plans to sell it both to private and public customers, and hoped that it could be useful in community development.

Merete Magnussen, Senior Project Manager in DNB, is currently managing the project, which she explained was the first project within DNB to explore the possibilities of taking their transaction data outside the borders of the bank. Magnussen stated that they have for a long time discussed the unique value of their data, as they possess one-third of the consumer market in Norway. "We have always talked about our data. How valuable it is, and how much of it we have. We have one-third of the consumer market. No one in the Norwegian market can compare. Daily, over 2 million transactions run through the

bank. We thought: we have to succeed in creating value out of this."

Ine Oftedahl, Director of Data Transformation in DNB, stated that they have a three-year plan on how to work with data in the organization, with a focus on utilizing insight from customer data in new ways. The first year of the strategy was about "protecting the bank," thus to get the system rigged for GDPR, and making sure all rules and routines were followed. Today, they are currently well into year two, and the work being done is ranging from cleaning jobs to improve data quality and availability, to projects seeking to monetize data. The third year is planned to be used for looking forward, working with artificial intelligence, machine learning, and other driving forces within data.

Process of opening data influenced by legal and ethical concerns

The initial plan of selling statistics based on customer data was a part of exploring new business models, Magnussen said. A small team of five has been working on the project for over a year. According to Magnussen, much of the earlier activities in the transaction statistics project have been used to map the legal and ethical side of sharing or monetizing the data. One of the reasons for this is that this is the first time anyone has considered taking data out of the organization. "There are ethical concerns of using data from the consumers, and monetizing this by delivering value to the business market," Magnussen said.

They have since had a lot of meetings with different stakeholders, including risk and compliance advisors and data owners. Moreover, a general population survey has been conducted, according to Magnussen. One of the concrete measures DNB have taken has been to establish an opt-out solution where consumers can choose to not participate in the solutions DNB are making with the data. Another measure taken has been to have a lawyer as a part of the team.

Magnussen further said that the decision-making processes have been comprehensive. Several workshops, meetings with the government and the top management as well as a customer survey was conducted during the initiation of the project. She also stated that they have been careful, as their customer trust is critical, and they have a different risk

profile than many other companies. Magnussen elaborated that only a few customers have opted out, and they have received few concerns on privacy, following from the publicity of the project. She further elaborated that "We have plans, but on a project like this, you learn as you go. The timeline is not always how you planned it to be." Sale of data has been tested to some degree, but not progressed much due to the challenges that have appeared, according to Magnussen. Lately, the focus has therefore been shifted towards exploring how data can create value for the society and our customers.

The main focus of the project is now on exploring what kind of analysis they can do of the market, Magnussen said. "Customers we have talked to, have found this very interesting. Especially when we are talking to people that work with strategy and data. They instantly understood that this data may be worth gold." She continued: "We are still at the point where we have a lot of interesting data, but we are not ready to deliver a lot of insights based on it." One of the customer pilots has been to make reports of their customer segments and demography, using simple variables, she explained and added that they are still exploring different formats. "If we had used advanced analytical techniques, I believe there would be customer demand for it. But then we would move in the direction of customized insights based on needs. As we have a large customer base, it would seem more appropriate to aim for a dashboard solution." In addition, she said that there are ethical and juridical concerns on which level they can aggregate and analyze their data and deliver it to the business customers.

Exploring business models that can increase customer loyalty

DNB is examining the costs of creating an automated solution, before potentially initiating development. This could be a dashboard solution, similar to what Barclays and Commonwealth Bank of Australia have made, which lets businesses attain insights about their customers, said Magnussen. In 2016, DNB closed down over half of their local offices (Fjelltveit & Aldridge, 2016), and Oftedahl, therefore, argued that this may be a new arena to meet their customers: "It is uncertain how monetary the value of our data will be, but after closing down over half of our offices, we need to communicate and reach our customers in new ways. So much of the short term value is to communicate

more efficiently with our customers, without meeting them physically in our offices." She assumed that the largest costs are associated with data and data quality, everything from cleaning the data to making it more accessible. "In an automated solution, you need to have complete control of the quality of the data, and there is no room for weaknesses in the data sets," she stated. The dashboard solution discussed in the interview is according to Magnussen a non-payable solution. "The incentive here is to tie the customers to DNB by giving them valuable insights, rather than cash revenues," she stated. According to Magnussen, they are still at the point where they believe they have a lot of valuable data but are not certain of how they can deliver insights to the customers yet.

Thoughts on freely sharing data

In terms of attitudes towards sharing data freely, Oftedahl admitted that it is still challenging for them to get used to the thought. "It is well established [in DNB] that one strives to carefully protect the data, and not set a foot wrong. So we are hurrying slowly." She further explained that she thinks that the largest actors would benefit the least if everyone started sharing more freely.

Further, Oftedahl referred to the Norwegian oil industry where a lot of data must be shared according to law. "Then the competition is about who can utilize the data in the best way, not about who has the most and best data to start with," Oftedahl said. When asked about opportunities in an open data economy Oftedahl said: "I think it would facilitate cooperation between third parties, both established and large ones, like DNB, and smaller more agile startups. As we get more control of our data, we get more mature to cooperate. Not everything needs to be made in-house."

As a recommendation for others working with similar projects, Oftedahl said: "I think the most important thing is to get a good understanding of the legal space, and also work thoroughly with the ethical parts of data." She told about experiences with companies that did not have a good understanding. Therefore, "GDPR is fundamental, and something everyone working with data should have in mind and be familiar with," according to Oftedahl.

5.2 Case 2: Telenor

Interviewee:	Time and place:
Lena Langrød Business Developer, Big Data and IOT Department	March 24th, 2020, Video conference

• Industry:	Telecommunications
• What data they want to open:	Customer location data
• What they want to achieve:	Create value for the society and new revenue streams
• What the status is now:	Selling insights to large organizations for road and railway planning

Telenor Group is a Norwegian telecommunications company that has business activities across the Nordics and Asia, with mobile, broadband, and TV services (Telenor, n.d.-b). Telenor Norge AS, a part of Telenor Group, holds the largest market share in Norway within these services (Telenor, n.d.-a). The company has 3400 employees spread out on 23 offices in Norway (Telenor, n.d.-a).

Initiation of project

In 2019, NRK published an article about Telenor selling analytics based on where their customers are located (Gundersen, 2019). The article described how Norway's two largest telecoms use mobility data to facilitate data driven decision making in counties, by contractors, and in tourism.

Lena Langrød is a business developer working within the Big data and IoT department in Telenor. According to Langrød, the department was established as a part of Telenor's innovation activities to do things within a new area. They are a small team, consisting of two data scientists and Langrød as a business developer and salesperson. "Sensor technology and IoT is one part of what we work with, and Big data is a subpart, which is not within the core competencies of Telenor, but is an area where we can create value for our customers," Langrød said. She said that the analytics project started by thinking

"We are going to work with big data, what do we have, and what can we deliver?"

Langrød further told us that they now focus on finding solutions for public benefit. "We try to see where we create value, and what customers are willing to pay for this value. If these customers take some of the development cost, we might be able to build something that everyone can benefit from." She further explained that "As a company, we realize that the world changes and that we have to change to be relevant for our customers and create new revenue streams." Along the way, Langrød explained that they have learned a lot, from initially thinking commercially to thinking more about corporate social responsibility. Telenor have for several years been involved with projects that they call "Big data for social good" by providing insight on how Dengue fever and Malaria spread in Pakistan and Bangladesh (Telenor.com, n.d.).

She further explains that in terms of planning, the most important has been to have a vision and something to aim for. Whether or not you succeed, lies close to you, according to Langrød: "It depends on customer number one, five and ten, and there must be value creation in three years." Langrød elaborates that they have several milestones, but are not working with very long ambitions. "The external environment affects us. It can be rules and regulations. But it can also be the maturity of a customer, suddenly willing to pay 50 million to solve their problem here and now."

Experimentation to find product-market fit

According to Langrød, they have worked agile with finding the product-market fit for many years. "For us, it is important to have some hypothesis of what we think will fit in the different segments in the market. We started back in 2017, where we had a hypothesis that our data on how people moved was smart and might give insights to many." Since then, they have worked with multiple iterations on who the customers might be, and what they needed, Langrød said.

Lena Langrød has been to many customer meetings to understand what value the data might give them. "Often, the customers think the data can help them, but they have not understood what problem they want to solve. They just know that they are in

a tough situation," Langrød said. Telenor have therefore facilitated many workshops to help the customers understand what they need to solve their problems. Langrød elaborated: "One of the main problems we have, is that the customers are not mature enough to understand their problems and how data can solve them." She added, "Some in the segments understand what they want, others do not. But it is not necessarily a separation between segments, but rather a separation in maturity within the segments." She further argued that the maturity of the customers makes a big difference on what they can offer them, "Often, we can deliver the data directly, and they would have a data scientist who could do the analysis. Others just understand the newspaper version and need to be told exactly what the numbers mean," Langrød explained.

Telenor have tested several segments to find out where they could deliver the most value, according to Langrød. "In the beginning, we tried to sell simple algorithms and analytics to tourism, where they really could understand where the tourists came from. We standardized the offering and delivered them to many. It was a simple analysis with standard visualization. It did not cost too much, so we thought we could scale it for several destinations." Langrød further told us that they priced it low, but the businesses still did not have it in their budget. Next, they approached the retail industry, without any luck. Langrød said that they had small margins and did not understand how the data could help them. "Now we are working with big customers, where we deliver data for city planning, road planning, and railway services." "Here, the price models have been completely different and the contracts were in millions," Langrød explained. This havs changed Telenor's approach: "We have to use a lot of resources on doing the analysis and combine them with different data sets and deliver it to the customer. So we are in another field game in terms of concept and price mechanisms than we started with in 2020."

Delivering Covid-19 analytics to counties

One of the segments they have reached out to and worked with is the Norwegian counties. Langrød explained that they are not a homogeneous segment: "The counties have a lot of different problems and needs. The pain points of one county can be totally different

for another. For big cities, reduced traffic to the city may be a problem. For them, it is interesting to see how many who are traveling by bus and when the busses should be scheduled. For smaller counties, however, this might not be a big problem." However, this changed, when the Covid-19 virus hit Norway in March 2020 and brought a common problem to all the counties. "After this Corona situation, they knew exactly what they needed, as they had an urgent need."

Langrød and the Big data and IoT department in Telenor are currently working with Telenor Research and FHI (The Norwegian Health Institute) in delivering data and algorithms to FHI's Covid-19 prediction models. They had previous experience from similar projects with fighting Dengue fever and Malaria. Now, Langrød said that they are delivering data to Norwegian counties on their populations, on how many that are entering and leaving the counties to fight the Covid-19 virus. We talked to Langrød five days after the government put down a restriction to visit cabins outsides one's county, and Telenor had helped the counties from before the restriction. "A community like Hemsedal, which might get their population multiplied by 5 or 10 times by in the weekends, can get problems with their health care system if many of the visitors get ill in their cabins," Langrød said.

According to Langrød, the analytics delivered is different from the more high-end analytics they usually work with. "We were not build to deliver this type of product. We are in another segment, so it was about pivoting, trying to streamline something fast, but also right." The numbers and analytics the delivered to the counties are standardized and should preferably have been automated to an even larger degree, Langrød argued. The analytics delivered to the counties are priced low, according to Langrød. "It is not much, it is cost-based. We have to get something in return to use our time on it."

Pricing of services and competitive situation

Langrød further explained that Telenor have set the prices on their analytic services based on multiple factors. One of them is what the customers are used to paying for similar insights from other providers. However, as these insights have previously been found through manually population surveys, Telenor can heavily cut the costs of gaining

insights. Therefore, Langrød said that their prices are based on the work they put down, but with a margin to build competency and develop the services further. "In some cases, we price the offerings low, so that we can showcase to the customers what we can do," Langrød said. She explained that Telenor does not make a lot of money on the services at the moment and that they are not break even in the project. "We have spent several million NOK to build what we have. But we are not putting the whole cost on the first customer," Langrød said, and added that by splitting the cost of development over the customers, they can build something that all can benefit from later.

When asked about the competitors, Langrød mentioned Google and the telecommunications company Telia who cooperates with Unacast. Unacast are solving the backstage solutions for Telia, according to Langrød. "They are strong competitors. In a new marked like this, I like competitors, they help to mature the customers. We may lose some customers, but the market will grow bigger. It also helps us to stay focused," Langrød said. Regarding Telenor's competitive advantage, Langrød told us: "We have great control of our network. When we make algorithms, we talk to the network planners, which know their local setups. The network is changing every day, and to have the control and tools are just as important as having people who are good with algorithms."

Thoughts on freely sharing data

When asked about opportunities related to freely sharing data, Langrød replied: "I think there are multiple perspectives. I think the idea is good. It is about creating new possibilities and ideas on how you can solve problems and create value through partnerships." She continued: "In a market economy, you have to have mechanisms that reward what you do. Open data freely available for everyone will not do that." "I understand the intentions, but I think it is too idealistic," Langrød argued. She also said that the quality of the data, and making it easy for others to consume is important. "I think that The Norwegian Public Roads Administration (Statens vegvesen) have counted and delivered data on how many cars passing certain points for years. However, it is just until recently that they succeeded in making it consumable for others." She further problematized how their data can be used by unwanted people: "To open up location data can be deadly.

