University of Bergen

Centre for the Study of the Sciences and the Humanities (SVT) /
Department of Biological Sciences

SDG351 – Internship-based master's thesis

Master of Philosophy in Sustainability

Spring 2024

Visions of Data for Deep-Sea Mining in Norway

How do central actors imagine the use and importance of scientific data in decision-making on the context of deep-sea mining in Norway?

Ingeborg Rønning

Roger Strand (main supervisor) and Vigdis Vandvik (co-supervisor)

"Retracting the past, man, the present dominator of the emerged earth, is now returning to the ocean depths.

His penetration of the deep could mark the beginning of the end for man, and indeed for life as we know it on this earth.

It could also be a unique opportunity to lay solid foundations for a peaceful and increasingly prosperous future for all peoples."

(Pardo, 1967).

Abstract

This thesis explores the controversial topic of deep-sea mining (DSM) on the Norwegian continental shelf through exploration of the role of data in decision-making. The study takes on the following research question: *How do central actors imagine the use and importance of scientific data in decision-making on the context of deep-sea mining in Norway?* The topic of DSM has gained criticism both nationally and internationally for the many uncertainties that the activity entails. Not only is the industry novel with undeveloped technology, but the deep-sea is also the least-known ecosystem on Earth, with a unique biodiversity. Scientists have raised concern for the marine environment, but the politicians are primarily concerned with potential economic profit. The study places itself within the world of *Science and Technology studies,* and addresses the issue at hand through models of justifications for the science-policy interface (Funtowicz & Strand, 2007), as well as the concepts of wicked problems, uncertainty, and imaginaries. The study is based on semi-structured interviews with actors central in the debate around DSM, within research, industry, governance, and NGOs. The findings reveal conflicting problem framings, diverging understandings of both data and the role of data, and visions of what good decision-making process in this context looks like. Frustration was prominent amongst all the informants and is understood as the result of the conflicting understandings of what data is and how it should be used in the decision-making processes related to DSM. Data in this context are conceptualised either as sources of information providing policymakers with what they need to ensure that their decision is right and rational, or as knowledge of uncertainties that require a precautionary approach. The informants either imagine data to *speak truth to power* and believe that DSM is important for the green transition, or they imagine data to *speak precaution to power*, and believe DSM to throw a spanner in the works for sustainable development.

Sammendrag

Denne masteroppgaven undersøker det kontroversielle temaet gruvedrift på havbunnen i Norge gjennom å utforske rollen til data i beslutningstaking. Studien tar for seg det følgende forskningsspørsmålet: *Hvordan forestiller sentrale aktører bruken og betydningen av vitenskapelige data i beslutningsprosesser i konteksten av gruvedrift på havbunnen i Norge?* Gruvedrift på havbunnen har blitt kritisert fra både nasjonalt og internasjonalt hold grunnet de mange usikkerhetene som industrien medfører. Ikke bare er industrien helt ny med uutviklet teknologi, men dyphavet er også det minst forståtte økosystemet på jorden, med en unik biodiversitet. Forskere har uttrykket bekymring for det marine miljøet, men politikerne ser ut til å kun tenke på potensiell økonomisk profitt. Studien plasserer seg i feltet teknologi- og vitenskapsstudier, og undersøker problemstillingen gjennom modeller for rettferdiggjøring av forholdet mellom vitenskap og politikk (*science-policy interface*) (Funtowicz & Strand, 2007), samt konsepter som samfunnsfloker (*wicked problems*), usikkerhet og forestillinger. Studien er basert på semistrukturerte intervjuer med sentrale aktører i debatten om gruvedrift på havbunnen innen forskning, industri, forvaltning og NGOer. Funnene avslører ulike problemforståelser, motstridende forståelser av både data og rollen til data, og ulike visjoner om hvordan en god beslutningsprosess i denne konteksten ser ut og burde se ut. Frustrasjon var fremtredende blant alle informantene, og forstås som et resultat av de sprikende forståelsene av hva data er og hvordan det bør brukes i beslutningsprosesser for gruvedrift på havbunnen. Data i denne konteksten konseptualiseres enten som kilder til informasjon som gir beslutningstakere det de trenger for å sikre at deres beslutning er riktig og rasjonell, eller som kunnskap om usikkerheter som krever en føre-var tilnærming. Informantene holder enten forestillingen om at *data taler sannhet til makt*, og samtidig mener at gruvedrift på havbunnen er viktig for grønn omstilling, eller så har de en forestilling om at *data taler føre-var til makt*, og mener at gruvedrift på havbunnen setter kjepper i hjulene for en bærekraftig utvikling.

Acknowledgements

Writing this thesis has been a roller coaster of both insights and emotions. The process has been challenging, but also highly educational and inspiring. The idea for this thesis arose from my internship with REV Ocean and HUB Ocean, and I would like to especially express my gratitude to Eva Ramirez-Llodra and Anna Silyakova for being outstanding mentors. I felt included and appreciated, and working with two esteemed ocean scientists was inspiring.

I would also like to thank all of the informants that set aside time for an interview. Not only were the interviews important for this thesis, but I also personally learned a lot from our conversations.

This thesis would not have been possible without my main supervisor, Roger Strand. Without him, both this document and I myself would have been a mess. Roger took on the role as my personal cheerleader from day one, and I would not have managed without his good feedback, advice and encouraging cheers. I would also like to thank Vigdis Vandvik for important and valuable feedback.

Lastly, I would like to thank friends and family that have made life during this time not just bearable, but even nice and fun at times. Without morning swims, the reading hall's quiz team, and facetimes with my mum and dog, this time would have been significantly harder.

Ingeborg Rønning

Bergen, May 15th 2024

Abbreviations

Abbreviation	Meaning
DSM	Deep-sea mining
IMR	Institute of Marine Research
IPCC	Intergovernmental Panel on Climate Change
ME	Ministry of Energy (FKA Ministry of Oil and Energy, changed name 01.01.2024)
NGO	Non-governmental organisation
NOD	Norwegian Offshore Directorate (FKA Norwegian Petroleum Directorate, changed name 01.01.2024)
SDG	Sustainable Development Goals
SMS	Seabed massive sulphides
STS	Science and technology studies
SVO	Particularly valuable and vulnerable areas (Særlig verdifulle og sårbare områder)
WWF	World Wildlife Fund

Table of Contents

1. Introduction

1.1 Setting the scene: deep-sea mining in Norway

January 9th this year (2024), the Norwegian Parliament voted to open areas on the Norwegian continental shelf for exploration and exploitation of deep-sea minerals (Ministry of Energy, 2024a). The thoughts have been parted even leading up to this vote:

> "We have all triumphed. Through what we have put forward, I believe we have found a balance the Government stands securely on." – *Terje Aasland, the Minister of Energy* (Melgård & Berglihn, 2023).

> "Embarrassing to be a Norwegian scientist. We are going against the flow, doing the exact opposite of everyone else." – *Lise Øvreås, the leader of the Norwegian Academy of Science and Letters* (Bjørnstad & Kjørstad, 2023).

> "A black day for Norwegian nature." – *Karoline Andaur, General secretary WWF* (Knežević et al., 2023).

The opened area covers 281 200 square kilometres in the Norwegian Sea, the Barents Sea, and the Greenland Sea (Meld. St. 25 (2022-2023)). Deep-sea mining (DSM) is the activity of extracting minerals from the deep seabed. Until this day, DSM do not take place anywhere in the world, but due to an increased demand for virgin minerals, some nations and companies are exploring the potential new maritime industry (Levin et al., 2016). The debate around DSM in Norway generally evolves around two issues: the lack of knowledge of the deep sea and the impacts of DSM, and reasons for why at all Norway sees the need to open this industry. Scientific advice and political agendas are not uniting in their views on how best to proceed in this issue. Thus, this thesis explores the interface of science and policy for DSM in Norway.

1.1.1 What do we know about the deep sea and deep-sea minerals in Norway?

The deep sea is usually denoted as depths below 200 metres and constitute the largest ecosystem on earth (Levin, 2019). The deep trenches of the ocean have long been inaccessible to humans, and the deep sea is the least-known ecosystem on earth (Ramirez-Llodra et al., 2011). The depths of Norwegian waters were first explored in the late 19th century during the

Norwegian North-Sea Expedition (Bjørnsen, n.d.), and since then – specifically the last couple of decades – technological developments such as remotely operated vehicles (ROVs) have advanced the exploration of the Norwegian deep-sea.

The first fossil mineral deposits in Norwegian waters were discovered early in the first decade of the 21st century: Mohn's Treasure, an inactive sulphide deposit was localised in 2002 and the first hydrothermal fields were discovered in 2005 (Pedersen et al., n.d.; Ramirez-Llodra et al., 2020). Today, a total of ten hydrothermal vent fields have been identified, seven of which are localised on the seabed, while three have been identified by anomalies in the water column (Pedersen et al., n.d.). Polymetallic crusts have also been identified at several locations (Pedersen et al., n.d.). Minerals in the deep sea that are of economic interest include mainly manganese nodules, seafloor massive sulphides (SMS) and polymetallic crusts (Levin et al., 2016). The two latter have been found on the Norwegian continental shelf.

On the Norwegian continental shelf, SMS are found at hydrothermal vent sites – underwater hot springs – that occur at spreading zones, such as the Arctic Mid-Ocean Ridge (AMOR) (Martin et al., 2008; Pedersen et al., 2010). These sites are often designated as either active or passive. At *active vent sites*, high-temperature, metal-rich fluids seep up from the seabed and form chimney-like structures when mixed with the cold seawater. In some places, these structures have been able to "grow" for an extended period of time, resulting in high, metal-rich structures of economic interest (Jamieson & Gartman, 2020). Such active sites are believed to be important in understanding the origins of life (Martin et al., 2008), and they constitute unique chemosynthetic habitats (Ramirez-Llodra et al., 2010). In contrast, at *inactive sites*, the venting of hydrothermal fluid is ceased (Jamieson & Gartman, 2020). Inactive sites have been poorly understood and for a long time believed to be "dead", with no to little life. However, a recent study by Achberger et al. (2024) shows that inactive sites are important for microbial activity and contributes to primary production in the deep sea. On the Norwegian continental shelf, polymetallic crusts occur on the flanks of seamounts and ridges, landscapes and structures that are too steep for sediments to accumulate (Pedersen et al., n.d.). Polymetallic crusts (Norwegian: "manganrike skorper") are a result of manganese and iron oxides that have precipitated on sediment free rock surfaces in the deep sea, and they vary in thickness from around 1 - 260 mm. (Petersen et al., 2016).