To show where crowds of people are located is information that can be used not only to create good solutions by companies and private users but can also be misused."

Langrød said that she thinks Telenor have already tested most of the opportunities more open data creates: "I have no unique, good thought of what business models that will create value now, other than what we have already tested. However, if we are going to deliver data to all bus, road, and train companies in the future, then it is more important to figure out the right price. Should it be monthly, yearly, or per use." She explained that Telenor already has a lot of data that they can not use themselves. One of the reasons for this is privacy, she explained: "We take our corporate responsibly seriously. Before delivering data in 2017, we had several meetings with The Norwegian DPA." When asked about tips for value creation with data, Langrød replied: "It is important to be close to the customers that you think you create value for. You have to be certain that you create value."

5.3 Case 3: DNV GL

Interviewees:	Time and place:
Tore Frihagen, Head of Digital Sales Anders Walløe, Business Controller and Product Manager	March 12th, 2020, DNV GL Oslo Office

- Industry: Maritime
- What data they want to open: Global energy consumption data
- What they want to achieve: Renew business models
- What the status is now: Seeking good use cases

DNV GL is one of the world's leading maritime classification societies, delivering services to the maritime industry, oil and gas industry, and energy value chains (DNV GL, n.d.-a). The establishment of DNV GL was a result of a merger between DNV (Det Norske Veritas) and GL (Germanischer Lloyd) in 2013 (DNV GL, n.d.-c). Since 1864, their vision has been to safeguard life, property, and the environment (DNV GL, n.d.-a).

Digital transformation of value offerings

In 2017, DNV GL released Veracity, a digital platform to create value from data and facilitate sharing and trading of data (Veracity, n.d.). The marketplace in Veracity offers different products, including software, APIs, and data sets (DNV GL, n.d.-b). Some of the content is developed by third parties, and some of it by DNV GL themselves. Most of the data DNV GL is in possession of is from their customers, acquired through their role as an independent third party. They use this data to create products and services made from and for data of their customers.

Tore Frihagen and Anders Walløe are working with content on the Veracity platform. When asked about why DNV GL initiated the Veracity project, Frihagen explained: "It is a part of the digital transformation, to do things in a smarter way, use digital possibilities, and data." He continued: "Veracity is an innovation platform and a service platform

where you can access digital services. Today we have around 190.000 users and 190 services." According to Walløe, Veracity has opened up for innovations and transformed business models for DNV GL and used an example to illustrate: "We now sell access to standards. Previously, we gave the standards away for free, and then delivered consulting on top of it." This was a consequence of DNV GL experiencing increased competition on consultancy contracts.

One of the data sets that DNV GL offer on Veracity is the Energy Transition Outlook (ETO) 2019 data set (DNV GL, n.d.-b). The data set provides insights and forecasts on energy supply chains, for instance how the global energy mix will change over time, Frihagen explained. These insights could be interesting both for journalists and politicians, but also for the industry, to understand new possibilities and restrictions of new energy sources, according to Walløe. Frihagen explained that DNV GL hav delivered the ETO report for many years and that they now wanted to make the insights accessible through Veracity, and at the same time opening for it to become a new revenue stream, similar to the standards. The raw data is available for free download on the Veracity marketplace, and they also offer what they call Premium Analytics, an analytics tool built on the data set, in Microsoft's Power BI (Store.veracity.com, n.d.). According to Frihagen, working with such data sets requires specific domain knowledge. Thus a tool like Premium Analytics can be helpful to acquire insights.

Challenges related to pricing

DNV GL have experienced low demand for the ETO report so far. There are only a few paying customers of Premium Analytics, but several hundred have downloaded the free data set, according to Frihagen. DNV GL had a hypothesis that companies would want to be the first to buy the analytical tools and make analysis on specific countries or regions. Frihagen further added that they were still unsure about why they have experienced low demand. "We are not certain if the product is not interesting or if we priced it too high." According to Frihagen, they set the price based on a gut feeling rather than through a systematic approach: "I think it was a test. It may be priced a bit high. 1000 euros per year. I am not sure how the price was set. I think it was a gut feeling."

Frihagen further explained that one of the key challenges of selling the data is unclear ownership structures. The ETO report is based on sources from different owners, collected over a long period. Frihagen explained that by giving away the raw data for free, they avoid any legal challenges related to ownership. Especially in the context of partnerships and research, monetization becomes problematic, Frihagen explained, and added: "Who owns it and how should the split of revenues be?"

Related to other data driven projects, Walløe said that they would ideally set the price closely tied to the value created for the customer, but that it is hard to estimate. As an example, he mentioned projects where they today sell a data set coupled with consultancy services. In these projects, it can be difficult to know whether the willingness to pay is connected to the data itself or the consultancy.

Immature customers and challenges related to data quality

Related to new data driven projects, Walløe said that they must be careful not to challenge their existing business models, especially in cases where they are the only provider. Walløe further said that it is hard to find the right use cases, where one can quantify the value of data, and pointed to the industry's and customers' low maturity level as a barrier. He said that when working with data driven projects, it can be hard to explain the offering to the customers unless they have specific use cases to show to. Thus, they now focus on running pilots that can serve as examples: "The goal is to understand the problems and solve different use cases, so people understand what we talk about. Otherwise, it gets too abstract and complicated." Walløe admitted that this way of working makes it hard to scale, but that it is important groundwork to be able to sell to customers later. The maturing of customers is a long process with several steps, according to Walløe. He explained that the customers need some time to understand that they can only extract the value of their data through the right partnerships and collaboration with others.

Another challenge is the quality of the data, Frihagen said: "When you collect IoT data, you collect data streams from assets, and stream it into a dashboard to analyze it. If these then shall be sold, the data is usually in a format that can be challenging to get into another system. So data normalizing and standardizing is a big challenge." Frihagen

posed the problem: "to standardize one needs to know the use cases."

Thoughts on freely sharing data

When asked about their view on more freely sharing data, Frihagen expressed that it could enable improvements of existing processes in the society. "Norway has come quite far digitally. So things that are equal for many industrial actors, like reporting emissions and such, should be made digitally available. Then one can do benchmarking of CO2 and such." Frihagen exemplified other opportunities that can be valuable: "In the seafood industry, many breeders must report fish health, lice and other data in multiple systems. Standardizing of these is a good starting point for a case." For DNV GL, available data could support their research of trends and development: "We do joint industry projects where we could need that type of data," Frihagen explained. Walløe and Frihagen have an advice to others that would work with similar data driven projects: "If one can avoid to build platforms, and find something to use, then you would save a lot of time. If you have a use case, it is better to test it on an existing platform. It is a matter of creating value quickly."

5.4 Case 4: Aker BP

Interviewee:	Time and place:
Katrine Tjølsen Director of Product Management, Cognite	March 5th, 2020, Video conference

- Industry: Oil and gas
- What data they want to open: Operational data from oil platforms
- What they want to achieve: Various benefits, focus on innovation
- What the status is now: Sharing data through Open Industrial Platform

Aker BP is one of the largest producers of oil and gas in Norway (AkerBP.com, n.d.). In 2017, the Aker Group became the main owner of Cognite, a tech company with the vision to digitalize heavy industries, starting with Aker BP and the oil industry (Cognite, n.d.-a). Cognite's main product, Cognite Data Fusion (CDF), is a software tool that enables companies to make better use of their operational data by contextualizing it and liberating it from silos. In this case study, we will explore how Aker BP use Cognite's technology to open their data to the public and value chain. The case information on Aker BP is based on Aker BP's and Cognite's whitepaper on their Open Industrial Data project (OID) (Cognite, n.d.-b), together with an interview with Director of Product Management at Cognite, Katrine Tjølsen.

Encouraging an open and collaborative industry

Aker BP have through CDF enabled sharing of operational data. One of their early OBD initiatives was OID, sharing live operational data from the Valhall oil platform through CDF. The data on OID is free to access and process for everyone, with a simple online login. Tjølsen explained that OID was initiated in 2018 based on the notion that data is more valuable when it is shared, and thus openness should be the new industry standard. Aker BP and Cognite hope that OID can be the first step toward

a more open and collaborative industry (Cognite, n.d.-c). They also encourage other companies to share their data stream on the platform and thus take part in the movement towards openness (Cognite, n.d.-c). The vision for the platform is stated as: "Imagine the speed of technological advancement in a world where hundreds or thousands of industrial companies share live data this way. This project is about injecting real, live data into the realm of innovation and invention. Then stepping back to see what happens, to be surprised" (Cognite, n.d.-c).

Ecosystem incentives for opening data

Aker BP state that companies exist as part of a larger ecosystem made up of suppliers, vendors, and other external stakeholders and that the individual pieces impact one another in many different ways, including innovation and collaboration (Cognite, n.d.-b). Further, they explain how OID could benefit the ecosystem actors: "By sharing this live stream of industrial data freely, Aker BP and Cognite hope to accelerate innovation within data-heavy fields, such as predictive maintenance, condition monitoring, and advanced visualization techniques, as well as other new, unexpected applications. Advancement in these areas will directly benefit Aker BP's operations and will also improve the health and outlook of the industrial ecosystem on the Norwegian Continental Shelf" (Cognite, n.d.-b).

Tjølsen illustrated with an oil platform compressor why industry actors should want to open their data. If anything happens to a compressor at an oil platform, producers might have to stop the production completely. Each day the platform is not operating costs a huge amount of money, which is why all information on how the compressor is functioning is important, and why an operator would pay a lot of money for any solution that monitors the health of the compressor, according to Tjølsen. Tjølsen also argued that companies, by sharing their data on the platform together with other companies, split the costs of developing solutions, that will be less expensive than custom made solutions and consulting services. "Operators gain very little by holding operational data to themselves. As long as it is operational. There are exceptions such as data associated with seismic, underwater data, or similar, as they have an incentive for keeping this to

themselves," Tjølsen concluded. For Aker BP, other drivers also include contributing to worldwide research by providing real data for evaluating state-of-the-art models and algorithms, testing and benchmarking vendors within machine learning and other data science fields, and attracting interdisciplinary talent (Cognite, n.d.-b). Publicity was also an incentive for launching the platform, according to Tjølsen, as Aker BP wants to establish themselves as a leading example of data sharing in the oil and gas industry (Cognite, n.d.-b).

Tjølsen further explained the incentives Cognite have to launch OID. "From Cognite's perspective, our interest as an enabler is that we want there to be as many good solutions built on our product as possible. Because that increases our value. A customer is more willing to pay for our offering if we have an ecosystem of great solutions integrated with ours." Tjølsen further argued that it is a win-win situation for the companies to share data on the platform: "Today, especially in the heavy industries, the companies have data and domain knowledge, but they don't have data science skills or software development skills needed to create new solutions. At the same time, many people are brilliant in data science. I was a student like that myself. I wanted to create a data science startup, but I lacked the domain knowledge, and I didn't have any data. By letting these two sides meet, we have a win-win situation."

Sharing data in value chain

Aker BP have utilized CDF for other purposes than OID as well. In cooperation with Framo, a supplier of pump systems for offshore industries (Framo, n.d.), they have intensified digitization of offshore operation through a smart service contract (Digital Norway, 2019). According to Aker BP, this will change the traditional approach to maintenance (Digital Norway, 2019). Abrahamsen, Managing Director of Framo Services AS explained: "With Cognite making live and contextualized data available, Framo can create apps to predict the status of our equipment, allowing us to plan efficient maintenance. The new system sends intelligent data on our pumps, so we can predict how the pumps will perform in the future" (Framo.com, n.d.). Data sharing make insights on how the pumps of a specific installation are functioning, which results in more efficient maintenance

(Framo.com, n.d.). Abrahamsen continued: "While our service agreements previously just defined hourly rates, we will now focus on uptime. This is something completely new for us and has required the design of new smart contracts with Aker BP".

Initiation of project

Tjølsen admitted that starting up the OID project was a bit opportunistic. Although they had some assumptions, they were not sure how it would play out, including who would be interested in the data, how they would use it, which problems they would solve or what solutions will be developed (Cognite, n.d.-b). However, they predicted that the potential rewards outweighed the risks (Cognite, n.d.-b). Some of the risks assessed were data breaches, risk of exposure of personal information, and risk related to transparency around i.e downtime on machines (Cognite, n.d.-b). "In the summer of 2018, we had matured enough for the project to be possible. We had started building a pretty strong brand on data liberation, and we had not yet fathomed the difficulties involved in solving business problems in oil and gas using data and data science. I guess we were a bit naive. We thought that it was a great idea, and wanted to start right away." She explained that they thought operators could just publish their data, and then people would strive to solve their problems in the best way.

The biggest surprise was related to the demand for the data product, according to Tjølsen. At it turned out, it was not as simple as saying "here you go, data scientist, now go on and create some magic." Tjølsen explained: "It requires a lot more cooperation between domain experts and data scientists to understand what the data says and what the real business problem is." She admits that they should have anticipated the insecurities before starting the project: "You have some assumptions for every project. We had a hypothesis that users of the data would be able to do something really interesting with it. We had an assumption that partner companies would want to show their skills to Aker BP and other companies by having their product run on the data. We had another assumption that the data would be interesting for universities, as lecture and exercise material, and also for master's and doctoral thesis." She explained that they should have worked in a more structured way, clearly stating their assumptions and insecurities upfront, and validated

them in the cheapest way possible. According to Tjølsen, a lot of the assumptions could have been validated without barely doing anything, just by calling universities and testing a couple of data sets with partners. Instead, they took one thing at a time, and discovered the insecurities as they went.

Maintenance mode

Since identifying the challenges mentioned above, the project has been put in a maintenance mode, rather than growth-mode, according to Tjølsen. Tjølsen elaborated that being in a maintenance mode entails that they do not actively work on getting more partners to share their data on the platform. This means that there is no development on what data is available. However, as the OID is built on CDF, the capabilities of the platform are improving as the software product is developed, according to Tjølsen. Tjølsen explained that the decision to stop developing the project was a result of prioritization. "As a company, we need to prioritize what to do well, at every given time. Where should we allocate our resources? At this time, it is more important to make sure that our product delivers value to our existing customers. We are working on making the product more self-service, so that we can scale. It requires a certain maturity for a company to be able to prioritize something that has good marketing value." Tjølsen said that Cognite is planning to grow a sustainability vertical, exploring how to make the industry more sustainable. When that happens, the platform might come into focus again, Tjølsen told us.

Tjølsen said that the initiation of the product was characterized by the fact that the company was young and relatively small at the time the project started. "Now Cognite is about 350 employees. When the project started, we were 60 employees. Being 60 employees in a newly established company, decisions are pretty informal. We started the project without much consideration on whether to go ahead or not." Tjølsen added that the decision to downgrade the project was a more carefully made decision. "To put the project on hold was a bigger decision, involving stakeholders from marketing, engineering, and the people working with our partner ecosystem, looking at how much we will gain from continuing, compared to how much time it consumes and distractions

it puts on other efforts. We decided that we were not able to execute in a good way and that running a mediocre version took more time than it benefited us."

Thoughts on freely sharing data

As mentioned, Cognite is an advocate for freely sharing data. "To make great progress, we must cooperate. That applies to regulatory and the industry." She further explained: "the cake gets bigger if more parties share," and added that those who cooperate can "run from the others" that do not. Tjølsen believes that this is a widespread opinion in the industry today. Her perception is that until about 2010, companies in the industry were protective about their operational data and IP, but that the trend now is the notion that sharing pays off. "But it requires that one gets used to being both competitor and partner at the same time," Tjølsen added. She mentioned that selling intelligence and as-a-service models will become more normal in the heavy industries too, for example pump as-a-service, as in the Framo case.

Tjølsen recently attended The Lerchendal Conference, where the topic was: "How do we secure the value of data?" (Lerchendalskonferansen, 2020). Tjølsen says that sharing of data can happen in a controlled way. "In my opinion, some of the conversations seemed to be based on a misunderstanding that we have to share all or nothing. Which is not the case." Another recurring topic was data quality, according to Tjølsen. Tjølsen has clear advice for companies looking to start projects around sharing data: "Make sure to validate the demand early. Run the project by lean principles. A lot of your assumptions will be wrong. It is better to fail fast. Lastly, be aware that there are more steps needed than just pushing the data out there."

5.5 Case 5: Think Outside

Interviewee:	Time and place:
Monica Vaksdal Founder and CEO	March 17th, 2020, Video conference

- Industry: Snow analysis
- What data they want to open: Sensor data on snow and ice conditions
- What they want to achieve: Create revenue streams
- What the status is now: Running pilots with B2B customers

Think Outside was founded in 2017 in Bergen, Norway, by the geologist Monica Vaksdal, who left her career in the oil and gas industry in order to start her own company. Monica has combined her background and experience from the oil and gas industry with her passion for skiing. The company is now a team of 11 people working full and part-time, with several of them with experience from working with big data in the oil industry.

Adaptable value offering

Think Outside have developed a technology called Sknow that enables them to deliver insights about snow and ice conditions. The insights are created by combining data collected from radar-based sensors on snow or ice-covered areas, with data from other sources such as weather and snow stations. Think Outside are still in an early phase, running pilots with a variety of potential customers, both B2C and B2B. Think Outside's B2B service provides skiers with live info on snow conditions and avalanche risk around them, enabling them to make safer choices. The insights on snow conditions can also empower B2B customers, such as ski centers and hydropower plants, to make better operational choices. Vaksdal listed various use cases for Think Outside's technology: "Infrastructure, safety, road, railway, avalanche monitoring, all the way to when the snow melts to water and becomes drinking water and potentially causes floods. Knowing

how snow will act, is crucial to many, and that is what we deliver," Vaksdal summarized.

Vaksdal explained that while running pilots, they adapt the solution and format of the insight to the specific customer's needs. Think Outside's radar-based sensors can be stationary, but also put on skis, snowmobiles, or drones, to collect data from a bigger area. Furthermore, the formats can be graphs, reports, PDFs, apps with a map functionality, or a single number. For the skiing industry, the insights are more qualitative, indicating the level of danger in the area through an app. For the hydropower industry, the insight can be a single number showing how much water is in the area.

Alongside the core business model of Think Outside, Vaksdal mentions selling the metadata as a potential additional revenue stream. "In our case, metadata can for example be a result of our data set toward the B2B electric power industry. Our data set will affect how much a power supplier produces and sells for, and thus becomes interesting for energy traders, who we can sell the metadata to." In B2C, the metadata is often tied to the consumers, and can according to Vaksdal create many potential spin-offs. She explains that even with the strict GDPR, one can, with their consent, create solutions that benefit the user. "If I know that you have been skiing in this area and that you have had this particular speed, that can be used, for example, to help you get cheaper insurance or better skies. A lot of these nuances are possible, based on pure consumer data, even with the new regulations."

From B2C to B2B

Think Outside initially started with a vision of creating a consumer product for skiers that would help reduce lives lost in avalanches, but their main focus is now on B2B solutions. Vaksdal explained that the reason for their market shift was that investors were more excited about the opportunities in the B2B market. She said: "The shift from consumers to companies was a result of external movement. If we had the economy to do it, we would have chosen to further develop a pure consumer product. The fact is that, when raising money, both through seed and series A, market size is crucial. It does not matter if you can show advanced and nuanced financial models when the market still does not have the potential for a unicorn. They love the technology, they love the team,

they hate the market. Because everyone wants a unicorn, and no one wants anything less."

The decisions made in the startup are guided by a set of clear key performance indicators, according to Vaksdal. Although working in a structured matter, following plans, goals, and structures, Vaksdal said that their planning is affected by being a startup. "It is difficult to have long horizons in the startup world. If you can plan for the next six months, you are quite happy. If you have a longer runway than that, you are extremely happy." Talking about the company's plans, Vaksdal explained: "We have a lot of goals, and we let the goals set the direction, both in year and long term, but we still have to changes continuously. The key is to pivot to persevere."

Challenges related to pricing

Vaksdal said that they have experimented with various pricing models. She explained that they have hardware-enabled software business model, thus he hardware can be sold in itself, or be bundled with the software. She further explained that they have a very analytic approach to pricing, making sure to always have an overview of the competitor landscape. "We know exactly what the cost of goods is on our hardware, and we know a lot about what similar data sets are begin sold for by our competitors." Still, Vaksdal pointed to the valuation of data as one of their main insecurities. "Valuating data is extremely hard. Everyone has the feeling that they are in possession of a pile of gold, but no one can quantify it."

Vaksdal said that they all in all experience good demand for what they offer, but explained that the outbound sales process can be challenging. Being the first on the market with their technology, Think Outside have to explain the value they can add to their potential customers. "It is completely binary," Vaksdal said, "Either they get it, or they don't." Customers that already have advanced data usage in their operations know that the data is valuable. "They know how to use it, and want to buy it because they know what advantages having the data set will bring." On the other side, the customers that are not used to operating with data, are harder to sell to. "If they live in, what I would call, the stone age, and have a immature data level, then we have to be willing to give to get

them to commit to a pilot. At this stage, it is a matter of doing due diligence for every case to land pilot deals" As a consequence of differences in customer's maturity, Vaksdal is aware that the prices of pilots might be completely wrong for future scalable solutions.

Thoughts on freely sharing data

Talking about the future of the Norwegian data economy, Vaksdal said to look to the oil and gas industry. She explained that Norway has taken some unique measures, compared to other countries such as England and the US, which have been important in the success of the Norwegian oil and gas industry. Vaksdal elaborated that data sets that are over a certain amount of years old are free and available to all industry actors that pay a yearly fee to the central database in Norway, whereas in other countries, you have to buy even the old data sets. "This means that everyone has the same starting point, no matter the size or financial muscles. Your advantage is your ability to do something about the data, make better data driven decisions than the others." Vaksdal further said that she thinks the hydropower industry could be better off by taking a similar approach.

As a tip to other companies working with data projects, Vaksdal said that it is important to be aware of digital legacy from the beginning in order to easily scale later. "One often chooses solutions which work with current IT systems and which works on small data sets or solutions which works for small operations, but that does not scale." Vaksdal added a general advice: "In my opinion, the oil industry is way ahead of everyone else. So I think that to explore what can be transferred of knowledge, competence, and methodology from that industry would help Norway as a whole."

6 Discussion

This section will seek to answer the research question stated in Section 1: How can Norwegian companies reap the benefits of open business data? We will do so by answering the subquestions in three sections. In Section 6.1, an analysis of the strategies followed and barriers faced by the case companies will be conducted, with the theoretical foundations established in Section 3.1. A discussion of the characteristics of OBD initiatives, relevant dilemmas, and market status is presented. In Section 6.2, we will discuss the case companies' decision-making processes based on the theory presented in Section 3.2, and use the case study to test the proposition that effectual decision making is prevalent among companies approaching OBD initiatives. In Section 6.3, we evaluate the proposed framework from Section 3.3 based on the empirics. We complement the framework with aspects to consider, based on insights from the case study. Through discussing the subquestions, we provide insights into strategies and drivers pursued, decision making and aspects to consider when approaching OBD initiatives, aiming to help managers reap the benefits of their data.

6.1 Subquestion 1: Which strategies do Norwegian companies follow and which barriers do they face?

All of the four outlined strategies in Section 3.1 are present in our case study. DNB follows a strategic leaking strategy, Telenor and Think Outside a monetizing data strategy, DNV GL use commercial openness, while Aker BP is following a combination of strategic leaking and philanthropy. We will further explore why the companies are following these strategies, and what benefits they seek.

DNB pursues strategic leaking to achieve customer loyalty

DNB are exploring ways to share data for free with their existing business customers through closed dashboards and thus can be said to pursue a strategic leaking strategy, according to Buda et al. (2016). The dashboard would provide business users with insights on their target market through transaction data. Since they closed down most of their

local offices, DNB have looked for new arenas to meet their customers. Giving data back to their customers can be a way to increase customer engagement and retention in line with Hammell (2012), which is especially valuable as physical presence is diminishing. The director of the Norwegian DPA explained that there is an expectation among many customers to receive something back for their data. DNB's initiative is an example of giving personalized insights as an added value to the product. The current status of the project is that they are still in the process of exploring a data platform to give data back to their customers.

Aker BP seek community building benefits from freely sharing data

Aker BP can be said to follow a mix of strategic leaking and data philanthropy. This follows from the data on the Open Industrial Data (OID) project being freely and publicly available but having an apparent target audience, which includes other businesses and citizens that can develop applications, citizens they may want to hire, and media to strengthen their brand name. Cognite is an advocate for data liberation, and Tjølsen said that protective mindsets belong to a different time and that sharing in order to increase the shared potential is the modern way of thinking. Through OID, Aker BP seek several drivers belonging to the community building category, including innovation, collaboration, and talent recruiting. By opening data to the ecosystem, the intention was to enable domain knowledge and external data science to meet and solve Aker BP's internal business problems, in line with the principles of open innovation (Janssen et al., 2012). This can facilitate cost-efficient innovation, by outsourcing the problem solving and splitting the cost with the other companies using the technology of OID. A platform with several companies can incentivize developers to make applications that can reach a broader customer base, benefiting the companies as such products would normally be cheaper than customized consultancy services. This can be described as coopetition, splitting risks and costs as described by Say (2013).

One of Aker BP's hope is that their data can contribute to worldwide research, and thus can be said to follow a data philanthropy strategy. This can increase customer sentiment and establish a reputation for being smart and responsible with data, as well

as potentially enhance shareholder confidence, according to Hammell (2012). This can be positive for publicity and PR, which was one of Aker BP's intentions. By sharing the data with the academic environment or data scientist professionals, they can discover talent or distinguish applicants in a recruiting process. In addition to OID, Aker BP also share data through the Cognite Data Fusion (CDF) solution with other businesses in their value chain to improve operations. Trough sharing data with their pump vendor, Framo, the two were able to establish smart contracts where both parties were incentivized to maximize uptime.