Marine research have been conducted in the Norwegian seas for centuries, with the Norwegian North-Sea Expedition marking the first thorough research expedition (Bjørnsen, n.d.). Biological studies in these deep waters have been intensified the last couple of decades, but still, the knowledge gaps are many. The pelagic ecosystems – the species distribution and the ecologic interactions – in addition to general hydrographical conditions and ocean currents in these areas, are generally well understood due to extensive research (Kutti et al., 2021). However, the Institute of Marine Research (IMR) has emphasised that for the deep pelagic ecosystems and the bottom currents (which will affect the geographical distribution of the direct impacts from DSM), the current knowledge is both fragmented and limited (Kutti et al., 2021).

In general, the benthic biological sampling has focused on mapping fauna, since patterns in and between habitats, as well as their interactions with the environment cannot be fully understood without a complete understanding of the biodiversity (i.a. Jaeschke et al., 2012; Pedersen et al., n.d.; Schander et al., 2010; Tandberg et al., 2018). Most of this research has been focused on active vent sites, but the Norwegian government has stated that the opening decision *does not allow mining of active hydrothermal vents* (Meld. St. 25 (2022-2023), p. 77). The greatest knowledge gaps applies to inactive hydrothermal vents and polymetallic crusts – the two types of mineral occurrences that *are* opened for mining (Pedersen et al., n.d.). What is known, however, is that the deep-sea ecosystems are "deep, diverse and definitely different", with a biodiversity amongst the highest on Earth (Ramirez-Llodra et al., 2010). The benthic ecosystems have been studied mainly by the deep-sea research environment at the University of Bergen, and video transects constitute the source for a large part of the current knowledge. In specific areas, such as the most studied hydrothermal vent sites, functional and microbial studies have taken place, and some parts of the fauna is beginning to be better understood (Pedersen et al., n.d.). Video transects have been efficient in identifying larger organisms, however smaller organisms and infauna are often missed. Since the benthic habitats are many and diverse, and thorough studies of the deep sea is resource demanding, the current knowledge of the benthic fauna and biodiversity is both fragmented and limited (Pedersen et al., n.d.). In addition, it is estimated that it takes around 13.5 years to describe a new species from the time of collection (Bouchet et al., 2023). Further, several studies have recently been focused on the environmental impacts of DSM in Norwegian waters, again emphasising the many unknowns (i.a. Ramirez-Llodra et al., 2020; van der Meeren et al., 2021).

1.1.2 Estimate of mineral resources on the Norwegian continental shelf

In relation to the opening process, the Norwegian Offshore Directorate (NOD, FKA Norwegian Petroleum Directorate) conducted a resource assessment of deep-sea minerals on the Norwegian continental shelf and estimates millions of tonnes of several minerals, i.a. 38 million tonnes of copper and 45 million tonnes of zinc from SMS, and 24 million tonnes of magnesium and 185 million tonnes of manganese from polymetallic crusts (Norwegian Offshore Directorate, 2023). The estimates are based on novel models made by NOD because "there exists today no specific, accepted and widespread model for resource assessment of seabed minerals." (Ministry of Energy, 2022, p. 40). These calculations have been criticised by i.a. *Bergfald miljørådgivere* (environmental consultancy company) as they emphasise that there are industry standards related to the commercial aspect of DSM that could have been used (Bergfald & Kristensen, 2023). The White paper does state that for both SMS and the polymetallic crusts, "the resource assessment does not provide a base for estimating whether or not these are recoverable." (Meld. St. 25 (2022-2023). However, they still base the decision to open these areas for exploration and extraction on these estimates.

1.1.3 The political and legal context

Until 1963, the Norwegian continental shelf was regulated by "Kontinentalsokkelloven" (The Continental Shelf Act). However, when it became evident that there were mineral deposits in these areas, a new act was suggested to explicitly govern the activity of DSM (Prop. 106 L (2017-2018)). The Seabed Minerals Act was adopted by the Norwegian parliament and came into force in 2019 (Havbunnsmineralloven, 2019). The purpose of this law is defined as follows:

> "This law will facilitate exploration and extraction of mineral occurrences on the continental shelf in accordance with societal objectives, ensuring that considerations for value creation, environment, safety of operations, other business activities, and other interests are upheld." (Havbunnsmineralloven, 2019, § 1-1)

Following the United Nations Convention on the Law of the Sea (UNCLOS), impact assessments are mandatory to implement when there are "reasonable grounds for believing that planned activities under their jurisdiction or control may cause substantial pollution of or significant and harmful changes to the marine environment" (United Nations Convention on the Law of the Sea, 1982, Article 206). In the Seabed Minerals Act, §2-2 states that:

> "The impact assessment will contribute to highlight the various interests at play in the area in question, so that this can form the basis when deciding whether, and possibly under what conditions, the area can be opened for mineral activities. The impact assessment shall highlight the impacts a potential opening can have on the environment, and assumed business-related, economic, and social impacts." (Havbunnsmineralloven, 2019, § 2-2).

Once the Seabed Minerals Act were in place, the process of opening areas for exploration and exploitation of deep-sea minerals could begin. The impact assessment did not go uncriticised, but with mostly minor edits to the initial proposal, – the area was reduced from 592 599 to 281 200 square kilometres – the White paper was published in 2023 (Meld. St. 25 (2022-2023)). In April 2024, the Norwegian Government announced that the first licensing rounds most likely will start in 2024, and that they aim to award licenses in the first half of 2025 (Ministry of Energy, 2024b).

"Naturmangfoldloven" (The Nature Diversity Act) is also central in this context, as it is the overarching law that regulates management of nature. Relevant in this context is the emphasis on the precautionary principle, knowledge base, ecosystem approach and cumulative impacts (Naturmangfoldloven, 2009, §§ 8-11). In an assessment of the legal implications of a potential opening decision, the law firm Wikborg Rein (on behalf of WWF) concluded the requirements related to the environment in The Seabed Minerals Act §2-2 are not met (Johansen, 2023). Parallel with the opening process for DSM, the Ministry of Climate and Energy has also worked on updating the management plans for the Norwegian seas, which was published in a White paper in April 2024 (Meld. St. 21 (2023-2024). In relation to this, the management forum of Norwegian sea areas (Norwegian: *Faglig forum*), consisting of several governmental institutions (i.a. IMR and the Norwegian Environmental Agency), has identified several *particular valuable and vulnerable areas* (Norwegian: Særlig verdifulle og sårbare områder (SVO)), whereof several overlap with the opening area for DSM (Eriksen et al., 2021). IMR stated back in 2021 that the opening area would overlap with later proposed SVOs (Nagelsen, 2021), but as was stated in the updated management plans "SVO do not have a legal status and do not give direct impact in the form of measures for conservation of nature or limitations/frames for industry activity" (Meld. St. 21 (2023-2024), p. 50).

1.2 Sustainability – to mine or not to mine

The two main conflicting views on DSM both use *sustainability* as their argument. How can this be? The concept of *sustainable development* was institutionalised and made publicly known through the Brundtland Commission Report "Our Common Future" as:

> "(…) development that meets the needs of the present without compromising the ability of future generations to meet their own needs." (World Commission on Environment and Development, 1987).

Today, the most known initiative for sustainable development is the 17 UN Sustainable Development Goals (SDGs), the world's working plan to address the three pillars of social, economic, and environmental sustainability (Purvis et al., 2019; United Nations, n.d.). The concept of green growth – clean energy technologies and promotion of energy efficiency – have been argued to unite the two (OECD, 2011). On the other side, green growth and sustainable development are also seen by many as incongruent, expressing a particular concern for the care of the environmental (Barbier, 2011).

The DSM debate accentuates to the question of whether the green growth and sustainable development, with a particular emphasis on the environmental pillar, can co-exist. The Norwegian government, through the Ministry of Energy (ME) and NOD, issued the White paper stating that: "Norway has great occurrences of minerals that will be important in the green transition." (Meld. St. 25 (2022-2023), p. 7). They refer to the report by the International Energy Agency on *The Role of Critical Minerals in Clean Energy Transitions*, that emphasise the need for critical minerals for the green transition (IEA, 2022). They argue that exploitation of seabed minerals will help achieve a sustainable future, and that DSM in Norway can specifically contribute positively to *SDG7 Affordable and clean energy* and *SDG13 Climate action*. The White paper states that more knowledge will be gathered alongside the opening process (Meld. St. 25 (2022-2023).. On the other side, concern of the many risks and the high uncertainty related to DSM has been raised by both leading scientists and environmental organisations (Andaur et al., n.d.; EASAC, 2023; Norwegian Environment Agency, 2023).

Limited knowledge both of the deep-sea ecosystems and the technology for DSM makes challenging the understanding of impacts and consequences of DSM on these ecosystems, even though the studies that do exist suggest that the risks of opening for DSM are too high, arguing for precaution (Boetius & Haeckel, 2018; Mengerink et al., 2014; Miller et al., 2021). The growing consensus amongst leading scientists, NGOs, big corporations and even several nations, is that the knowledge gaps are too big and many, and that the potential environmental impacts too harmful for DSM to contribute positively to global sustainability, and thus advocate for a *global moratorium* (EASAC, 2023; McVeigh, 2023; WWF, n.d.).

To mine or not to mine – the issue of DSM is obviously complex, and one could argue that it fits under the concept of *wicked problems* (see Chapter 2). Whether or not DSM in Norway will contribute to a more sustainable world is understood differently by different people. Both sides use and build their arguments on the available knowledge, both on mineral demand and on the deep-sea ecosystems, but conclude differently. One side argues for the potential importance of DSM and more knowledge gathering, while the other side warns about environmental harm and urges to stop the process of opening for DSM.

1.3 Motivation

Arguably, DSM is *the* hot potato within the marine sustainability debate these days. This is especially interesting within Norwegian borders, as the Norwegian Prime Minister is co-chair of the High Level Panel for a Sustainable Ocean Economy, which have committed to 100% sustainable ocean management (World Resource Institute, 2023). Norway has been criticised by esteemed scientist for pursuing activities, i.a. DSM, that undermine the panel (Amon et al., 2024; Nature Editorial, 2024).

The idea behind this thesis arose in parallel with the rise of this debate, during an internship with REV Ocean and HUB Ocean the fall of 2023, as part of the master's programme. REV Ocean and HUB Ocean are both non-profit foundations established and funded by Aker ASA (HUB Ocean, n.d.a; Hub Ocean, n.d.b; REV Ocean, n.d.). The main reason for my choice of these internship hosts was their highly ambitious missions: REV Ocean aims to ensure "One Healthy Ocean" and HUB Ocean aims "To change the fate of the ocean by unleashing the power of data, technology and collaboration." (HUB Ocean n.d.b; REV Ocean, n.d.). It was my preconceived impression that both organisations are occupied with the importance of scientific knowledge and data, and I was curious as to how this took shape in practice.