Aker BP have an ambition to lead the way for more data sharing in their industry. According to Buda et al. (2016), first movers can reap all the benefits that come with being a keystone in their business open data ecosystem. Further, Gjørv et al. (2020) outline the importance for Norwegian companies to act fast in order to keep their competitive advantage in industries where they are industry leaders. Thus, arguments from both scholars indicate that Aker BP could benefit from taking the lead in their market. Despite their big OBD initiative, Aker BP have still not seen a large spike in the innovation around the OID.

Telenor and Think Outside are monetizing data directly trough selling data products

Telenor and Think Outside follow a monetizing data strategy, where data is offered to a selected set of users in exchange for a fee, thus gaining new revenue streams as the main driver. The users of Telenor data are businesses and public intuitions like counties, while Think Outside customers can be both businesses and citizens. For Telenor, the sale of analytics is driven by a small group experimenting with new business models, while Think Outside was founded on the idea that they could build hardware technology to produce data and sell the insights. These companies both have unique access to data which have strategic relevancy for users, allowing them to take direct monetary benefits. Telenor's initiatives to use data to help stop the spread of infectious deceases, Malaria, and recently Covid-19, are examples of initiatives driven by public good as a part of their corporate social responsibility strategy. The companies can not yet be said to have succeeded, as

Telenor is not break even and Think Outside is still a startup in development.

DNV GL are seeking new revenue streams by commercial openness

DNV GL can be interpreted as following Buda et al. (2016)'s commercial openness strategy, by opening up and selling data sales and tools to all possible users, including private individuals. This differs from the monetizing strategy of Telenor and Think Outside, as they do not restrict the services to only a part of the ecosystem. DNV GL are enabling coopetition through their platform Veracity, as competitors can create applications on the platform, building a larger pie, and taking a piece of it. By this, DNV GL have leveraged their position as a neutral third party and access to industry data, to modernize their business model. However, DNV GL only have a few number of sales on their data tools related to the ETO report, and are therefore early in the process.

In the next part of this section, we will discuss the barriers faced by the companies when approaching OBD initiatives, before concluding with some overarching observations.

Improving data quality is perceived as particularly challenging

Most of the companies mentioned data quality as a challenge. This is coherent with the literature, where data quality is one of the most frequently mentioned. Several aspects of ensuring data quality are seen as challenging, both in the case companies and in literature. DNB stated that tasks associated with cleaning and ensuring that the data is accessible will be the most costly activities in their project. DNV GL argued that one of their main challenges is getting access to the right data. They said that a prominent dilemma is that standardization of data has to be made according to the use of it, but the use is unknown before one has standardized and can make sense of it. This dilemma might be a consequence of the fact that there is a lack of understanding of the value potential in the data due to the fact that there are few benchmark stories to serve as examples (Manyika et al., 2013; Say, 2013). For companies looking to utilize their data for the first time, improving the data quality is a big investment (Janssen et al., 2012). Aker BP has solved much of their problems associated with data quality by using Cognite's

data platform CDF. Tjølsen argued that, with the use of CDF, the question of sharing is a matter of intention, rather than ability. Almost all of the scholars focus on data quality as an important barrier for firms and this seems to be the case for the Norwegian firms as well.

Companies struggle with product-market fit and scalability

For any product or service, it has to offer a value that customers are willing to pay for. Several companies mentioned finding the right product to the right customer group as challenging. Rantala et al. (2020) made similar observations through their interviews with companies selling data. A major challenge they found the companies to have was to customize each data-based innovation so that it generates value for every customer. Due to the versatile nature of data (Levitin & Redman, 1998), the adaptation of the data product is possible. Think Outside adapts their product offering to the specific customer's need, ranging from graphs and numbers, or detailed insights in a PDF. Thus they avoid the problem by delivering the format which gives maximum value for every customer.

However, by adapting their offering to the customers, Think Outside are not able to build a scalable automated solution. Although it is not specifically mentioned in the literature on OBD, several of the companies are facing this dilemma. DNB said that they have not landed on a particular business case yet, and they are examining the costs related to developing an automated dashboard solution. However, an automated solution is difficult to make when the quality of data is bad. With a team creating statistics manually, they can make quick controls to ensure the product. Tailored solutions also facilitate delivering something that of greater value for the customer, and thus are more willing to pay for.

Telenor have explored various products in various segments. They tested what they called a "low price to many" approach, selling some simple algorithms to the tourist industry. However, these customers wanted the tabloid version, where the story is written out for them, requiring manual work from Telenor which could not be justified by the price. Business developer in Telenor, Langrød, added that they do not like making tailored products, but that they want the products to feel tailored. Rantala et al. (2020) mention

this problem, saying that new data-based innovations need to be carefully formulated into smaller pieces when communicating with customers. Currently, Telenor are delivering more detailed insights to big corporations in projects with substantially bigger budgets.

Significant challenges related to pricing

Pricing was interpreted as a difficult part of the process of selling data and data products by several of the case companies. The companies had different, and often several approaches. Telenor had multiple ways of pricing, including basing it on the cost of development and production, low pricing for showcasing their products, and prices based on what customers have paid for similar services earlier. DNV GL based their pricing on gut feeling when they published the ETO tools on the Veracity platform. Looking at other data based products and services, they have sought to price based on cost savings for the customers. However, they admit that this is a challenging exercise, especially since they often offer the products bundled with consultancy services, making it hard to separate the value-added from the data services alone.

Think Outside have been trying out several pricing methods. One approach has been to price according to development costs and often the pilot costs much more than scalable solutions. Other times, they have cut the price to generate customers to show traction for investors. Think outside emphasized that pricing is extremely difficult, as people can have totally different perceptions of what they would want to pay for knowledge. Therefore one of the measures taking into account has been on the competency level of the customers, setting a higher price for the customers that have a clear vision for what they want to do with it. She argued that they are most likely underselling in terms of the value of their data. We find that methods used by the companies are mostly based on value and cost parameters, according to Heckman et al. (2015)'s categories. The experiences of the case companies are very much in line with the theory on the characteristics of data and selling of data, stating that it is hard to valuate because of its uncertain value potential, and versatility. The theory on data sales also addresses these challenges, however, they are not sufficiently emphasized by OBD scholars.

Lack of efficient available infrastructures

Infrastructure is a problem apparent for several of the companies, making it harder to reach out to the users. This is in line with the theory presented in Section 3.1.2, where the challenges of infrastructures were pointed out. DNV GL and Cognite address the problem of how to reach out to the customers of data and data products by making their own platforms. DNV GL argue that a lot of work needs to be done with contracts and sales when opening up a platform of your own. Cognite emphasized that getting an infrastructure in place for a given provider is costly, as there is a need for heavy technical and commercial work to make it usable with tools for users. With a limited amount of data, this would probably not be cost-efficient for most providers, especially when it is not their core competency. The literature on selling data also points out the fact that a lot of sales happen through private agreements (Heckman et al., 2015), and not an open marketplace. This seems to be the case for Telenor and Think Outside, which have extensive customer interactions before delivering value, which is not a scalable process. All in all, we see that none of the companies use existing data markets or platforms in delivering their products and services, which might imply that there is a lack of efficient available infrastructures.

Perception of legal leeway leads to conservative approaches

Legal and ethical challenges are often mentioned by both academics and practitioners of OBD. These are also central focus areas among the case companies. Aker BP said that they have heightened awareness of GDPR, especially related to the potential exposure of data that includes personal information. Besides the privacy of individuals, ownership is a central legal challenge. DNV GL worked around the issue by giving the data with unclear ownership away for free and charging for tools they have made on top of it. Gjørv et al. (2020) argue that lack of competence in interpreting the law results in conservative practices, and points to the perception of little legal leeway as a barrier for companies. This may cause some companies to be overly cautious when approaching customer data or similar. DNB have used much resources on ethical and legal concerns to ensure compliance and that their customers are not dissatisfied with the use of data. This is supported by Buda et al. (2016), saying that the manner in which the OBD initiative is communicated

to external parties needs careful consideration in order to avoid adverse reactions. To help companies find out how to utilize customer data within the legal boundaries, Bjørn Erik Thon at The Norwegian DPA advised the government to create a regulatory sandbox where companies will receive counseling and be able to explore before they go to market.

Protectionistic thinking is still prevalent

In contrast to OGD, it is easy to see how sharing of data can be perceived as counter-intuitive for private companies, due to fear of losing competitive advantage to competition (Janssen et al., 2012). Gjørv et al. (2020) point to mistrust between actors as one of the major barriers for data sharing, but still argue that the companies will be better off sharing. Likewise, Cognite argues compellingly for this view, saying that the cake gets bigger with more sharing, leaving all participators better off (Cognite, n.d.-b) . In contrast, DNB and Telenor are more skeptical of the notion of sharing data freely with competitors, fearing that the small companies will be the only ones benefiting. One of the aspects of the agenda on the report to the Storting report is to investigate how sharing in the private sector can be regulated. Langrød stated that if companies feel that they give away their competitive advantage and otherwise gain nothing when sharing data, they will simply shift their business model so that they do not rely on data, thus potentially have nothing to share, and in any case not fulfill the governmental overarching goal of business growth. In conclusion, it is evident that there exist different views on sharing data freely, and that governments must carefully address the challenges following potential regulations ensuring that the outcome aligns with their purpose.

Immature users complicate the sales process

Both Buda et al. (2016) and Rantala et al. (2020) outlined customer immaturity as a barrier affecting aspects of OBD, especially related to sale. More specifically, the literature points to a lack of understanding of how data can solve their problems, as well as the technical capability to use the data. This is evident in several of the case companies. DNV GL explained that it is challenging to convince the customers of what value the data can bring and that it is important to have examples and success stories to use as illustrations. Think Outside told about similar experiences, saying that it

is binary whether the customers get it or not. Their CEO, Monica Vaksdal, said that negotiation on the pricing of pilot projects is affected by the company's technical maturity and understanding. If they are experienced with using data, they can boost the price up, Vaksdal said and added: "They know how to use the data, they know that the data itself has value, and they want it because they know that having the data set will make a difference." In the case of more immature customers, Vaksdal said: "Then we must be willing to give, simply to get them hooked." There is reason to believe that knowledge about the value potential in data will increase with more success stories of OBD.

Overarching characteristics of the OBD market

From the cases, it is apparent that none of the companies have come far in the process of reaping the benefits following their strategy. This finding is in line with what was suggested in Section 3.1 about OBD, saying that private companies are still at an early stage (Buda et al., 2016). Even though the literature widely acknowledge the value companies can extract from data, more success stories may be necessary for developing the market and to overcome the barriers discussed in this section.

Lack of success stories makes it harder for both suppliers and users to identify good use cases. On the supplier side, they are struggling to find a good product-market fit, as data can have many applications due to its versatile nature. Further, the case companies experience that immature users do not understand what the data can be used for or do not have the technical capabilities to use it, making it difficult to create new success stories. Thus, the empirics support the vicious circle describes in Section 3.1.

A significant dilemma related to data's versatility can be described as a "chicken or the egg" problem. Companies do not know to whom or what the data may be useful for before it is opened. However, opening the data may impose risks and investment costs, and they will therefore be hesitant to open it before knowing the benefits. On the other hand, users will not know whether the data is interesting for them before the data is standardized and opened. This seems to influence the market as a whole, slowing down the development and maturation, and is an overarching barrier.

Summarized, the market can be characterized as immature, indicated by a lack of success stories and underdeveloped artifacts such as lack of infrastructures and pricing mechanisms. This results from the market being new, and the characteristics of data, especially versatility.

6.2 Subquestion 2: What characterizes the decision making processes?

In this section, we will discuss the case companies' decision making processes, and seek to test the proposition made in Section 3.2, stating that companies approaching OBD initiatives use effectual decision making to a larger degree than causation. We will mainly use the principles of Sarasvathy (2001), and measures of Chandler et al. (2011) to analyze the decision making.

Companies are starting with a set of means

The first observation to make is that the starting point for several of the firms is what they can do with their current data. Telenor exemplifies this, by asking themselves the questions "We are going to work with big data, what do we have, and what can we deliver?" DNB said something similar: "We have always talked about our data. How valuable it is, and how much of it we have (...) We have to succeed in creating value out of this" These statements correspond to choosing between possible effects that can be created with their given means, which is one of Sarasvathy (2001) descriptions for effectuation.

Companies experiment to find the right products for the right customers

Our findings suggest that several of the companies go forward by experimentation, a characteristic connected to effectuation by Chandler et al. (2011). One example of this is that Telenor have approached several customer segments, such as counties, the retail industry, and transportation services, to find the right customers. Another example is that DNB have shifted their focus from selling statistics based on customer data to exploring how they can create value for their banking customers and the society by sharing data freely. As a result of this, the services that DNB and Telenor now provide are different from what they first imagined, which corresponds to Chandler et al. (2011)'s measure on exploration. DNV GL used experimentation when setting the price, testing the customer's willingness to pay, by setting an initial price based on gut feeling.

Aker BP focus on controllable aspects of the future

Aker BP had a clear vision of the OID project to be the first step towards an industry-shift with increasingly proactive data sharing (Cognite, n.d.-b). After releasing their data on the platform, their approach can be said to be characterized by effectuation. This is clearly stated in their white paper: "This is about open industrial data. Injecting real, live data into the realm of innovation and invention. Then stepping back to see what happens, to be surprised" (Cognite, n.d.-b). This shows that although they have a clear vision, they are open for it to be realized through a set of various effects, in line with Sarasvathy (2001)'s definition of effectuation. There are also other aspects of Aker BP's decision making that are effectuation-based. According to Sarasvathy (2001), "focus on controllable aspects of an unpredictable future" is associated with effectuation. This is evident in Aker BP: "Rather than stand overwhelmed by the impending metamorphosis, Aker BP has determined to go on the offensive. Daring to invest in philosophical shifts, even or especially in the early stages. Considering the possibilities, the risks, the rewards, and picking a side." When inviting others to share data and become a part of the data liberation front, where innovation can benefit all users, they also follow Sarasvathy (2001)'s notion of creating markets through alliances and other cooperative strategies.

Companies remain flexible and take advantage of opportunities as they arise

Several of the findings in the case study points towards flexibility as a key factor in the decision making in the companies. This is especially evident in Think Outside, DNB, and Telenor. In Think Outside we observe a combination of what Chandler et al. (2011) define as experimentation and flexibility. Chandler et al. (2011)'s measures for flexibility; "We were flexible and took advantage of opportunities as they arose" and "We adapted what we were doing to the resources we had" are evident in Think Outside's change of focus from B2C to the B2B market as a result of investor inputs. Vaksdal stated: "If we had the economy to continue, we would have kept focus purely on the consumer solution. However, to get funding on seeds and A series level, the market size is crucial." This shows that they adapted their services to get the funding they need to proceed. By doing this, Think Outsides products are substantially different than first imagined, and thus also reflect an experimental approach according to Chandler et al. (2011)'s measures.

In Telenor, flexibility also comes to show in the way they take advantage of opportunities as they arose when the counties wanted mobility data related to the Covid-19 infection. Langrød stated: "We were not made to deliver this. We were working with another segment, but we mobilized quickly so we could deliver fast and correct data to the counties." This is similar to what Sarasvathy (2001) describes as "exploiting contingencies". DNB also focus on remaining flexible, by choosing a broad formulation on the opt-out form for use of customer data, enabling multiple business models.

Few observations of causation

By contrast to several of the observations, DNB and Cognite have shown signs of not using an effectual approach. Cognite commented that they probably did not validate their hypothesis regarding the demand for their offering thoroughly enough during the development of the OID project. Similarly, DNB have initiated the process to clean their data despite not having landed on a specific use case. DNB also have a three-year-long business strategy, that can be interpreted as planning business strategies, which is in line with Chandler et al. (2011)'s measure of causation. Apart from this, we have found few indications of causation being used extensively in the decision-making processes.

Effectual approaches - a result of entrepreneurship, an immature market or OBD?

The observations outlined in this section indicate that effectual decision-making approaches are dominant compared to causation in the OBD market. However, there may be several reasons for this.

Looking at the case companies, one might argue that the decisive factor for the effectual approaches are the entrepreneurial characteristics of the projects they are engaged in. In Section 3.2, we saw that scholars have focused on effectuation decision making in new ventures. Here it was pointed out that it is natural for entrepreneurs to start with the means in hand when approaching new ventures (Sarasvathy, 2001). This may, therefore, be the case for the case companies as well, as they are new to OBD initiatives. Think Outside is a startup and the other companies all have newly initiated OBD projects, yet to succeed. Cognite argued that their decisions and plans were characterized by the

company being young and relatively small at the time the project started.

Another possible explanation is that the effectuation processes are consequences of the fact that the market is immature, as pointed out in Section 6.2, rather than aspects specific to data. We have observed that Aker BP and DNV GL have created their own infrastructures, in the lack of existing ones. Further, we have seen that there there are no established standards for the pricing of data and data products in the market. The lack of artifacts such as infrastructures and pricing mechanisms, as seen evident in the OBD market, are pointed out as characteristics of situations where effectual approaches are relevant (Sarasvathy, 2001).

Entrepreneurial characteristics and the immaturity of the market are both valid arguments. However, we argued in Section 6.1, that the immature nature of the OBD market is influenced by data's characteristics, outlined in Section 2.1, not only by lack of success stories and infrastructure. Especially versatility, the difficulties related to valuation, and the lack of competency to use the data influence the decision making to a high degree. As a result of this, effectual approaches such as experimentation and flexibility may remain useful despite the market maturing, as the chicken or the egg dilemma related to use cases will still be there. Moreover, from our case study, it seems like the companies have general aspirations of creating value with data, rather than a clear and concise goal. This is also in line with circumstances relevant for an effectual approach (Sarasvathy, 2001). By this, we conclude that data poses a significant influence on the decision making towards effectuation processes, and therefore our proposition from Section 3.2 is strengthened.

6.3 Subquestion 3: How should companies approach open business data?

In Section 3.3 we presented a decision support framework based on OBD and effectuation theory. In this section, we will evaluate the framework with insights from the case study. Based on these insights, we present a revised framework, where important aspects for managers to consider in each step are added, see Figure 5.

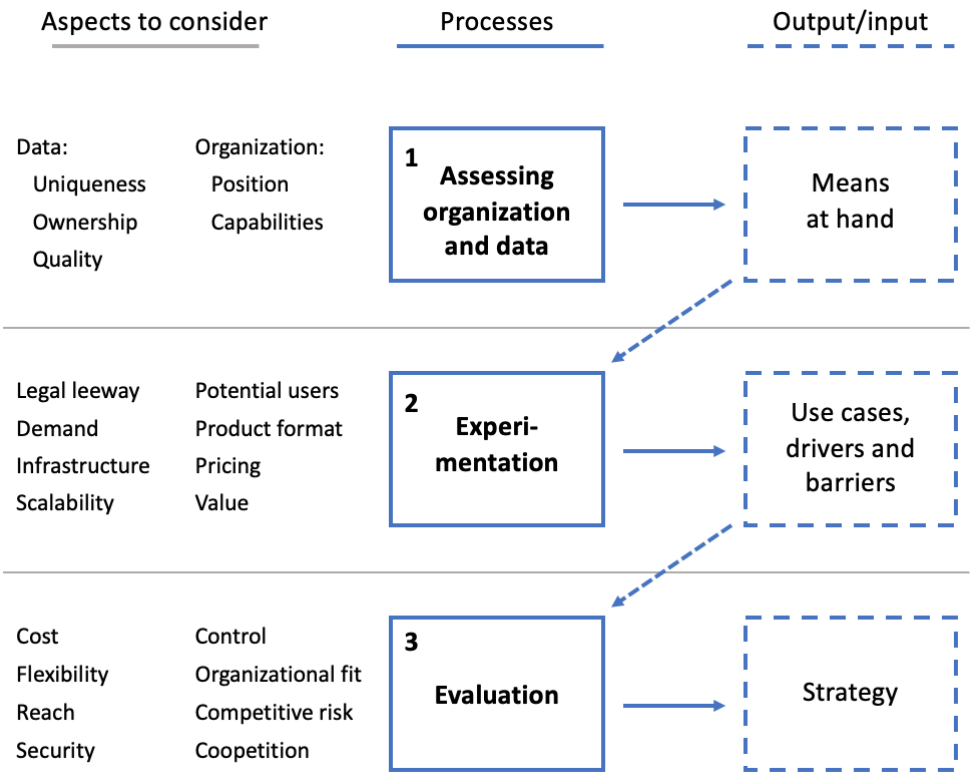

Figure 5: Open business data decision support framework with aspects to consider

Case findings support starting with the means at hand

In Section 3.3, we argued that the first step companies should take is to assess the organization's means and available resources, in line with effectuation thinking. The case study indicates that the starting point of several companies is to have a general aspiration of extracting value from data. This is especially evident in DNB and Telenor, as argued in Section 6.2. Both had been aware of their valuable data pool for some time but did not know how they could extract the value. A framework should have a logic that corresponds

to the practitioner's way of thinking. The empirics thus strengthens the reasoning behind examining the set of means in step 1, as this seems to be intuitive and commonplace for the companies to start with. We find that important aspects to consider in step one are data characteristics such as uniqueness, ownership, and quality, as well as organizations' position and capabilities.

Experimentation is key to identify use cases and validate demand

Experimentation was presented as the second step in the decision support framework in Section 3.3. This step was proposed as the theory indicated that it is challenging to find good use cases with data. Due to its versatility, data can be used in several applications, and it may difficult to predict the demand. Further, we argued that as initiating OBD projects may require expensive commitments, companies could avoid spending unnecessary high costs on projects that fail, by validating their hypothesis at an early stage through experimenting.

In the cases, we saw that several of the case companies have used experimentation and that it has lead to changes in their approach, exemplified in Section 6.2. We have also seen that Cognite would presumably have benefited from experimenting more. Cognite admitted that they could have discovered some of the barriers that caused them to stop the development at a much earlier point if they had worked more structured to validate their hypothesis. By placing a phone call to academic institutions, they could have discovered whether their data set actually was of any interest for researchers. Advising other companies to not make the same mistake, Tjølsen said: "Don not plan it as a long term project from the beginning. A lot of your assumptions will be wrong, so it is a matter of failing fast." Supporting this notion, DNV GL advised companies to test products on existing infrastructure if possible, rather than building a platform on their own. The chicken or the egg dilemma related to use cases of data, discussed in Section 6.1, may also strengthen the need to experiment. Thus the empirics support that experimentation is important before committing resources to extensive data cleaning and development projects. What aspects to take into account in this step will vary, but from the case study, we saw that particular important aspects were related to scalability,

infrastructure, and pricing.

To evaluate drivers and barriers is vital in order to choose a strategy suitable for the company

The step of evaluation was proposed in the framework as a process to choose an OBD strategy that fits the organization out of the use cases validated in the experimentation step. A pattern observed in the case study was that some of the companies ended up following another driver or change their focus from where they initially started. Initially, DNB considered the prospect of a new revenue stream to be their main driver, looking for ways to monetize the transaction data they possessed. Being a bank this however imposed much risk on their brand and reputation among their customers. After a while they switched their focus over to explore how they could use the data to the benefit of their customers and society, improving customer loyalty and brand, instead of direct revenues. In other words, DNB changed direction as they found the initial strategy to go at the expense of their values. Similarly, Think Outside pivoted their focus from B2B to B2C, giving up their original passion for making skiing safer, as they found the market size to be a barrier that was hard to overcome as long as they are dependent on raising money. DNV GL early discovered the potential legal barriers that could have risen from monetizing the ETO data set, and chose to indirectly monetize instead by offering a value-added tool. These examples show why it is crucial to evaluate drivers and barriers for several of the identified use cases and ensure organizational fit before committing to one. In addition to organizational fit, the case study indicated that important considerations evolved around cost, flexibility, and control of data.

Framework evaluation

The framework proposed in Section 3.3 was intended to help practitioners approach OBD initiatives by outlining intuitive steps to follow. Our framework highlights the importance of experimenting and validating the demand to identify good use cases early on. This was not sufficiently addressed in Buda et al. (2016)'s framework. Furthermore, the case study illustrates that thorough evaluation of drivers and barriers of use cases may lead to dramatic shifts in organizations' strategy, thus proving the importance of this step.

However, there are several aspects of the framework that are debatable. Firstly, as we only have three steps, it may be criticized for not being concrete enough. In particular, the steps of experimentation and evaluation represent complex processes rather than a clear path. We however argue that it is important to incorporate these broader processes as the versatility of data and characteristics of the market require testing and considerations to overcome uncertainties, which will be different for each use case. Some might argue that the explorative effectuation approach to OBD initiatives is less efficient than a more targeted causation approach. This might be a valid argument for managers with a specific goal or application in mind, in contrast to those with general aspirations of extracting value from data. Thus, the framework might not be as suitable for those cases.

All in all, the empirics indicate that our framework is sensible. Specifically, it seems suitable for managers with general aspirations of extracting value from data. The framework could inspire companies to initiate OBD projects, even though they might not have specific plans and drivers to start with, as these can be identified and changed along the way.

7 Conclusion and Implications

7.1 Conclusion

Private sector organizations are usually seen as potential users of open data (Buda et al., 2016). Our thesis takes the view of them as providers of data and explores the research question of how companies can reap the benefits of OBD. More specifically, we have focused on the strategies Norwegian companies follow, which barriers they face, what the characteristics of their decision making are, and how they can approach OBD initiatives. Through investigating these questions, we have four main contributions.

Firstly, we find that the Norwegian OBD market is highly immature, both on the supplier and user side. This is evident through a lack of competency in identifying the value potential of data, as well an absence of infrastructures and efficient data markets. This leads to several prominent barriers for companies, including challenges related to pricing data products and identifying good use cases.

Secondly, we identify through a case study that Norwegian companies usually follow effectual decision-making processes in the development of their OBD initiatives. This is especially seen in the case companies' focus on means, experimentation, and desire to remain flexible. We further argue that effectuation is an advisable approach for managers with generalized aspirations of creating value from data, as it is effective for identifying and reaping benefits from OBD. We suggest that an important reason for effectuation's relevance in this field is the distinct characteristics of data, but that decisions are also likely influenced by the entrepreneurial characteristics of the initiatives and the immature market.