During this internship, I became familiar with various types of scientific data, and gained insight into how work is done to collect and make available ocean data with the purpose of a healthier ocean. I grew an interest in this data and the clear trust that more data and technology will ensure a healthy ocean. It eventually became clear that it is not at all obvious what data is and what it possible should be used for, both in general and in the context of DSM in Norway. Data was seen as something that, as long as it was shared and accessible, would *save the ocean*. However, it was still not clear to me, nor did it seem that it was clear to them, what data really is and how it should be used. The fact that it did not seem entirely clear to those working in these organisations, I found highly interesting, and it made me think how the ideas of data takes shape in the wider society. In the context of DSM, I find this especially interesting due to the fact that the current level of data, technology and knowledge concerning DSM, particularly in a Norwegian context, in general is relatively low.

1.4 Problem framing

Inspired by my experiences in the internship, this thesis studies the topic of DSM in Norway in the context of data and decision-making. As a result of my perception of ambiguity around data, even within organisations working with data for a healthy ocean, I want to study these understandings of data within the actors that work with DSM in Norway. Thus, this thesis aims to explore *what data is and does* in this context and the role it plays, or is given, in decision-making, by central actors. More specifically, my analysis considers the use and role of marine scientific data, such as marine biodiversity, ecology, geology, microbiology and more.

I find it necessary to emphasise what the chosen problem framing omits. This study does not seek to explore the issue of DSM itself or whether or not DSM could be considered as sustainable. In addition, the thesis does not seek to assess alternative future roadmaps of a sustainable future up against a future containing DSM.

The specific research question will be presented in Chapter 2 and 3.

1.5 Structure of the thesis

This thesis is structured into six chapters, beginning with this introductory chapter that introduces the reader to the deep sea and DSM, and contextualises the thesis in terms of the topic, scope, and purpose. Chapter 2 presents the theoretical approach, introducing the concepts of science-policy interface, uncertainty, and data. In the third chapter, I present and discuss the chosen method, semi-structured interviews, as well as ethical aspects and the analysis of the data material. Following this, in Chapter 4, the empirical findings from the interviews are presented and analysed. Chapter 5 discusses the results and analysis from the previous chapter. Lastly, in the conclusion, I aim to answer the research question and suggest potential future research.

2. Theory

This chapter introduces the theoretical perspectives of this thesis. I will first briefly present the field of science and technology studies, before I introduce the core concepts of this thesis, including the concepts of science-policy interface, uncertainty, complexity, and data.

However, before I present the theoretical concepts, I want to briefly present the reflections that resulted in the chosen concepts. I come from the field of natural science, more specifically molecular biology, and have been trained and socialised to understand data, science, and knowledge, and the use of the three, as relatively simple, straightforward concepts. Taking on this master's programme and particularly this master's thesis, I have had to question my own academic understanding. The field of Science and Technology Studies (presented below) has been helpful in asking critical questions to the standardised *ways of knowing* in the field of natural science, and is thus relevant for this thesis.

2.1 Science, technology, and society intertwined

The field of *Science and Technology Studies (STS)* is a relatively young academic interdisciplinary field that emerged during the latter decades of the 20th century (Jasanoff et al., 1995). STS seeks to explore and understand the relationship between science, technology, and society and emphasise the importance of bridging the gap between natural sciences and the humanities, as well as promoting *transdisciplinary* work (Harvard, n.d.). Transdisciplinary or transacademic work transcend the boundaries of academia and integrates the broader society through collaborative measures (Öberg, 2011). Studies within STS usually follow one of two main interests, either studying knowledge production or technology development (Skjølsvold, 2015). In the early ages, STS focused on understanding the *social fabrication of scientific facts*. Now, however, we see a growing emphasis on the changing role of science within the broader context of society, policy, and economy (Rohracher, 2015).

For a long time, the narratives of science and technology were dominated by *internalist explanations of science* and *technological determinism* (Skjølsvold, 2015). Science is understood and explained as an enclosed entity; that science itself holds the answers to how science should be explained and understood. In this view, science is objective, not influenced by external factors such as social or cultural features. The idea of technological determinism follows the same line of thought; technology is believed to hold an inherent, self-driven power that leads to continuous technological development that influences society without society having any impact on the development. In these views, science and technology are described and explained as independent entities that are not influenced by society, culture, or history. The boundaries between science and society, and technology and society are understood as clear and absolute. STS is critical to these views, arguing that both science and technology are products of their time, the social and cultural context.

The core of STS is the belief that science, technology and society are not separate constructions, but that they all are social constructs. However, the relationship is not linear in the sense that society exclusively shapes developments in science and technology. Science, technology, and society all influence each other, they are *co-produced.* The term *co-production* has several definitions, but Jasanoff (2004) emphasise that the term "reflects this self-conscious desire to avoid both social and technoscientific determinism in S&TS accounts of the world." (p. 20). Co-production understands the relationship between science and technology on one side and society at the other, as non-linear – influence goes both ways (Skjølsvold, 2015). As presented in Chapter 1, this thesis aims to explore the role of data in decision making, in the context of DSM in Norway. Thus, the concept of co-production is relevant to help understand the non-linear relationship of data and decision-making.

2.1.1 Sociotechnical imaginaries

A central theoretical concept within STS is *sociotechnical imaginaries*, which can be used to try to understand the complex interactions within this co-production. The concept was introduced by Jasanoff and Kim (2009) and they define it as:

> "(…) collectively held, institutionally stabilized, and publicly performed visions of desirable futures, animated by shared understandings of forms of social life and social order attainable through, and supportive of, advances in science and technology." (Jasanoff, 2015, p. 4)

Such *collectively held imagined and desired futures* serve as an instrument to legitimise a program of action, namely investments in specific science and technology. Simultaneously, progress and breakthroughs in this program of action reinforce a trust in the state's capacity to uphold the public's interest (Harvard, n.d.). Going back to the concept of co-production, sociotechnical imaginaries can be applied to help explain why some visions are preferred and co-produced at the cost of others (Harvard, n.d.). I will highlight that I do not use sociotechnical imaginaries as an analytical concept in this thesis. However, the concept is useful to understand the context that gives meaning to the phenomena being studied in my research. One can see the contours of the *desirable future* i.a. in the White paper (Meld. St. 25 (2022-2023). This *desired future* is *green* in the sense of the green transition, ensuring sustainable energy production: “Norway has great occurrences of minerals that will be important in the green shift.” (Meld. St. 25 (2022-2023), p. 7). The future is sustainable, but only if increased access to minerals is ensured, and the SDG7 Affordable and clean energy and SDG13 Climate action are highlighted as important (p. 12). Part of the desired future is also a safe and stable mineral supply: “It is a great and increasing attention to supply safety for such effort factors in Europe, in the USA and in the rest of the world.” (p. 5). The White paper argues that this desired future will be achieved through advancements in green technology, and that science will reliably produce knowledge that makes sure that these activities remain good and sustainable (p. 10, p. 72). This imagined future includes visions of society, technology, and science; in other words a future that is a result of co-production.

2.2 Science-policy interface

Critical, STS-informed studies of the relationship between science and policy have flourished since the early 1990s (Funtowicz & Strand, 2007). This relationship works two ways, or one could say that there are two different relationships: (1) science informing policy, and (2) policy regulating science – science as the “object of policy” (Funtowicz & Strand, 2007, p. 267). I will focus on the former; science informing policy. The “received view”, from the modern tradition of European Enlightenment, describes the relationship between science and policy as linear and relatively simple: science produces objective and reliable knowledge which is used to inform policy (Funtowicz & Strand, 2007; Rommetveit et al., 2013; Strand, 2022). In this way of thinking, science is neutral, valid, and all-knowing and thus legitimise policy and policy-making; in other words, the idea that *Science Speaks Truth to Power.* Funtowicz and Strand (2007) describe this linear relationship between science and policy as *the modern model*, one of several conceptual models that describe the science-policy interface and relationship.

2.2.1 Models of justification for the science-policy interface

Funtowicz and Strand (2007) presents several conceptual models that describe the relationship between science and policy. The models are not descriptions of reality, but instead conceptualised ideas about how the interactions of science and policy are legitimized, and what a *valid* model looks like. As mentioned, the modern model describes a linear relationship between science and policy where *science speaks truth to power*. In addition to the neutral view on scientific knowledge, the modern model also assumes that uncertainty is controllable and can thus be eradicated and that the systems and problems of interest are not complex. However, in contexts of what Rittel and Webber called "wicked problems" (see Rittel & Webber, 1973), the modern model faces challenges in the presence of uncertainty, complexity, and a plurality of conflicting values and/or conflicts of interests (Funtowicz & Strand, 2007). Three of the remaining models described by Funtowicz and Strand aim to "rescue" the modern model from its pitfalls. Instead of understanding the relationship between science and policy as linear, the other models emphasis that science and policy co-produce each other and therefore should not be understood and approached separately (Rommetveit et al., 2013).

The precautionary model

Wynne (1992) argues that as a result of intrinsic uncertainties in scientific knowledge, science is indeed *not an objective truth*, but is rather shaped by social and cultural contexts. Further, he emphasises that uncertainty is unavoidable and that recognising and accepting uncertainty is crucial for strengthening decision-making in complex issues. Wynne (1992) describes different types of uncertainty, from known odds to open causal chains. The distinction between uncertainty and indeterminacy is emphasised, where uncertainty highlight that lack of control of risks is a result of lack of scientific knowledge and that more knowledge will fill the gaps – *the more the better*. Indeterminacy adds a layer of contextual societal factors, emphasising that societal factors are also unpredictable and uncertain, but still influence the issue at hand.

There is almost always a question of uncertainty, or indeterminacy, in issues of sustainability (Strand, 2022). Hence, one could argue that the modern model and the precautionary model in practice are not that different, given that there always exists a level of uncertainty. However, the precautionary model emphasise that there exists situations where a certain harm or risk is strongly believed in by the scientific community, even though the standardised scientific methods cannot yet provide evidence for this harm (Funtowicz & Strand, 2007).

The concept of uncertainty in the science-policy interface was first described internationally in and is most known from the Rio Declaration on Environment and Development in 1992:

> "Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation." (Rio Declaration on Environment and Development, 1992, Principle 15)

Despite the aim of the precautionary principle to protect the environment in a world of uncertainties, the double, or even triple, negative in the principle, in addition to the notion of cost-effective measures, does however limit the rigour of the principle. Strand (2022) emphasise that cost-effective measures of preventative actions *cannot* be estimated reliably when uncertainty is present. Further, the precautionary principle is seen as less important, or secondary to cost-benefit analyses (Funtowicz & Strand, 2007).