Thirdly, we contribute by proposing a decision support framework for managers approaching OBD initiatives, based on theory from OBD and effectuation. The framework proposes an order of steps, starting with the means or data available, in line with what we find to be a common starting point of practitioners. Further, experimentation and evaluation are found to be suitable steps to address the challenges of finding validated

use cases and organizational fit in a cost-effective manner. The framework also includes aspects that managers should consider in each step, that can be helpful in a field with few success stories.

Lastly, we contribute by clarifying concepts of OBD theory, building on the supportive theory of open data, OGD, and data sales. As a part of this, we propose a definition of the term OBD that includes the commercial aspects, built on perceptions of open data and how businesses create value from it. These contributions form a foundation for subsequent studies in this new field of research.

To conclude, our study is a contribution to a scarcely studied literature field which has gained much attention from practitioners in recent years. Our paper provides managers with insights and a framework to help them extract the great underlying values of their data.

7.2 Implications for managers

The literature on OBD has mainly focused on the drivers and barriers, and few studies have explored how managers should go forward. Our observations from the Norwegian market reveal characteristics that have implications for managers. The combination of the versatile nature of data and an often low maturity level among customers, in terms of technical capabilities and an appreciation of data's value, imposes challenges related to valuation, sales and sharing of data. As there is an absence of success stories, specific use cases must be illustrated and used as examples to convey the value offering to the customers.

For managers with general aspirations for what to do with their data, following an effectuation approach is presumably beneficial to facilitate that they identify the full potential embodied in their data. This entails that managers should gain an overview of their organization and available data as a starting point. Before choosing a strategy, managers should experiment with different use cases and use cost- and time-effective ways to validate demand, in order to avoid committing large investments without realizing expected

benefits. This is a common methodology in product development (Ries et al., 2012) and is particularly important in OBD due to the versatile nature of data and few success stories to serve as examples. This approach is presented through the decision support framework in Section 6.3.

To further ensure flexibility, managers should choose systems that enable scaling and adaptability to other applications, remaining open for a change of prioritized driver. Managers should be aware of the challenges related to infrastructure, and investigate available options to split development costs with other companies before deciding to make costly developments independently.

Lastly, managers should develop plans to improve their employees' digital competency and understanding of the potential of data, in order to identify and exploit opportunities. The described cases and strategies in this paper can serve as examples and inspire managers to explore how their data can create value trough OBD initiatives.

7.3 Implications for policymakers

Implications for the Norwegian government were recently addressed by Gjørv et al. (2020). Our findings both add to and strengthen some of the recommendations for policymakers, both in Norway and in countries with similar OBD markets.

Increased understanding of the massive underlying value potential of data could increase both the supply and demand for OBD. Governments can stimulate this through general counseling to the different actors, competitions, investments in research centers, and more focus on data science and data engineering in the education system. Governments can also engage directly in OBD initiatives as users of the data to increase the demand. Furthermore, we support the recommendation given by both the Norwegian DPA and Gjørv et al. (2020) to create a regulatory sandbox, to provide companies with counseling and a place to experiment with possible solutions within the legal leeway.

Governments can also contribute by facilitating data infrastructures, making sharing of data easier, and less costly for companies. This can be systems used for OGD or by

creating initiatives for the establishment of data fabrics, which facilitate meeting places for suppliers and users.

7.4 Implications for research

When considering the benefits one would expect of OBD, presented in Section 2, existing literature is comparatively shallow. Among scholars in the field, the emphasis has been placed primarily on the drivers and barriers companies face, with less focus on how managers should move forward. Together with Buda et al. (2016), our paper is one of the few which addresses this. We argue that the scarcity of such studies is problematic, as research should seek to help managers in a practical manner. Thus, further research is warranted to validate our framework.

We pointed out in Limitations, Section 4.5, that most of the studies on drivers and barriers are based on assumptions, rather than observation and empirics. This undermines the credibility of the contributions and, as argued by Herala (2018) might create a perception where attention is skewed towards certain barriers. Such perception might lead managers to approach OBD on false premises or fail to illuminate prominent barriers. For instance, the challenge of identifying viable use cases has not been sufficiently addressed in the literature, despite being a critical topic in our case study. Consequently, research demonstrating a more realistic and nuanced view of the negative effects is warranted. For this purpose, case studies are well-suited (Eisenhardt, 1989). Our research is a contribution to more empirical evidence; however, a broader set of companies diversified in size, sectors, and countries, could validate the transferability of our findings related to market characteristics. Moreover, case studies should also address the need for success stories, as pointed out by Herala (2018), as such examples are central for maturing the market.

Notably, none of the companies in our case study can be said to have succeeded. Herala (2018) made similar findings, concluding that supplying open data is not a viable strategy, as there are few clear business models related to it. Given the large expected benefits (European Commission, 2020a), it is evident that more research is needed to outline feasible business models for OBD suppliers.

Due to the fact that effectuation theory is predominately used for startups, further research measures focused on effectuation in established companies is justified. In particular, we found that Chandler et al. (2011)'s measure of affordable loss to inapplicable for our established case companies. To our knowledge, this thesis is one of the first to use effectuation theory on decision making related to OBD initiatives. Our findings suggest that several factors, namely entrepreneurship, immaturity, and data characteristics, could influence decision making. However, more research is necessary to understand the interrelations of these factors, as well as which other elements could potentially prove influential. Consequently, we agree with Nummela et al. (2014)'s suggestions that several factors, such as the influence of managerial characteristics, should be investigated together with the influence of data's characteristics. To explore this, longitudinal studies of OBD projects are appropriate (Nummela et al., 2014), and could also address recall bias encountered in our study (Learning Hub, n.d.).

As one of few studies, together with Buda et al. (2016) and Herala (2018), this thesis approaches open data from the perspective of private companies as data suppliers. Monetization of customer data is often controversial, as misuse can impose threats to the privacy and security of individuals and societies. These concerns were recently legitimized in Norwegian media, exposing the sale of data on the movements of easily identifiable individuals, that unknowingly were tracked by apps on their phone (Nrk.no, n.d.). This highlights the need for more research on the consumer perspective of open data, to ensure that OBD development does not occur at the expense of citizens' rights. Notably, policymakers are in the process of imposing laws and regulations to the Norwegian data economy, with the government expected to launch a white paper by autumn 2020. The consequences of such government initiatives should be studied from the view of both private organizations and citizens.

7.5 Final remarks

Many of the barriers companies face when looking to sell or share data are consequences of the fact that the Norwegian OBD market is still in an early phase and suffers from a lack of artifacts such as infrastructure, pricing standards, and demand. Meanwhile, The European Commission are estimating both the data amount and value of the data economy to skyrocket during just the next five years, indicating that the activity level will intensify. In a mature OBD market with many success stories to serve as examples, new barriers will surely arise, while barriers such as finding product-market fit, pricing and infrastructure might be overcome. Arguably, this could lead to more causation based decision making as companies will have a clearer image of what they want to achieve.

One potential future outlook of OBD could be that as companies understand the underlying values of their data, they would become more protective of it. This could lead to a focus on only the commercial aspects of OBD, at the expense of community benefits. On the other hand, a future scenario could be that as companies become aware of the underlying benefits of sharing, large and active ecosystems will develop. If companies can look past their traditional competitive thinking, they might be able to extract more value from their data by combining it with data from other companies and sources. Such ecosystems and the collective benefits reaped from them might be the only way to challenge big tech giants on seizing new business opportunities as well as defending today's market position.

References

AkerBP.com. (n.d.). *Historien om Aker BP.* Retrieved from https://www.akerbp.com/historien-om-aker-bp/

Andersson, S. (2011, 8). International entrepreneurship, born globals and the theory of effectuation. *Journal of Small Business and Enterprise Development*, *18*(3), 627–643. doi: 10.1108/14626001111155745

Belisssent, J. (2018). *Your Data Is Worth Nothing — Unless You Use It.* Retrieved from https://go.forrester.com/blogs/your-data-is-worth-nothing-unless-you-use-it/

Bengtsson, M., & Kock, S. (2000, 9). "Coopetition" in business networks - To cooperate and compete simultaneously. *Industrial Marketing Management*, *29*(5), 411–426. Retrieved from https://www.sciencedirect.com/science/article/pii/S001985019900067X doi: 10.1016/S0019-8501(99)00067-X

Berends, H., Jelinek, M., Reymen, I., & Stultiëns, R. (2014, 5). Product Innovation Processes in Small Firms: Combining Entrepreneurial Effectuation and Managerial Causation. *Journal of Product Innovation Management*, *31*(3), 616–635. Retrieved from http://doi.wiley.com/10.1111/jpim.12117 doi: 10.1111/jpim.12117

Bjørkeng, P. (2019). *Private selskaper bør dele mer data.* Retrieved from https://www.aftenposten.no/kultur/i/Op1aBV/private-selskaper-boer-dele-mer-data?spid_rel=2

Bonina, C. (2013). *New business models and the value of open data: definitions, challenges and opportunities* (Tech. Rep.). Retrieved from http://blogs.lse.ac.uk/nef/

Bower, J. L., & Christensen, C. M. (1996). Disruptive Technologies: Catching the Wave. *The Journal of Product Innovation Management*, *1*, 75–76.

Brettel, M., Mauer, R., Engelen, A., & Küpper, D. (2012, 3). Corporate effectuation: Entrepreneurial action and its impact on R&D project performance. *Journal of Busi-*

ness Venturing, *27*(2), 167–184. Retrieved from https://www.sciencedirect.com/science/article/pii/S0883902611000139 doi: 10.1016/j.jbusvent.2011.01.001

Buda, A., Ubacht, J., Janssen, M., & Sips, R. (2016). *Decision support framework for opening business data.* Retrieved from https://books.google.no/books?hl=no&lr=&id=9jWeDAAAQBAJ&oi=fnd&pg=PA29&dq=%22business+data%22+sharing+benefits&ots=v0-COKPsnu&sig=NvotmrJtJdfwwbSwHe7Jx8KSWqY&redir_esc=y#v=onepage&q=%22businessdata%22sharingbenefits&f=false

Bulger, M., Taylor, G., & Schroeder, R. (2014). *Data-Driven Business Models: Challenges and Opportunities of Big Data* (Tech. Rep.). Oxford Internet Institute. Retrieved from https://www.oii.ox.ac.uk/archive/downloads/publications/nemode_business_models_for_bigdata_2014_oxford.pdf

Chandler, G., DeTienne, D., McKelvie, A., & Mumford, T. (2011, 5). Causation and effectuation processes: A validation study. *Journal of Business Venturing*, *26*(3), 375–390. Retrieved from https://www.sciencedirect.com/science/article/pii/S0883902609001086?casa_token=SRLjg9rB17kAAAAA:6jyfQADUByBxoJhi20JAQC9NZ3_4GFgxd_2WGr0y6-n2mcTWvlE6PZXCMtyri2hJKihHs_M69jM doi: 10.1016/j.jbusvent.2009.10.006

Chesbrough, H. W., Vanhaverbeke, W., & West, J. (2006). Open Innovation : Researching a New Paradigm. *The new Imperative for creating and profiting from technology*, *1*.

Cleveland, H. (1982, 12). Information As a Resource. *Futurist*, *16*(6), 34–39.

Cognite. (n.d.-a). *Meet Cognite.* Retrieved from https://old.cognite.com/about-us/the-cognite-story/

Cognite. (n.d.-b). *Open Industrial Data.* Retrieved from https://openindustrialdata.com/media/1065/open-industrial-data-cognite-akerbp.pdf

Cognite. (n.d.-c). *Open Industrial Data.* Retrieved from https://openindustrialdata.com/

Colclough, S., Rialp, A., & Moen, O. (2020). *How Do Internationalizing Firms Deal with Uncertainty through Effectuation-Based and Causation-Based Decision-Making.*

Creswell, J. W., & Miller, D. L. (2010). Determining validity in qualitative inquiry. *Theory Into Practice, 39:3, 124-130*. Retrieved 12-12-19, from https://www.tandfonline.com/doi/pdf/10.1207/s15430421tip3903_2?needAccess=true

Datatilsynet.no. (n.d.). *Om Datatilsynet.* Retrieved from https://www.datatilsynet.no/om-datatilsynet/

Dew, N., Read, S., Sarasvathy, S., & Wiltbank, R. (2009, 7). Effectual versus predictive logics in entrepreneurial decision-making: Differences between experts and novices. *Journal of Business Venturing*, *24*(4), 287–309. Retrieved from https://www.sciencedirect.com/science/article/pii/S088390260800027X doi: 10.1016/j.jbusvent.2008.02.002

DIFI. (n.d.). *Om data.norge.no.* Retrieved from https://data.norge.no/om

DIFI. (2019). *Veileder for tilgjengeliggjøring av åpne data* (Tech. Rep.). Retrieved from https://doc.difi.no/data/veileder-apne-data/

Digital Norway. (2019). *Slik utviklet Aker BP ny datadrevet forretningsmodell for olje og gass.* Retrieved from https://digitalnorway.com/aker-datadrevet-forretningsmodell-olje-gass/

DNB. (n.d.). *DNB-konsernet.* Retrieved from https://www.dnb.no/om-oss/om-dnb.html

DNV GL. (n.d.-a). *About DNV GL.* Retrieved from https://www.dnvgl.com/about/index.html

DNV GL. (n.d.-b). *Explore the digital marketplace.* Retrieved from https://store.veracity.com/

DNV GL. (n.d.-c). *Our History - DNV GL.* Retrieved from https://www.dnvgl.com/about/in-brief/our-history.html

E24. (n.d.). *DNB vil videreselge data om kundenes handlemønster – E24.* Retrieved from https://e24.no/naeringsliv/i/0n0keA/dnb-vil-videreselge-data-om-kundenes-handlemoenster

Eaton, J., & Bawden, D. (1991). What Kind of Resource is Information? *International Journal of Information Management*, *11*(2), 156–165. Retrieved from https://www.sciencedirect.com/science/article/pii/026840129190006X doi: 10.1016/0268-4012(91)90006-X

Eisenhardt, K. (1989). Building Theories from Case Study Research. *The Academy of Management Review*, *14*(4), 532–550.