The framing and demarcation model

Funtowicz & Strand (2007) proceed to present what they consider two attempts to save the modern model from indeterminacy and value-ladenness or conflicts of interests, called "the framing model" and "the demarcation model". Indeterminacy and value-ladenness are issues that raise the fact that *knowledge is not neutral*. As has been noted, uncertainty makes it impossible to get a complete overview of a situation, which leaves the task of acting in the presence of the uncertainties. The choices made in these situations are value-laden, either consciously or unconsciously. The two models represent two significantly distinct responses to the challenges of indeterminacy and value-ladenness.

The demarcation model is built on the implicit (and problematic) assumption that the value-ladenness of knowledge is the result of insufficiently independent science. Accordingly, its solution is to support conditions for the independence of scientists, and it advocates for a clear separation (demarcation) between science and policy (Funtowicz & Strand, 2007). This strict boundary aims to prevent especially the politicisation of science, but also the opposite scientisation of politics to uphold the accountability of both. The values of the experts, their conflicts of interest, requires supervision in order to ensure integrity. On the other hand, the framing model acknowledges the values of the experts and therefore accepts that scientific advice is value-laden. The solution is argued to be pluralism, that multiple perspectives from different experts can both enrich the framing of the problem and eliminate the bias (Strand, 2022). Pluralism is meant both in terms of expertise, disciplines, approaches, and affiliations – in other words inclusion of different stakeholders and their opinions.

Neither the modern model, the demarcation model nor the framing model are able to solve the initial problem of *legitimation*. A well-grounded theoretical insight in the world of social science and humanities is that "science is not able to carry the burden of legitimacy of policymaking." (Strand, 2022, p. 9). This is also visible in practice, and Strand (2022) emphasises several sustainability issues such as climate change and ecosystem disruption, issues in which science has been almost unanimous in their view for decades, but only partially translated into decision-making and policies. He further notes that scientific knowledge and advice are welcomed when it fits the vision of the receivers, the policy-makers. Despite the many identified shortcomings of the different models, particularly the modern model, status quo still remains the implicit assumption of the modern model. *However,* it includes a subordinate clause stating that non-scientific views would also be *good*.

2.2.2 The role of the scientist

In the interface of science and policy, Pielke Jr (2007) notes that the *scientist* has choices in this relationship, of whether, how and when they want to engage with policy. Scientists have an explicit role in making sense of science in policy, and what role they take on has implications in the broader picture (Pielke Jr, 2007). At the core of the reflections and choices done/needed by the scientist are values and uncertainty. Thus, it is crucial that the scientist is capable of recognising and distinguishing situations with value conflicts from situations with value consensus (Öberg, 2011). Nevertheless, in a functioning democracy, all types of situations arise, and thus, all types of roles a scientist can take on are both important and necessary (Pielke Jr, 2007). In situations with high value conflicts, the scientist can either advocate for a specific solution based on his or her own values, or provide alternatives for the decision-maker leaving it up to the decision-maker to take the final choice, based on *their* values and preferences. It is a choice of either more science or more options. The first often presents itself as a scientist arguing that he or she is expressing the objective best solution, but is rather using their power of scientific authority to advocate their own values and believes, thus often called *stealth advocacy* (Pielke Jr, 2007). The other alternative, which Pielke Jr (2007) argues is highly needed in complex problems such as sustainability issues, is often termed the *honest broker*.

The concept of the honest broker in the science-policy interface shares similarities with the framing model (Funtowicz & Strand, 2007), emphasising the need for multiple perspectives in order to achieve the best result. However, a study by Gundersen (2020) examined how scientific experts in the Intergovernmental Panel on Climate Change viewed their own role in the science-policy interface, and the general view amongst the experts was that they understood their role as neutral providers of scientific facts. This is more along the same lines as what Pielke Jr (2007) calls the *pure scientist*.

2.2.3 The role of governance

In the relationship between science and policy, there are not only views on the role of *science for policy*, but also on the role of policy for science, in other words governance. As Strand (2022) notes, governance of evidence-informed policymaking is complex, both in terms of the use of science in policymaking, and governance of the activity of using science in policymaking. There exist many different visions on what this type of governance should look like; however, I will not go into detail on this. I will rather briefly highlight the distinction Strand (2022) makes of governance *of* complexity and governance *in* complexity. Governance *of* complexity places the governance actors outside of the system they govern can often be seen as efforts to reduce and control complexity. Contrary, governance *in* complexity acknowledge the dynamics and uncertainties of the complex system.

2.3 Wicked problems and complexity

Sustainability problems are complex in that they expand into, influence, and are dependent on the biosphere, the society, and the economy. However, many – if not all – problems of sustainability are seen as *wicked problems* rather than complex. The term *wicked problem* was coined by Rittel and Webber (1973), and the problems are characterised by the fact that they have no definitive formulation, the nature of the problem's resolution is determined by the way the explanation is framed and there are no clear solutions. Wicked problems arise when complexity, uncertainty, and conflicts of interest are high (Head, 2008). Wicked problems are not merely problems of *greater complexity*; the challenge of wicked problems can be understood to be about understanding the problem rather than solving it. In contrast, complex problems, despite their complexity, could be understood as more solution-oriented. However, central to both is the importance of understanding the system the problem portrays in, and that the system needs to be understood as more than the sum of its parts.

2.4 Data

It is now evident that in the world of STS, science, and thus also scientific data, is not considered as an objectively given, neutral entity. In the *modern model* presented above, data would be seen as the objective, neutral facts provided by science. However, as noted, complexity and uncertainty make it impossible to view and assess data separate from its context (Funtowicz & Strand, 2007). Regardless, as briefly mentioned in Section 1.3, there is a prominent view that data is highly necessary in order to be able to manage and ensure a healthy ocean. Data, particularly big data, has been imagined to provide desired futures with social and economic growth (Burns et al., 2017).

What is meant by *data* does not have a single answer, but will vary, depending on the larger context, the influence from society and culture (Skjølsvold, 2015). Data is understood differently in different academic disciplines, in different business sectors and in different societies. For a molecular biologist, data could be DNA sequences, concentrations, and ratios, while data for a social anthropologist could be observations of interactions within societies and cultures. What is viewed as *valid, rigorous, or right data* is not an objective matter, but rather an issue of context. The conclusions that are drawn from the data, and how these conclusions are based on the data will also diverge, raising complexity and uncertainty in dealing with data. In this sense, data is a product of society, in the same way that society is influenced by and shaped by input from science and data. In other words, data and society co-produce each other. In the context of DSM in Norway, a controversial and debated societal issue, what is meant with *data* is therefore not obvious.

Scientific data in most cases also brings along a level of uncertainty (Wynne, 1992). How this uncertainty is understood and viewed, varies. Landström et al. (2015) studied how scientific experts understand scientific uncertainty to be perceived by i.a. policy makers, and found that the expert experienced policy-makers as being unable to understand scientific uncertainty.

2.5 Problem framing revisited

With the now presented theoretical concepts, I now want to revisit the problem framing presented in Section 1.4. As stated, this thesis aims to explore data and the role of data in decision-making, in the context of DSM in Norway. In this chapter, I have presented theoretical concepts that emphasis that it is not obvious how one does or should understand data and the role of date in such contexts. Thus, it would be meaningful to further explore what is understood by *data* in this context, how the different actors imagine and vision the role of data in decision-making. Therefore, with the presented theoretical backdrop, I want to express this in a more specific research question:

> *How do central actors imagine the use and importance of scientific data in decision-making on the context of deep-sea mining in Norway?*

The presented theoretical frameworks and concepts will be revisited in chapter 5, where I will discuss and reflect on my findings in relation to the content of this chapter.

3. Methods

The purpose of this study is to address the following research question, as presented in the previous section:

> *How do central actors imagine the use and importance of scientific data in decision-making on the context of deep-sea mining in Norway?*

The research question was pursued by the use of semi-structured research interviews with a strategic selection of informants involved in the context of governance of DSM in Norway. In this chapter, I will go through and explain the design and methodological choices of this study, as well as reflect on the chosen approach and research ethics.

Öberg argues that complex problems often requires an interdisciplinary approach, using and integrating knowledge from several disciplines (Öberg, 2011, p. 8-9). However, as the purpose of this study is not to explore the wicked problem of DSM per se, but rather how actors imagine a phenomenon within this problem, I have chosen to take a disciplinary approach to aim for quality rather than quantity within a 30 ECTS master's thesis.

3.1 Methodological approach: semi-structured research interviews

The phenomena I was interested in are at the level of imaginaries, meanings, understandings, opinions, and reasons. These concepts can be studied through different approaches, depending on the aim of the study. It is common to separate between quantitative and qualitative methods, based on the properties of the data material (Grønmo, 2004, p. 22). Regardless of the discipline, quantitative data is expressed through numbers or other quantities, and quantitative methods often take a deductive approach. On the other hand, qualitative data are often expressed through text (Clark et al., 2019, pp. 15-16; Grønmo, 2004, p. 22). Questions asked in qualitative studies include such as "how" and "why", rather than for instance "how much" or "how long", as is the case for quantitative studies (Öberg, 2011, p.12). Regardless of whether a study is based on quantitative or qualitative method, the researcher can either take on an explorative (hypothesis-generating) or a confirmative (hypothesis-testing) approach (Grønmo, 2004, pp. 282-283 & 346). Qualitative studies in the hermeneutical-phenomenological tradition explore meanings and interpretations among actors (Grønmo, 2004, pp. 392-395; Blaikie & Priest, 2019, pp. 200-201). Phenomenology in qualitative social science seeks to explore how actors perceive social phenomenon, – their life world – and describe the world based on this (Kvale & Brinkmann, 2021, p. 45). The hermeneutical approach assume that the whole is more than the sum of its parts, and thus requires interpretation to achieve a complete understanding (Öberg, 2011, p. 22). In this study, I have chosen a qualitative approach, due to the fact that the research question is focused on the meanings and understandings of actors, and because I want to take an explorative approach to the research question. I take on a hermeneutical-phenomenological approach by aiming to contextualise meanings from the life worlds of the informants.

Qualitative research can be pursued by a number of different methods and approaches, such as participatory observation, in-depth interviews, focus group, document analysis or semi-structured interviews (Blaikie & Priest, p. 201). A multitude of qualitative methodologies suited for a hermeneutical-phenomenological approach were considered to investigate the research question, each capable of unravelling different layers and nuances of comprehension and perspectives. Participatory observation could have been a suitable choice for the research question, as it allows for both observation of the actors and for the researcher to partake in the social processes (Grønmo, 2004, p. 138-139). However, this was unfortunately out of scope for this thesis in that it would have been too challenging to implement. By pursuing with focus groups, I might have lost some of the individual meanings and understandings. To capture the informants' formalized perspectives, their official statements, I could have pursued with document analysis or formalised email interviews. However, the study sought to go deeper into the interplay between the participants' professional responsibilities and their value systems, elements that can be hard to locate in formalized text. Consequently, the decision was made to go forward with semi-structured interviews, a choice predicated on the potential to elicit more in-depth and personal discourse than what could be gained from document analysis or electronic communication.