European Commission. (n.d.). *Data protection in the EU.* Retrieved from https://ec.europa.eu/info/law/law-topic/data-protection/data-protection-eu_en

European Commission. (2011). *Open data An engine for innovation, growth and transparent governance* (Tech. Rep.). Retrieved from http://www.official-documents.gov.uk/document/cm76/7650/7650.pdf.

European Commission. (2020a). *The European Data Strategy.* Retrieved from https://ec.europa.eu/commission/presscorner/detail/en/fs_20_283

European Commission. (2020b). *A European strategy for data* (Tech. Rep.). Retrieved from https://ec.europa.eu/digital-single-market/en/policies/building-european-data-economy

Fjelltveit, I., & Aldridge, O. (2016). *DNB legger ned 59 filialer – 600 mister jobben.* Retrieved from https://www.aftenposten.no/okonomi/i/0QBM/dnb-legger-ned-59-filialer-600-mister-jobben

Framo. (n.d.). *Framo.* Retrieved from https://www.framo.com/

Framo.com. (n.d.). *Aker BP signs "data liberation contract" with Framo.* Retrieved from https://www.framo.com/news/aker-bp-signs-data-liberation-contract/

Fricker, S., & Maksimov, Y. (2017). Pricing of data products in data marketplaces. In *Lecture notes in business information processing* (Vol. 304, pp. 49–66). Springer Verlag. Retrieved from https://link.springer.com/chapter/10.1007/978-3-319-69191-6_4 doi: 10.1007/978-3-319-69191-6{_}4

Gjørv, A., Dingsør, L., Føyen, A., Kjesbu, E., Lervik, M., Nordlsetta, A., ... Viste, J. (2020). *Rapport fra Ekspertgruppe* (Tech. Rep.). Retrieved from https://www.regjeringen.no/no/aktuelt/mottok-rapport-om-datadeling-i-naringslivet/id2696938/

Gnyawali, D. R. (2001). Cooperative Networks and Competitive Dynamics: A Structural Embeddedness Perspective. *The Academy of Management Review*, *26*(3), 431–445. Retrieved from https://www.researchgate.net/publication/215915771 doi: 10.2307/259186

Golafshani, N. (2003). Understanding reliability and validity in qualitative research. *The qualitative report, 8(4), 597-606.*. Retrieved 12-12-19, from https://nsuworks.nova.edu/cgi/viewcontent.cgi?article=1870&context=tqr/

Gundersen, M. (2019). *Telia og Telenor selger analyser av hvor kundene befinner seg.* Retrieved from https://nrkbeta.no/2019/10/11/telia-og-telenor-selger-analyser-av-hvor-mobilbrukere-befinner-seg/

Hammell, R. (2012). *Open data Driving growth, ingenuity and innovation* (Tech. Rep.). Deloitte. Retrieved from https://www2.deloitte.com/content/dam/Deloitte/uk/Documents/deloitte-analytics/open-data-driving-growth-ingenuity-and-innovation.pdf

Hammell, R., Lewis, H., Perricos, C., & Branch, D. (2012). *Open growth Stimulating demand for open data in the UK* (Tech. Rep.). Retrieved from https://www2.deloitte.com/content/dam/Deloitte/uk/Documents/deloitte-analytics/open-growth.pdf

Hannah, D. P., & Eisenhardt, K. M. (2018, 12). How Firms Navigate Cooperation and Competition in Nascent Ecosystems. *Strategic Management Journal*, *39*(12), 3163–3192. doi: 10.1002/smj.2750

Harms, R., & Schiele, H. (2012, 6). Antecedents and consequences of effectuation and causation in the international new venture creation process. *Journal of International*

Entrepreneurship, *10*(2), 95–116. Retrieved from https://link.springer.com/article/10.1007/s10843-012-0089-2 doi: 10.1007/s10843-012-0089-2

Hartmann, P., Zaki, M., Feldmann, N., & Neely, A. (2016). Capturing value from big data – a taxonomy of data-driven business models used by start-up firms. *International Journal of Operations and Production Management*, *36*(10), 1382–1406. Retrieved from https://www.emerald.com/insight/content/doi/10.1108/IJOPM-02-2014-0098/full/html doi: 10.1108/IJOPM-02-2014-0098

Heckman, J., Boehmer, E., Peters, E., Davaloo, M., & Kurup, N. (2015). *A Pricing Model for Data Markets* (Tech. Rep.). Retrieved from https://www.ideals.illinois.edu/handle/2142/73449

Herala, A. (2018). *Benefits from Open Data: Barriers to Supply and Demand of Open Data in Private Organizations* (Doctoral dissertation). Retrieved from http://lutpub.lut.fi/handle/10024/158560

Herala, A., Kasurinen, J., & Vanhala, E. (2016). Current Status and the Future Directions of Open Data: Perceptions from the Finnish Industry. Retrieved from http://dx.doi.org/10.1145/2994310.2994312 doi: 10.1145/2994310.2994312

Herala, A., Kasurinen, J., & Vanhala, E. (2018, 1). Views on open data business from software development companies. *Journal of Theoretical and Applied Electronic Commerce Research*, *13*(1), 91–105. Retrieved from https://scielo.conicyt.cl/scielo.php?pid=S0718-18762018000100106&script=sci_arttext doi: 10.4067/S0718-18762018000100106

Herala, A., Vanhala, E., Porras, J., & Kärri, T. (2016). Experiences About Opening Data In Private Sector: A Systematic Literature Review. Retrieved from https://www.researchgate.net/publication/306278502 doi: 10.1109/SAI.2016.7556060

Hoepfl, M. C. (1997). Choosing qualitative research: A primer for technology education researchers. *Journal of Technology Education (Vol. 9 Issue 1)*. Retrieved 12-12-19, from https://vtechworks.lib.vt.edu/bitstream/handle/10919/8633/hoepfl.pdf?sequence=1

Huijboom, N., & van den Broek, T. (2011). Open data: An International comparison of strategies. *European Journal of ePractice*, *12*(1), 1–13. Retrieved from https://research.vu.nl/en/publications/open-data-an-international-comparison-of-strategies

Huttunen, H., Seppälä, T., Lähteenmäki, I., & Mattila, J. (2019). *What Are the Benefits of Data Sharing ?* (Tech. Rep.). Retrieved from https://www.etla.fi/en/publications/what-are-the-benefits-of-data-sharing-uniting-supply-chain-and-platform-economy-perspectives/

Imai, M. (1986). *Kaizen – the key to japan's competitive succes.*

Immonen, A., Palviainen, M., & Ovaska, E. (2014a). Requirements of an open data based business ecosystem. *IEEE Access*, *2*, 88–103. Retrieved from https://ieeexplore.ieee.org/abstract/document/6730652 doi: 10.1109/ACCESS.2014.2302872

Immonen, A., Palviainen, M., & Ovaska, E. (2014b). Towards open data based business: Survey on usage of open data in digital services. *International Journal of Research in Business and Technology*, *4*(1). doi: 10.17722/ijrbt.v4i1.197

Innomag.no. (n.d.). *Her er Norges 25 mest innovative virksomheter!* Retrieved from https://www.innomag.no/her-er-norges-25-mest-innovative-virksomheter/

Jaakkola, H., Mäkinen, T., & Eteläaho, A. (2014). Open data - Opportunities and challenges. *ACM International Conference Proceeding Series*, *883*, 25–39. Retrieved from https://dl.acm.org/doi/abs/10.1145/2659532.2659594 doi: 10.1145/2659532.2659594

Jalali, S., & Wohlin, C. (2012). Systematic literature studies: Database searches vs. backward snowballing. In *International symposium on empirical software engineering and measurement* (pp. 29–38). Retrieved from https://ieeexplore.ieee.org/abstract/document/6475394 doi: 10.1145/2372251.2372257

Janssen, M., Charalabidis, Y., & Zuiderwijk, A. (2012, 9). Benefits, Adoption Barriers and Myths of Open Data and Open Government. *Information Systems Management*,

29(4), 258–268. Retrieved from https://www.tandfonline.com/doi/full/10.1080/10580530.2012.716740 doi: 10.1080/10580530.2012.716740

Jetzek, T., Avital, M., & Bjørn-Andersen, N. (2013). *Generating Value from Open Government Data* (Tech. Rep.).

Juell-Skielse, G., Hjalmarsson, A., Johannesson, P., & Rudmark, D. (2014). *Is the Public Motivated to Engage in Open Data Innovation?* (Vol. 8653; Tech. Rep.). Retrieved from https://link.springer.com/content/pdf/10.1007/978-3-662-44426-9_23.pdf

Kalinic, I., Sarasvathy, S. D., & Forza, C. (2014, 6). 'Expect the unexpected': Implications of effectual logic on the internationalization process. *International Business Review*, *23*(3), 635–647. Retrieved from https://www.sciencedirect.com/science/article/pii/S0969593113001546 doi: 10.1016/j.ibusrev.2013.11.004

Kitchin, R. (2014). *The Data Revolution: Big Data, Open Data, Data Infrastructures & Their Consequences*. SAGE Publications Ltd. doi: 10.4135/9781473909472

Kitsios, F., Papachristos, N., & Kamariotou, M. (2017). Business Models for Open Data Ecosystem: Challenges and Motivations for Entrepreneurship and Innovation. *2017 IEEE 19th Conference on Business Informatics (CBI)*, 398. Retrieved from https://ieeexplore.ieee.org/abstract/document/8010744 doi: 10.1109/CBI.2017.51

Kommunal- og moderniseringsdepartementet. (2016, 4). *Meld. St. 27 (2015–2016).* regjeringen.no. Retrieved from https://www.regjeringen.no/no/dokumenter/meld.-st.-27-20152016/id2483795/?ch=1

Kushal, A., Moorthy, S., & Kumar, V. (2012). Pricing for data markets. *technical report, Tech. Rep.*.

Learning Hub. (n.d.). *Strengths of longitudinal data.* Retrieved from https://learning.closer.ac.uk/introduction/what-can-longitudinal-studies-show-us/strengths-of-longitudinal-studies/

Lerchendalskonferansen. (2020). *Årets tema 2020.* Retrieved from https://lerchendalkonferansen.no/arets-tema/

Levinthal, D., & March, J. (1993). The myopia of learning. *Strategic Management Journal*, *14*(S2), 95–112. Retrieved from http://doi.wiley.com/10.1002/smj.4250141009 doi: 10.1002/smj.4250141009

Levitin, A., & Redman, T. (1998). *Data as a Resource: Properties, Implications, and Prescriptions* (Vol. 40; Tech. Rep.). Retrieved from https://search.proquest.com/docview/224970085?pq-origsite=gscholar

Lincoln, Y., & Guba, E. (1985). *Naturalistic inquiry*. SAGE Publications, inc.

Manyika, J., Chui, M., Groves, P., Farrell, D., Van Kuiken, S., & Doshi, E. A. (2013). Open data: Unlocking innovation and performance with liquid information. *McKinsey Global Institute*, *21*, 116.

Matalamäki, M., Vuorinen, T., Varamäki, E., & Sorama, K. (2017). Business Growth in Established Companies; Roles of Effectuation and Causation. *Journal of Enterprising Culture*, *25*(2), 123–148. Retrieved from https://www.worldscientific.com/doi/pdfplus/10.1142/S0218495817500054 doi: 10.1142/S0218495817500054

Mathison, S. (1988). Why triangulate? *Educational researcher, 17(2), 13-17.*.

Mintzberg, H., & Waters, J. (1985). Of Strategies, Deliberate and Emergent. *Strategic Management Journal, Vol. 6, No. 3 (Jul. - Sep., 1985), pp. 257-272*. Retrieved from https://www.jstor.org/stable/pdf/2486186.pdf?casa_token=K_r8XCEf478AAAAA:zQaYDVx72dZDV2-XmB4aMrZmuXeGHU_tye4uN0j4Sq_1ItgjE4QEpnbHw3WD9xk9SSpyHBfkR_s4pvdSh4QRAuEJQ_hC8BhQV8aypfG1mx4qqqkw-OrF

Muschalle, A., Stahl, F., Löser, A., & Vossen, G. (2012). *Pricing Approaches for Data Markets* (Tech. Rep.). Springer.

Nalebuff, B. J., Brandenburger, A., & Maulana, A. (1996). *Co-opetition*. HarperCollins-Business London.