In qualitative research, interviews aim at gathering information about, and understanding, the respondents' thoughts and experiences about the world (Kvale & Brinkmann, 2021, p. 20). Semi-structured interviews are based on a set of predetermined themes and questions, but it allows the interviewer to vary the order of and the formulation of the questions, based on the setting in the interview, as well as giving the interviewer room for follow-up questions (Kvale & Brinkmann, 2021, pp. 156-157). This is in contrast to the structured interview, where the essence is for all of the interviews to be equivalent and comparable, and the unstructured interview, where the interview almost is led by the respondent and his/her train of thought on a topic given by the interviewer (Clark et al., 2019, pp. 211-212). Interviews informed by phenomenological approaches seek to discern shared experiences among participants, while the flexibility of the semi-structured format also allows for the identification of variances within the collected data (Kvale & Brinkmann, 2021).

3.2 Data collection

3.2.1 Strategic selection

Upon choosing candidates for the interviews, strategic selection was used. In strategic selection, the informants are chosen based on an assessment of whom that are most relevant for the purpose of the study (Grønmo, 2004, p. 103). The selection was based on a review of actors that has been publicly active in this issue. This review included public documents such as the White paper, the associated impact assessment and background documents and comments to consultation papers, in addition to watching the public hearing on the White paper in October 2023 (Appendix 1). The review resulted in a list of approximately 24 potential institutions, organisations, and companies, with representatives from each. The challenge arose in narrowing down the selection, and to make sure that as many of the potential voices as possible were included in the final selection. The final candidates were chosen based on a quota selection, where a set of respondents are chosen from determined categories relevant to the topic (Grønmo, 2004, p. 114). In the end, 13 interviews were carried out with actors from industry, academia and research institutions, politics and management bodies, and environmental organisations.

3.2.2 Conducting semi-structured interviews

The interviews were conducted in a semi-structured manner and an interview guide was designed to help answer the research questions (Appendix 2). The interview guide was prepared based on the research questions, and contained a set of themes and guiding questions. Before I set out for interviews, the interview guide was tested in a pilot interview with a colleague at the internship location with knowledge of the topic. Some changes were made after the pilot to increase the clarity in the question formulations. During the interviews, the questions in the interview guide were in many cases rephrased into a more oral manner, occasionally on the request from the informant, with the aim to clarify the meaning of the question (Kvale & Brinkmann, 2021, p. 166). I began each interview with an inquiry regarding the individual's personal relationship with the ocean. This approach was intended to engage the informants on a personal value-based level, potentially enriching the depth of their responses beyond the perspectives tied to their professional roles. Following, all informants were asked to elaborate on what *marine sustainability* meant for them. How they understand sustainability and marine sustainability might relate to how they understand the problem of DSM, and could give some more depth to those answers. The remaining main questions of the interview were divided into three overarching categories (Appendix 2):

- Data
- Visions and imaginaries
- General reflections on deep-sea mining

These categories were chosen to explore the informants meanings, understandings, and opinions about what types of data that exists in this context, what data is to them, how they view the role of data, and their understanding of the general issue of DSM. The two first categories, "data" and "visions and imaginaries" were both initiated with one or two introductory question to get the informants' own descriptions and understandings of the topic. These questions were relatively open, in order to let the informants highlight what they identified as most relevant or important. The interview guide also provided a set of follow-up questions I could pursue, depending on the answer from the informant. The questions in the last category, "general reflections on deep-sea mining" aimed to get an understanding of the informants view of DSM per se.

The aim was to perform all interviews in person but due to logistical issues, 9 had to be conducted online over Teams. On average, the interviews lasted about 50 minutes, ranging from 25 to 75 minutes. All interviews were recorded and later transcribed in MS Word.

3.3 Data analysis

The analysis of the semi-structured interviews is based on thematic analysis. Braun and Clark (2006) describe a six-phases process of thematic analysis and highlights the importance of the process being iterative. Table 1 shows the six phases of the process and how the analysis in this study was done according to the phases.

Table 3.1: The six phases of thematic analysis (Braun & Clark, 2006).

1. Familiarization with the data	First, the interview transcripts were read a few times with an open mind, to get familiar with the material. Then, the transcripts were re-read, now with a focus on the study's goal of identifying views of data of relevance to DSM in Norway. This was done to get a sense of general themes in the data material.
2. Generation of initial codes	Going through the transcripts more thoroughly, interesting sections were highlighted and turned into a set of different codes. Such codes are points of significance in the data material and could be either a few words or whole paragraphs. This was done two times to make sure nothing was overlooked. A set of codes was established across the data material. In addition to the codes, several "meanings" were identified. These meaning are text segments that says somethings about one or several codes.
3. Identification of themes	The codes, and the belonging meanings, were then gathered into initial themes. This was done by writing the name of the codes on separate pieces of paper and collating them into several piles which then ended up being some of the initial themes. Doing this, it became possible to see correlations and relationships between codes and between themes, in addition to sub-themes.
4. Reviewing themes	The themes were assessed to see if they worked with the codes and overall, for the data set. In reviewing the themes, some changes were made to the initial set of themes. Some themes were merged together, and some were adjusted/modified to sub-themes. This phase resulted in a thematic map, or an overview of the themes and sub-themes, which can be seen in *Figure 1*.
5. Defining themes	In this phase, the themes are defined by developing a narrative for each of them. The themes were described both separately and in relation to the others. All of the themes were also given precise names.
6. Evidencing the themes	This phase is the writing of the analysis, and will follow in the next chapter, Chapter 4.

Steps 2-5 in the analysis process brought with them some challenging elements. The first challenge arose in identifying specific codes, making sure that they were not too broad. However, by repeating the process a second, and for some interviews a third time, this became easier. Some codes were disregarded as they only applied to one or a few interviews. Going a step forward to the process of identifying themes also helped to see the connections between codes, meaning and themes. The process of reviewing the themes was an iterative process. Initially, 5 themes were chosen, but after going through the data material, the codes, and meanings several times, I ended up with 3 themes with associated sub-themes.

The empirical findings from the data collection and analysis are presented in Chapter 4.

3.4 Reflections of choice of method

Challenges and limitations occur in all research and are significantly linked to the selection and execution of methodology. The aim of this study is to explore the visions a set of stakeholders have of data in relation to DSM in Norway. In this context, it makes sense to take a qualitative rather than a quantitative approach, as the study seeks to analytically describe the findings and it does not have an intention of, nor the grounds to, statistically generalise the findings (Grønmo, 2004, p. 144). Other methodological concerns pertain to the constructs of validity and reliability, which will be examined in greater depth in the following sub sections.

3.3.1 Validity and reliability

I have considered validity as the issue of whether or not the chosen methodological approach is suited to answer the research question. (Clark et al., 2019, p. 53; Grønmo, 2004, p. 241). Kvale & Brinkmann (2021, p. 277-278) argue that it is important to be concerned with validity throughout the entire research process, from planning to analysis. First, semi-structured interviews with strategically selected informants who are publicly concerned with DSM suits the research question. However, the fact that the study is only based on semi-structured individual interviews might limit the rigour of the validity. It could have been relevant to analyse public documents written by the different actors to compare with the interviews, as well as performing fieldwork and participatory observation. This might have been interesting to investigate whether or not the informants expressed their own personal view or their affiliation's view.

The concept of saturation has also been considered, as an important criteria for the size of the informant selection (Grønmo, 2004, p. 104). Grønmo (2004) emphasizes that data collection should not be discontinued until new data no longer provide essential information. I carried out a total of 13 interviews. During the last couple of interviews, I had the experience that no new information was added to the table, and the decision was made to stop after the 13th interview. Ultimately, the balance had to be struck between richness in methodological approaches and data sources on one hand, and the practical constraints of the 30 ECTS master project on the other.

Reliability is concerned with the trustworthiness of the data material, how consistent and stable the data is and whether or not the data sampling is repeatable (Clark et al., 2019, p. 52; Grønmo, 2004, p. 240-241; Kvale & Brinkmann, 2021, p. 276). First of all, transcription of interviews poses a potential limitation; the quality of the recording could be poor considering whether or not one manages to include the paralinguistic and the emotional elements, meaning what the informants express beyond the explicit words (Kvale & Brinkmann, 2021, p. 211). In order to reduce these potential limitations, I listened through the recordings several times and were careful in retaining the details. The interviews were transcribed verbatim, and paralinguistic elements such as pauses, laughter and sighs were included and written out in the transcriptions. These measures were taken in order to try to retain the full meaning of the informants expressions also in the written transcriptions. Reliability is also a matter of whether or not the data sampling is done rigorously so that the data material is consistent and repeatable. The data material shows redundancy, due to the fact that similar questions were asked to each informant. The themes are recurring across the data material, even though the focus put on each of them varied amongst the informants.

3.3.2 Other limitations

I have reflected upon my role as a master's student in sustainability, as well as my role as an intern with REV Ocean and HUB Ocean, in the interview settings. As mentioned, DSM is a highly debated topic in terms of sustainability, and there are strong voices advocating for whether or not DSM is sustainable. Although the primary objective of this study did not encompass an evaluation of the sustainability of DSM, the topic was included indirectly in the interview, and was also raised by several informants both just before the interview started or in the course of the interview itself. Some informants ventured to speculate on my personal stance on the issue, informed by my academic and professional engagements, being a student in this master's programme and having the role of an intern with REV Ocean and HUB Ocean. Such perceptions could potentially influence informants to withhold information or shape their answers according, presuming a perceived bias on my part. However, generally, I had the experience that all of the informants spoke freely. In addition, during several of the interviews, my experience was that due to my "social status" in that setting as a masters student versus their role as an expert in their field, the informants were detailed in their answers, and to some extent stepped into a role as an educator, teaching their expertise to me. Hence, I did not have a feeling that the informants were withholding information, but rather that they expressed an urge to share their meanings and opinions. Thus, despite the many potential pitfalls, my experience is that the overall integrity of the research is not compromised due to my role as a student of sustainability and an intern with REV Ocean and HUB Ocean.

Given that DSM in Norway is a topic of immediate interest, it might be important to note when the data gathering began and concluded. The collection of data started in November 2023 and wrapped up in January 2024. During this period, two significant occurrences transpired. Initially, in December 2023, news broke of a consensus to initiate DSM on the Norwegian seabed. Subsequently, in January 2024, the Norwegian Parliament voted on the matter, resolving to proceed with DSM. The timing of the interviews, conducted both before and after these central developments, could have influenced the participants' responses. However, considering that the purpose of this study is not to examine the debate itself, I do not see this as a major limitation, though it is nonetheless an important aspect to mention.

3.5 Ethics

Qualitative studies come with several ethical unavoidable issues since the aim is to explore and describe people's meanings and personal believes for the public eye (NESH, 2021). Ethical reflections must be made throughout the entire interview process, from planning to verification and reporting (Kvale & Brinkmann, 2021, p. 97).

The thesis is registered in RETTE, which is University of Bergen's administrative system for processing personal data in research projects and theses. The participants were solicited via email, and were given an information letter with information about the study and the study's aim. The information letter also contained information about their right to withdraw from the study at any point, and that their data then would be deleted. In addition, they received a consent form they had to sign either in person or over email, before the interview could start. At the outset of the interview, it was explicitly communicated to the informants that the session would be recorded. Access to the identifiable data material has been exclusively restricted to myself and my main supervisor.

The topic of the study, DSM is a sensitive topic and there are relatively few actors that have been publicly active in the debate. Consequently, there exists a possibility of informant re-identification when associated with their professional affiliations. Thus, even though the interviews did not ask for sensitive personal information, all informants have been deidentified. Another measure taken to protect privacy and confidentiality was to remove the identity of informants in the presentation of individual quotes. However, even though confidentiality and privacy are important measures, NESH (2021) also emphasises that the public has a valid interest in gaining insight into how public institutions, private companies, and non-governmental organisations work. Thus, although individuals with extensive knowledge of the topic might be able to reidentify the informants, the fact that the informants were studied in their work context is supported by the argument NESH (2021) makes.

4. Results and analysis

In this section, the findings derived from the semi-structured interviews will be presented. The results are analysed based on a thematic analysis, as described in Chapter 3. The analysis produced three main themes with some associated sub-themes (Figure 1). This chapter is organized according to these primary themes, presenting them in detail and with a selection of quotations from the interviews to exemplify both the principal and subsidiary themes. In line with the reflection on privacy and confidentiality specified in Section 3.5, informants remain deidentified, and thus the quotations are not attributed to specific individuals. Quotations originally in other languages have been translated into English by me.

Generally throughout the interviews, I had the experience that the topic of data in this context was not something the majority of the informants were used to talk about or reflect upon. However, most of the informants talked freely and light, and answered the questions with energy and enthusiasm. It was clear that the topic of DSM was of interest to all. The general experience was that the informants had long reflections, and I sometimes had to interrupt in order to make sure we would get through the essential questions.

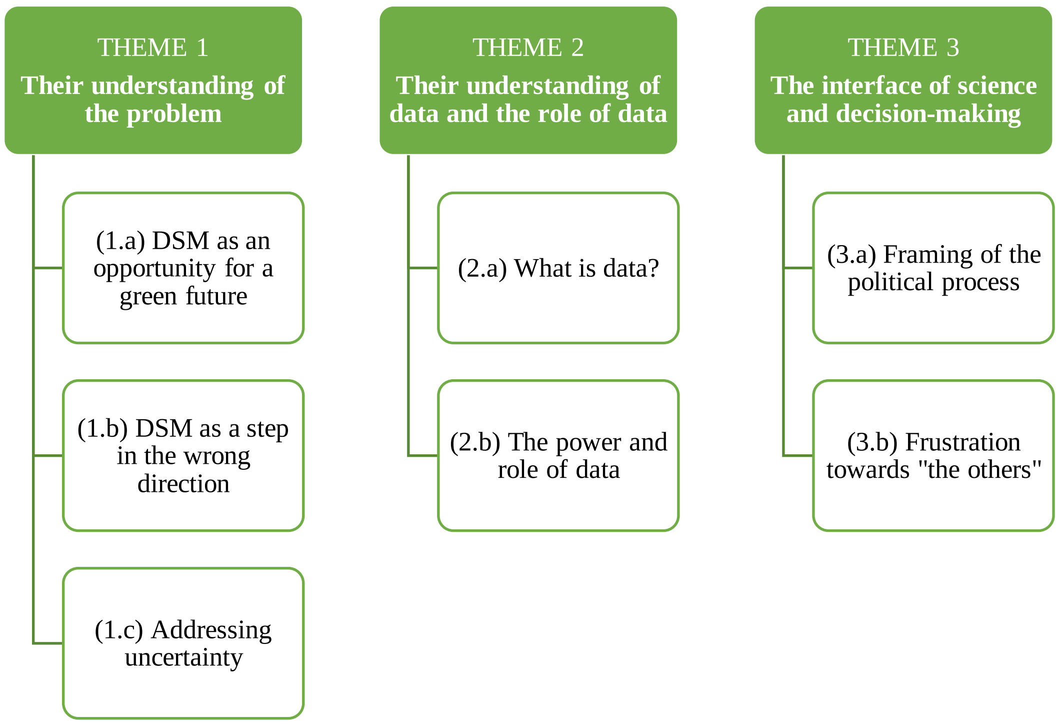

Figure 4.1: Overview of main themes and associated sub themes.

The red thread in the analysis is that all of the informants perceive data as something that is *highly important for decision-making*. However, their understandings of what data is, as well as their understandings and arguments as for *why* data is important and what role it should have, varied amongst the informants.

4.1 Their understanding of the problem

The first theme that was identified by the thematic analysis process described in Section 3.3 has been named “Their understanding of the problem”. With this, I mean how the different actors frame the issue of DSM in Norway, what they highlight as important, and how they view it in relation to sustainability. This theme, which was not initially anticipated, emerged prominently from the data, almost serving as a foundation for the other themes that were identified. Their understanding of the issue itself can contribute to illuminate their vision of the future, particularly within the scope of science, data, and technology. Overall, all informants acknowledged that there is a need for minerals in today’s society, although their elaborations on this diverged. Generally, two main understandings were identified: (1) DSM in Norway as an opportunity for the green shift, and (2) DSM as a step in the wrong direction.

4.1.1 DSM as an opportunity for a green future

First, several informants framed the problem of DSM in Norway as an *opportunity*, in terms of collecting the needed minerals for the green shift. In their view, the need for minerals is urgent and crucial if the green transition is to take place. Renewable energy sources like wind turbines, electric vehicles, and the wider electrification of society were identified as crucial for the development of society, all requiring mineral resources for their advancement. As part of this green transition, DSM was also discussed as a step towards Norway’s transition away from the petroleum industry. The respondents mention the transferable skills, technology and knowledge from the oil sector that could be used in the establishment of this new industry. Some even describe DSM as a necessary mean for this transition to happen.

> “And that shift, it’s not happening, and it's not going to happen faster than we have access to metals. It is the metals that control how fast it happens, not decisions at COP28 or anything like that. They can decide whatever they want but if there aren't metals to implement it, then it doesn't happen."

It was highlighted by some of the informants that mining on land, which is the only source of minerals today, has a lot of challenges, and that DSM could be a way of being less dependent on these mines. The informants especially mentioned the societal challenges that a lot of the land-based mining in continents such as Asia and Africa entail. The copper production in Kongo was highlighted by one of the informants as a particularly bad example of this. Reading between the lines, I got the sense from the informants that they believe that DSM in Norway could substitute some of the mineral demand from these land-based mines, and consequently reduce/get rid of some of these societal challenges.

> "That is the challenge, that these minerals come from a mine on land that we do not always have control over, both in terms of the environmental and societal impacts."

When they talked about the mineral resources on the Norwegian continental shelf, several of the informants did not talk about whether or not these minerals should be considered for mining in the first place. In their reflections, it seemed there was an implicit understanding that potential resources must be investigated further. With this, I mean that the question of whether or not Norway should explore the possibility of a new mining industry on the seabed was never raised. There was an embedded understanding that DSM *of course* should be explored as an opportunity.

> "Since around 2011, we discovered that we had several/some minerals on the Norwegian continental shelf, and since then we have mapped the resources, and now it has come so far that we have new laws in Norway, plus that we are also on the verge of initiating announcement of licencing rounds".

There was also a congruence between how these respondents viewed DSM as an opportunity and the way they talked about sustainability and marine sustainability. Generally, the answers around sustainability were broad and vague, discussing the management of the ocean, as well as the *possibilities* that the ocean possess. Some were sceptical to the term sustainability in general and argued that the term is often misused or used as "decoration". Several also discussed marine sustainability as a two-sided coin: *taking care of the ocean,* but also using the *necessary resources* from the ocean.

> “Eh, but marine sustainability is that one does what is best for the ocean, but at the same time what is necessary.”

This quotation showcases this two-sided coin and also expresses an understanding of an implicit contrast between what is *good for the ocean* and what is *necessary for humans*. However, none of these informants explain what they mean is *good for the ocean*, what success looks like in that context. Neither do they reflect on what sort of activities or actions they perceive as *necessary*, and those that are not. Their understanding of marine sustainability entails a balance between the needs of the ocean and humanity. However, in their way of framing marine sustainability, it appears as if this balance has a prejudiced overweight on the needs of humanity. First priority is the needs of humanity, and then comes the needs of the ocean.

As mentioned, DSM is seen by these actors as a sustainable opportunity in terms of decarbonisation of society. It seems that these actors are mostly concerned with sustainability in terms of tackling climate change, and that they are seeing climate change as the most urgent issue to deal with. Upon discussing the potential future of DSM as a new industry in Norway, despite several challenges, these respondents were overall positive to the technological development making this possible. It was highlighted that there is a belief that technology for extracting deep-sea minerals will be developed to have minimal environmental impact. In this way of framing and understanding the problem lies a technology optimism, a trust in technological development for a visioned future. Overall, the topic of DSM was understood and viewed by some of the informants as an *opportunity* to deal with sustainability, and particularly climate change.

4.1.2 DSM as a step in the wrong direction

> “I mean, deep-sea mining does not come to my mind when I think of marine sustainability. Absolutely not.”

In contrast to the informants that understand DSM as an opportunity, several informants expressed concern and scepticism towards DSM and articulated that this activity will not contribute to a more sustainable society nor future. Their take on sustainability is articulated through a focus on the environmental side and articulate a concern for the (marine) environment.

> "It is first and foremost about environmental sustainability. Then there is economic and social sustainability, but you can't have sustainability without environmental sustainability"

Even though they recognise that there is a demand for minerals, they argue that the current demand should be addressed not by extracting new, virgin resources but through establishing a circular economy with investments in relevant technologies and infrastructures. Several emphasized the capitalist consumer society as the root of the problem, and that DSM would only address some of the symptoms and not the underlying causes of environmental issues. The shift they envision transcends the notion of the green transition, advocating for a comprehensive move towards a sustainable future, looking beyond the decarbonisation of society.