Nrk.no. (n.d.). *Avslørt av mobilen.* Retrieved from https://www.nrk.no/norge/xl/avslort-av-mobilen-1.14911685

Nummela, N., Saarenketo, S., Jokela, P., & Loane, S. (2014, 7). Strategic Decision-Making of a Born Global: A Comparative Study From Three Small Open Economies. *Management International Review*, *54*(4), 527–550. Retrieved from https://link.springer.com/article/10.1007/s11575-014-0211-x doi: 10.1007/s11575-014-0211-x

OECD.org. (n.d.). *Defining innovation.* Retrieved from https://www.oecd.org/site/innovationstrategy/defininginnovation.htm

Oljedirektoratet. (2019). *Diskos.* Retrieved from https://www.npd.no/om-oss/organisasjon/samarbeidsfora/diskos/

Ombudstvedt, H., & Sildnes, J. (2019). *Creating Competitive Advantage from Data as a Key Resources.*

Oxfordlearnersdictionary.com. (n.d.-a). *Confirm.* Retrieved from https://www.oxfordlearnersdictionaries.com/definition/english/confirm?q=confirm

Oxfordlearnersdictionary.com. (n.d.-b). *Credibility.* Retrieved from https://www.oxfordlearnersdictionaries.com/definition/english/credibility?q=credibility

Oxfordlearnersdictionary.com. (n.d.-c). *Dependability.* Retrieved from https://www.oxfordlearnersdictionaries.com/definition/english/dependability?q=dependability

Oxfordlearnersdictionary.com. (n.d.-d). *Transferability.* Retrieved from https://www.oxfordlearnersdictionaries.com/definition/english/transferability?q=transferability

Patton, M. Q. (1990). *Qualitative evaluation and research methods.* SAGE Publications, inc. Retrieved 12-12-19, from https://vtechworks.lib.vt.edu/bitstream/handle/10919/8633/hoepfl.pdf?sequence=1

Pedersen, K. (2020, 4). What can open innovation be used for and how does it create value? *Government Information Quarterly*, *37*(2), 101459. Retrieved from https://www.sciencedirect.com/science/article/pii/S0740624X19302266 doi: 10.1016/j.giq.2020.101459

Perkmann, M., & Schildt, H. (2015, 6). Open data partnerships between firms and universities: The role of boundary organizations. In *Research policy* (Vol. 44, pp. 1133–1143). Elsevier B.V. doi: 10.1016/j.respol.2014.12.006

Ponte, D. (2015, 5). Enabling an Open Data Ecosystem. *ECIS 2015 Research-in-Progress Papers*. Retrieved from https://aisel.aisnet.org/ecis2015_rip/55

Rantala, T., Apilo, T., Palomäki, K., & Valkokari, K. (2020). Selling Data-Based Value in Business-to-Business Markets. *Technology Innovation Management Review*, *10*(1). Retrieved from https://timreview.ca/article/1313

Read, S., Dew, N., Sarasvathy, S., Song, M., & Wiltbank, R. (2009). Marketing Under Uncertainty: The Logic of an Effectual Approach. *Journal of Marketing*, *73*, 1–18. Retrieved from https://journals.sagepub.com/doi/full/10.1509/jmkg.73.3.001

Read, S., Song, M., & Smit, W. (2009, 11). A meta-analytic review of effectuation and venture performance. *Journal of Business Venturing*, *24*(6), 573–587. Retrieved from https://www.sciencedirect.com/science/article/pii/S0883902608000487 doi: 10.1016/j.jbusvent.2008.02.005

Regjeringen.no. (2019). *Starter arbeid med stortingsmelding om datadrevet økonomi og innovasjon - regjeringen.no.* Retrieved from https://www.regjeringen.no/no/aktuelt/starter-arbeid-med-stortingsmelding-om-datadrevet-okonomi-og-innovasjon/id2680668/

Richter, H., & Slowinski, P. R. (2019, 1). The Data Sharing Economy: On the Emergence of New Intermediaries. *IIC International Review of Intellectual Property and Competition Law*, *50*(1), 4–29. Retrieved from https://link.springer.com/article/10.1007/s40319-018-00777-7 doi: 10.1007/s40319-018-00777-7

Ries, E., Bouvier, M., Guenette, M., & Sobecki, C. (2012). *Lean startup*. Pearson.

Ritala, P. (2001, 3). Coopetition Strategy - When is it Successful? Empirical Evidence on Innovation and Market Performance. *British Journal of Management*, *23*(3), no-no. Retrieved from http://doi.wiley.com/10.1111/j.1467-8551.2011.00741.x doi: 10.1111/j.1467-8551.2011.00741.x

Sarasvathy, S. (2001, 4). Causation and Effectuation: Toward a Theoretical Shift from Economic Inevitability to Entrepreneurial Contingency. *The Academy of Management Review*, *26*(2), 243. Retrieved from http://www.jstor.org/stable/259121?origin=crossref doi: 10.2307/259121

Say, M. (2013). Can open data work for the private sector? — CIO. *CIO.com*. Retrieved from https://www.cio.com/article/3525129/can-open-data-work-for-the-private-sector.html

Schuritz, R., Seebacher, S., & Dorner, R. (2017). Capturing value from data: Revenue models for data-driven services. *Proceedings of the 50th Hawaii International Conference on System Sciences*. (DOI: 10.24251/HICSS.2017.648.)

Skogli, E., Stokke, O., Hveem, E., Aamo, A., Scheffer, M., & Jakobsen, E. (2019). *Er Verdiskapning med data noe Norge kan leve av?* (Tech. Rep.). Menon. Retrieved from https://www.nho.no/contentassets/dece97a9ac1e4c918039d2d7c6f69879/verdiskaping-med-data-menon_231219_endelig.pdf

Store.veracity.com. (n.d.). *Energy Transition Outlook Premium Analytics.* Retrieved from https://store.veracity.com/energy-transition-outlook-premium

Svensrud, E., & Åsvoll, H. (2012). Innovation in Large Corporations: A Development of the Rudimentary Theory of Effectuation. *Academy of Strategic Management Journal, Volume 11, Number 1*, *11*(1). Retrieved from https://www.researchgate.net/profile/Havard_Asvoll/publication/287944109_Innovation_in_large_corporations_A_development_of_the_rudimentary_theory_of_effectuation/links/57dbc91e08aeea1959348363/Innovation-in-large-corporations-A-development-of-the-rudiment

Telenor. (n.d.-a). *Om Telenor.* Retrieved from https://www.telenor.no/om/

Telenor. (n.d.-b). *Telenor Group at a Glance - Telenor Group.* Retrieved from https://www.telenor.com/about-us/telenor-at-a-glance/

Telenor.com. (n.d.). *Big data for social good.* Retrieved from https://www.telenor.com/innovation/research/big-data-for-social-good/

The Open Definition. (n.d.). *The Open Definition - Open Definition - Defining Open in Open Data, Open Content and Open Knowledge.* Retrieved from http://opendefinition.org/

Veracity. (n.d.). *Why we build Veracity.* Retrieved from https://www.veracity.com/article/why-we-build-veracity

Vorontsova, O. (2016). *The analysis of the impact of Causation and Effectuation approaches on decision-making of IT start-ups Dissertation of Master in Management* (Tech. Rep.). Retrieved from https://repositorio-aberto.up.pt/bitstream/10216/83956/2/135409.pdf

Waller, P. (2011). *The Openness of Government Editorial The Openness of Government* (Tech. Rep.). Retrieved from www.epracticejournal.eu

Werhahn, D., Mauer, R., Flatten, T., & Brettel, M. (2015, 10). Validating effectual orientation as strategic direction in the corporate context. *European Management Journal*, *33*(5), 305–313. Retrieved from https://www.sciencedirect.com/science/article/abs/pii/S0263237315000390?casa_token=qVCMteMOH18AAAAA:z5Vp_07JXTlSRl2JlCOpJlAvqH6pztHRXOXAJxMr9lRu1xQn5A8tdLk2hGqesanZFSgxhYbgFYQ doi: 10.1016/j.emj.2015.03.002

Wiltbank, R., Dew, N., Read, S., & Sarasvathy, S. (2006). What to do next? The case for non-predictivie strategy. *Strategie Management Journal Strat. Mgmt. J., 27: 981-998*. Retrieved from https://www.jstor.org/stable/pdf/20142390.pdf doi: I:10.1002/smj.55

Yin, R. (2009). How to do better case studies. *The SAGE handbook of applied social research methods*, *2*, 254–282.

Zuiderwijk, A., Janssen, M., Choenni, S., Meijer, R., & Alibaks, R. (2012). Socio-technical Impediments of Open Data. *Electronic Journal of e-Government*, *10*, 156–172.

Zuiderwijk, A., Janssen, M., & Davis, C. (2014). Innovation with open data: Essential elements of open data ecosystems. *Information Polity*, *19*, 17–33. Retrieved from

https://content.iospress.com/articles/information-polity/ip000329 doi: 10.3233/IP-140329

A Appendix

A.1 Interview guide: Case companies

Introduction of researchers and study The interviewers present themselves, the purpose of the study and the structure of the interview:

- Thanking interviewees for participation
- Personal and academic background
- Purpose of the study and problem statement
- Structure of the interview: semi-structured
- Asking for consent to record the interview
- Informing them that transcribed version of the interview will be sent for their approval

Questions

1. Background and company information:

- Can you tell us about the company you work for, and your role?
- Do you have any activities or projects you consider data-driven? Can you please tell us about them?
- For the project you mentioned, how would you describe the business model ?
- When did the project start, and how did it develop?

2. Decision making

- What is your vision with the data driven project?
- What were the triggers or drivers for starting up the project?
- How did you plan the project?
- What discoveries have you made so far?

- How will you work on the project from now?
- How do you see the project develop in the future?
- What was your viewpoint on the investment cost and potential returns of the project?
- Have you experienced any uncertainties during the project? How did you address them?
- How would you describe the decision making processes in the project?
- Is it possible to define any competitors for you project? What do you consider to be your competitive advantage compared to them?

3. Resources and activities

- How many work at the project, and what do they do?
- Please describe your product offering to your customers.
- Can you tell us about the data/information that is used, and how you process it?
- Has the project created a need for new competencies, other investments or organizational changes?
- What characteristics of your data do consider to be most valuable?

4. Data sales (only used for monetization of data)

- Can you explain the revenue model?
- How do you price data?
- Can you explain the sales process?
- Describe a typical agreement with a customer?
- What are the key negotiation areas with customers?

5. Opportunities

- Do you see any new opportunities arise from your projects?

- There is a lot of focus on open data. What is your thoughts on that?
- What is your view on opening/ facilitate for sharing your data with other private and public actors?
- Do you see any new business opportunities arise from more open data?
- How do you think exchange of data will affect your industry?
- Do you have any lessons learned from your project, that you want to share with other companies?
- Are there any other topics you consider relevant, that we have not talked about?

A.2 Interview guide: The Norwegian DPA

Introduction of researchers and study The interviewers present themselves, the purpose of the study and the structure of the interview:

- Thanking interviewees for participation
- Personal and academic background
- Purpose of the study and problem statement
- Structure of the interview: semi-structured
- Asking for consent to record the interview
- Informing them that transcribed version of the interview will be sent for their approval

Questions

- What are your thoughts on the work being done on the governmental white paper on The Norwegian data economy?
- What trends do you see in Norway related to data sharing?
- Specifically data sales, what trends are there in Norway?
- What methods of sharing data and business models do you think we will see more of?
- Is it possible to provide an overview of what the drivers of the actors in the ecosystem are?
- What are the most prominent barriers and worries associated with sharing and selling data?
- Can you please explain some of the work being done related to COVID-19?

A.3 Measures of causation and effectuation by Chandler et al. (2011)

Table 2: Chandler et al. (2011)'s measures for causation

Construct	**Item**
Causation	We analyzed long run opportunities and selected what we thought would provide the best returns
	We developed a strategy to best take advantage of resources and capabilities
	We designed and planned business strategies
	We organized and implemented control processes to make sure we met objectives
	We researched and selected target markets and did meaningful competitive analysis
	We had a clear and consistent vision for where we wanted to end up
	We designed and planned production and marketing efforts

Table 3: Chandler et al. (2011)'s measures for effectuation

Construct	**Item**
Experimentation	We experimented with different products and/or business models.
	The product/service that we now provide is essentially the same as originally conceptualized. (Reverse coded)
	The product/service that we now provide is substantially different than we first imagined.
	We tried a number of different approaches until we found a business model that worked.
Affordable loss	We were careful not to commit more resources than we could afford to lose.
	We were careful not to risk more money than we were willing to lose with our initial idea.
	We were careful not to risk so much money that the company would be in real trouble financially if things didn't work out.
Flexibility	We allowed the business to evolve as opportunities emerged.
	We adapted what we were doing to the resources we had.
	We were flexible and took advantage of opportunities as they arose.
	We avoided courses of action that restricted our flexibility and adaptability.
Precommitments	We used a substantial number of agreements with customers, suppliers and other organizations and people to reduce the amount of uncertainty.
	We used pre-commitments from customers and suppliers as often as possible

Henrik Ombudstvedt & Julie Sildnes

NTNU
Norwegian University of
Science and Technology