> "On one hand, I believe that yes, we need minerals for the green shift, but most importantly, we must learn to use fewer resources. I think that's step one. And if we haven't taken the first step, then I don't think we deserve those minerals in the deep sea either. We can't just say that if we claim we need them for the green shift but not consider the other aspect simultaneously, then we will just end up using more, and I don't believe that's sustainable. So my view is that if we are to shift, we must shift towards a sustainable society."

In their problem framing, the informants highlighted the potential consequences that DSM can entail for the marine environment, and focused on what could be lost in terms of resources and nature. They were concerned with the marine life and potential resources that these benthic habitats harbour. It was emphasized that the marine environment in these areas not only is poorly understood, but that it, as nature in general, has intrinsic value. They cautioned against risking the loss of species, some of which may not have been discovered yet or are still unknown to us. This concern was especially emphasized with regard to the technology used for extracting the minerals on the seabed floor. Many voiced apprehensions about the fact that some of this technology is either undeveloped or in the initial stages of development.

> "But we know nothing, this is a completely undeveloped technology."

Land-based mining was also raised by these informants. However, different to the others focusing on the challenges of land-based mining in other countries, these informants highlighted the potential that Norway has for land-based mining. Several of the informants expressed a concern that DSM is taking away focus on and efforts put into land-based mining in Norway. Norway already has a mining industry on land, and several articulated that instead of moving the mining industry to a new, unknown habitat, the focus should be on improving the industry that already exists on land.

> "On land, it is basically more profitable, and we know much more about the technology than what would be the case on the seabed. But at the same time, it can be done extremely more environmentally friendly than it is done today. So our solution is increased focus on circularity and on more sustainable mining operations."

Overall, these actors viewed the issue of DSM as a step in the wrong direction, arguing that the activity does not align with environmental sustainability, and that the focus should be in implementing a circular economy and improving terrestrial mining.

4.1.3 Addressing uncertainty

Consistently among all the informants, it was expressed that there is a degree of uncertainty associated with DSM, mostly related to the fact that this industry is not yet taking place anywhere else in the world. Regardless, the level of uncertainty, and the importance of this uncertainty varied among the informants. For the informants that were presented in Sub-chapter *4.1.1 DSM as an opportunity for the future*, this uncertainty was addressed as a window of opportunity. Contrary, for the informants presented in *4.2.2 DSM as a step in the wrong direction*, the uncertainty was articulated both as a sign to not go forward with this, and almost as a fear of the unknown.

The first theme, "Their understanding of the problem" explored the informants views and perceptions of DSM. Two sub-themes emphasised the main difference: viewing DSM as an opportunity for a greener future or viewing DSM as the opposite, a step in the wrong direction for a sustainable future.

4.2 Their understanding of data and the role of data

The second theme that arose from the interviews was the informants' understanding of the data and their view of the role of data. The theme explores *what data is* to the different informants, how they talk about data, and what the data is good or not good for, in their view. There were big differences in their *knowledge* of existing data. However, all informants stressed the importance of data, even though their views of why differed. In this theme, two sub-themes developed. The first sub-theme is concerned with *what data is* for the respondents, while the second explores their view of the role of the data, and the power data holds.

4.2.1 What is data?

The informants were asked about what types of data they were familiar with, as well as their thoughts about data in the context of DSM in Norway. When given these questions, the answers varied among the respondents, from the respondents listing up different types of scientific data to vague statements. Before I go any further, it can be useful to note that the word "data" inherently holds different meanings, and that there is a correlation between how one understand the word data and one's profession or academic background. Indeed, several informants inquired about what I was referring to when questioning them about data. In those instances, I replied that I was interested in their perspectives.

One the one hand, some informants gave clear, relative precise answers when questioned about data. A few of them had a clear vision of data in a scientific context, either listing different types of (scientific) data or going more into detail on one or more types of data.

> "For plankton, we have this data [points to a figure on a screen] and that is deep stations. And we have something here [points] and [points] that goes down to 700 meters, but that is all we got. For fish, we have no trawling under 800 meters, so there we know nothing."

This expression of data as something that is scientifically collected and produced suggests a particular understanding of science and scientific process. For these informants, data is the result of extensive work and research that requires both time and funding. Data is numbers, pictures, videos, tables, and figurers collected through standardised procedures. Regardless, these expressions or views about data were not limited to the informants representing research institutions. To some extent this could articulate a way of thinking where scientific precise data is valued as a particularly important type of data or knowledge, at least in the context of DSM. However, this was not followed up explicitly in the interviews, and could also be caused by the informants trying to answer the questions precisely.

On the other side, some informants gave rather vague answers when asked about their knowledge of data. Whether or not this means that their knowledge of existing data is limited or that they just do not regard the specificities of data types as the most important is difficult to answer. These informants did not talk about data in a scientific context, but rather focused on data as useful information, a functional unit. They were mainly concerned with data being the source for *better knowledge*.

> "How am I going to answer this, we have to have a better knowledge base."

Some of informants were even more unclear in their statements of data by articulating that *the type of data that is needed is the type of that that is needed*. By this I mean that the informants distanced themselves from the question and to some extent beat around the bush. As mentioned in the previous paragraph, whether or not these expressions mirrored their knowledge of data is not easy to answer. However, in their reflections, these informants viewed data in the light of activities or actions, emphasising that data is something that is needed to know whether or not an activity can take place. What this data is, however, was not specified.

> "I believe that one must collect the data needed to illustrate or document that what one is doing can be done in a responsible and sustainable manner."

To summarise, the informants held different views on *what data is*. Some expressed a clear and precise understanding of data in and for science. Others had a more vague vision of data, emphasising it as a tool for increased and improved knowledge. Lastly, some understood data as *something* that is needed to determine whether or not an activity can take place, thus expressing an even more unclear view of data.

4.2.2 The power and role of data

A general finding from every interview is the importance given to data by the informants. All of them explicitly expressed that data is important, even though their concept and understanding of what data is or could be varied greatly. When asked about the importance of data in this context, one informant answered the following:

> "Very, very, very, very, very, very, very."

Regardless of their understanding of data, they were all explicit in expressing that data either is or should be the basis in discussions around topics such as DSM. A general view was that data is important for decision-making, making up the foundation for science-based management. An interesting founding was that this trust in data to ensure *proper*, *right,* or *knowledge-based* decision-making was prominent amongst all informants, even though they held different views on what outcome would be seen as *the right one*.

> "[Data is important] in order to build the right knowledge, and then data need to be the basis for decision-making."

It was a unanimous view that *if we just get more data, the right decision will be made.* There is an implicit trust in data amongst the informants that is not argued for or explained by any of them. However, even though they all articulated the importance of data, the nuances in their arguments of why varied.

For several of the informants, the importance of data was articulated in the terms of the need to understand the ecosystems in question. It was argued that more data would increase the knowledge and understanding of the benthic ecosystems, as well as the pelagic ecosystem. Further, these informants emphasised the view that without basic scientific knowledge of these systems, it is difficult if not impossible, to assess potential impacts from an industry such as DSM.

> "So you're kind of like, you need to try to understand what's there. It is an incomplete jigsaw puzzle. So the more data you have, the easier it is to try to understand these systems."

This quotation emphasises the view held by many of these informants that there exists a final answer or solution to understanding these ecosystems, and all that is needed is to find and place all the pieces of the puzzle. In their reflections, they stressed the complexity of these systems, but they still believed in more data to complete the "incomplete jigsaw puzzle". Nevertheless, a few of the informants noted that with their current knowledge of these systems, they know enough to say that these ecosystems will not recover from DSM. This view contrasts the jigsaw puzzle metaphor, stressing that the complexity and uncertainties of these systems are too great to ever achieve a complete understanding.

In another perspective, data is seen as important for industry and the public sector, the decision makers, for them to know whether or not they are doing the *right* thing. Contrary to the informants who argued that data is important for understanding the ecosystems, some informants stated that the data is important from the perspective of industry, in order to determine if an activity can be conducted in the area.

> "[The data] is important so that the public sector can take the right decisions, but it is also important for industry, for them to be sure that they are doing the right thing."

For some, *getting more data*, was seen as an issue of data sharing, especially from research institutions and the academic world, which I will explore further in subsection 4.3.2. For others, getting more data was articulated as a need for more science. By collecting more scientific data from the seabed in the opening area, more knowledge will be gathered and the base for proper decision-making will be there.

The informants' understanding of data and the role of data varied, even though they all explicitly stressed that data is important in decision-making. Some viewed data as important for improving the understanding of the ecosystems. Others were more concerned with the importance of data for decision-making in both industry and the public sector, where data is used to as a tool to ensure that the decisions made are the right ones.

4.3 The interface of science and decision-making

The third and last theme that emerged from the analysis is concerned with the interface of science, or scientific data, and decision-making. The integration of scientific knowledge, understanding and data in decision-making was discussed by all informants. The theme is associated with the sub-theme "the role of data" but goes a step further in including how visions of data can influence understanding of the political process and how differences in such visions can generate frustration. All of the informants talked about the political process of opening areas on the Norwegian continental shelf for DSM, and expressed their interpretation or understanding of this opening process and how data and scientific knowledge plays a part in that process. In addition, several of the respondents voiced frustration towards other actors or sectors. This frustration was sometimes articulated as other actors acting or being irrational. These findings were divided into two sub-themes; "framing of the political process" and "frustration towards other actors".

4.3.1 Framing of the political process

Nearly all informants articulated, to some extent, their understanding of the manner in which the political process was established, how it works and why it is important. All were aware that opening marine areas within the jurisdiction of Norway for industrial activity is a political decision ultimately for society to make through its democratic institutions, and no one expressed any disagreement or opposition towards this. In other words, all of the informants shared the perception that democratic decision-making by elected politicians is how it should be. However, the different perspectives arose in relation to what the opening process really means, what the implications are. The first perspective express a trust in the political process, while the other stress a concern about a potential gap between theory and reality in the political process.

Stepwise process – the decision is yet to come

One group of informants highlighted that the opening process is *only* a step to collect more knowledge and data, and not a decision to open for extraction of minerals. They emphasised the intention that this is meant to be a stepwise process, where it will be made sure that the environmental risks are at an okay level before a next step is taken. The criteria, regulations, and protocols of this political process are in place to ensure proper decision-making, and these informants stressed the need to believe that these rules will be followed. From this way of framing the political process, we might infer an implicit trust in the political system to ensure that scientific knowledge, data and advise is taken into consideration in decision-making.

> "That is what we now have made a decision about, that the authorities start to allocate licenses. In practice, that also implies that commercial actors can contribute to that knowledge gathering and mapping."

These informants expressed a satisfaction with the political process. They were conscious about the criticism raised against especially the impact assessment as being based on insufficient knowledge. However, they dismissed that criticism, arguing that the impact assessment met the requirements it was supposed to fulfil according to the Seabed Minerals Act. In their understanding, the knowledge gaps recognised in the impact assessment should be, and will be, filled simultaneously as the mineral resources on the seabed are explored further. Aligned with the view of a stepwise process, it was expressed that the impact assessment had to be general, and that by opening the areas to commercial actors, more detailed impact assessment of the smaller areas of interest can be developed, and these will be sufficient.

> "It is obvious, the way I see it, that the impact assessment had an impossible task, right. It was supposed to describe the environmental conditions in an area of 600 000 square meters and that is impossible. At least at something else than an overall level, and overall, it is an okey document."

In practice already set – a slippery slope

The remaining of the informants viewed the political process as insufficient, and in their perspective by opening the areas for exploration, the areas are in practice also opened for exploitation. In other words, they do not see the same effect of the stepwise process, and instead emphasise the high risk of this process being a *slippery slope*. First of all, the informants highlighted that the opening process does not follow scientific advice. They articulate that several highly respected institutions have publicly noted that the impact assessment does not take the knowledge gaps sufficiently into consideration. The fact that the process continued despite of these comment, they argue is a result of science not being given the proper weight it should have in decision-making.

> "We have tried to express in all of our comments to the consultation papers that we don't have any knowledge. (…) The impact assessment has to be built on the knowledge we have, if not, it is empty. It is meaningless."

Another perspective they articulated was that an opening process in practice is a *slippery slope*, despite the criteria, regulations and promised check-points. The informants stressed that if science is not listened to at this stage, as expressed in the quotation above, why should they believe that the opposite will happen at a later stage. It was emphasised that once exploration is initiated, it will be easier to proceed with exploitation rather than to revert to closing the areas for any mining activities. Some also referred to the law, the Seabed Mining Act, and stressed that by opening these areas to exploration, the decision is in practice already made, favouring a potential industry over potential environmental risks. One of the informants expressed this clearly and explicitly:

> "The politicians say that this is *only* an opening decision, we have not agreed that there will be extraction of minerals. But if you read the law you will see that then the premise is set, because already at that stage, one should have assessed the different interest against each other. And in this case, summa summarum in this situation is that the situation already in that opening decision is made in favour of initiating the industry."

The informants held different views on the political opening process. While some expressed trust in the criteria and regulations embedded in this process, others stressed concern about the true rigour of these rules. The informants either understood the opening process as a stepwise process safeguarded by the strict regulations, or they understood it as a slippery slope, where allowing exploration in practice also entails exploitation.

4.3.2 Frustration towards "the others"

Frustration towards some actors, or *the others* was expressed to different extents by all actors. This frustration took different formats, but overall it was described as a lack of understanding among *the others*. Some of the informants articulated this frustration clearly and explicitly, while others presented it more as expressions of resignation, in the sense that they had given up on making the others understand. In some cases, the informant did not explicitly articulate *the other* the frustration was targeting, whether it was a group of people, an institution, a sector, or a way of knowing. By expressing this implicitly, it appears that several of the informants perceive a polarization in the debate surrounding DSM, yet this seems so evident to them, that there is no need to elaborate or specify who this *opponent* is. Others explicitly delineate "the other" and direct their frustration towards these actors' lack of knowledge or understanding. This highlights the impression all of the actors have of a polarisation, but it also demonstrates that they contribute to his polarisation by upholding the focus on *the others*, rather than breaking down the barriers and looking for common grounds. This polarisation appears as a disagreement not necessarily about whether or not Norway should open for DSM, but about whether or not the process has been *good enough*.

On the one hand, several informants expressed a frustration towards politicians and the political process. Overall, this was portrayed as Norwegian politicians either not understanding, or not having the will to understand or value science and scientific process. In this, many pointed to the impact assessment and the comments from different scientific communities regarding knowledge gaps. They express a frustration towards politicians prioritize their own agendas over scientific knowledge and advice. In this, several also articulate a lack of understanding of this agenda, that it is difficult to completely understand both why the political process continue to go on despite continuously advice against it and why there seems to be such a rush in the process.

> "It is almost hard to believe how outrageously bad the process is. I was chocked myself. In a way, it is an unparallel process when it comes to not listening to science, not being knowledge-based. Not even trying, not even pretending to try and listen too science."

Some also addressed the role of scientists and experts. If their advice is not taken adequately into account in decision-making, then why are they asked for advice in the first place? As one of the informants said, "If we have many experts that are not listened to, then what is our function? Another layer to the issue of science not being taken seriously was raised by several of the informants. They addressed a set of numbers published by NOD related to the potential of mineral resources on the Norwegian seabed in the areas of interest. One of the informants even went so far as to calling it "kindergarten science versus grown-up science.".

> "There is no foundation to support what NOD and ME say. They are publishing some numbers about the potential and such, which we believe are highly speculative. It is our belief that one does not have any foundation to say anything about."

On the other hand, frustration was also expressed towards the scientific community, and in some cases explicitly towards scientists conducting biological research. The red thread in this frustration relates to the slow pace of scientific process and a feeling that the scientists do not understand what is important and not. First of all, some of the informants addressed the lack of data as a result of scientists, and specifically biological scientists, not being willing to share their data. At the other hand, they praise the industry for their data sharing.

> "It is of no help to collect more data if it ends up in the pocket of a scientist. The data must be available for everyone, and it needs to be quickly available."

The frustration aimed towards the scientific community also include a perspective of scientists only doing science on the topics or in the areas the scientist find the most interesting. This corresponds to the view of data being important for humans and industry. The informants express the need for scientists to understand that data needs to be collected not just for science, but for an issue of interest to industry or human activity in general.

> "There has been what you might call a conflict of interests between industry and researchers because the researchers find it most exciting to go to the active sites – that is where it is fun, that is where stuff happens – but we have said that we will not mine the active sites, so figure out what is away from those sites. But that has been more difficult, to get them to spend scientific cruises on doing that, because that is no fun."

Frustration towards *the others* was expressed by all of the informants. In some cases, this frustration targeted politicians and the political process for not understanding science or not taken science seriously. The other informants expressed frustration towards the scientific community for their lack of understanding of the bigger picture.

5. Discussion

The aim of this study was to explore how the use and importance of scientific data is visioned and imagined in decision making on the context of DSM in Norway, by central actors. Here, I will first briefly summarise the findings presented in Chapter 4 and then discuss these findings in the light of the theoretical concepts presented in Chapter 2 and similar research.

5.1 Brief recapitulation of the results

The main findings from Chapter 4 can briefly be summarised as follows. The findings were categorised in three themes, presenting the informants' view on the problem, their understanding of data and the role of data, as well as their reflections on the interface of science and decision-making. In general, DSM was either seen as an opportunity for a green future or as an environmental threat, in that it is an activity that cannot co-exist with the concept of sustainability. Data was understood either in a clear scientific context largely related to our understanding of the marine ecosystems, or in a vaguer framing more connected to filling knowledge needs for policy-making and decisions. A unanimous view amongst the informants was that data is important, even though the reasons why were different and perhaps even contradictory. The visions for data diverged from being important for *good decision-making* to being an important tool in understanding *nature in itself*. The science-policy interface was either understood as good, that the present systems account for all the important measures, or as insufficient, in that scientific advice is not listened to. In conclusion, there was a general expression of frustration towards *the others*.

It is clear from the results presented in Sections 4.2 and 4.3 that there exist several different understandings of *what data is*, and how scientific data is best translated into policy. The three main themes in the results: (i) their understanding of the problem, (ii) their understanding of data and the role of data, and (iii) the interface of science and decision-making, all resonates with the greater picture of how science and policy are and should be interacting to achieve a more sustainable future. In their reflections, one can see contours of several of Funtowicz and Strand's (2007) models of justifications, interconnected with complexity, uncertainty, and perceived views on the roles of both science and governance.

5.2. A world of frustration

The issue of DSM was understood differently by the informants. DSM was either seen as an important part of the solution for the green transition, or as the opposite to sustainable development. Not only did they disagree on the solution, but they had different ways of framing the problem. These conflicting problem framings reflect that the problem at hand, DSM, is indeed complex and wicked (Rittel & Webber, 1973). The problem at hand portrays in a system, and when this system is not understood coherently by the actors involved, finding a solution to the problem is challenging, if not impossible (Head, 2008). The conflicting views of how the process should proceed supports this. However, the informants themselves did not reflect on the conflicting problem framings per se, but rather expressed frustration in the form of "why don't *they* understand?". The reason why *the others* do not understand is given by the fact that they see and understand a different problem. Their conflicting problem framings also translates into the fact that they have different views of what is at stake.

In their expression of frustration, this demarcation of *us* and *them* is clear and prominent. The experience several of the informants expressed, that policy-makers do not understand science and scientific process coincides with Landström et al.'s (2015) study on scientific uncertainty, where scientific experts emphasised their view of policy-makers being unable to comprehend scientific uncertainty. Here, in this study, this feeling presents itself as a stronger frustration rather than just observations, emphasising the diverging problem framing and their views on what is at stake. This frustration towards policy-makers not being able to comprehend scientific advice is to some extend expressed as "I understand, the other do not", but is still accompanied by a belief that they eventually *will understand* once more science is provided to the table. Thus it could seem that there exists a belief – if it is naïve or not is not up to me to discuss – that the ideal of everybody understanding and then acting for the greater common good is still possible, and that more data could make for this common ground.

Several of the informants emphasised the scientific weakness in the resource estimates made by NOD. A report by NORCE on knowledge-based decision tools stated that in management plan work, there is a tendency that policymakers are too connected to the process of knowledge production, thus creating a self-referential system (Andersen et al., 2019). In this case, where the base of the White paper is the resource estimate provided by NOD, the challenge of policy-makers creating a self-referential system is clear, which some of the informants themselves noted. However, as I did not follow up on these expressions by the informants, I will not explore this any further. Nevertheless, the notion does coincide with the findings in the report by NORCE.

Not only did the informants express different problem framings, but they also had different perceptions of what makes a *good process*, how scientific advice should best be translated into policy and what the decision-making should look like in this context. One group of the informants expressed satisfaction with the current process, where the opening decision allows for exploration in parallel with knowledge gathering, and potentially exploitation. The other group expressed the opposite, voicing concern about the absence of listening to scientific advice. If we assume their reflections on and understandings of what good science for policy looks like as different models of justification for the science-policy interface, we can make sense of their expressions through two models: the modern model and the precautionary model (Funtowicz & Strand, 2007). These models can help to structure the prominent disagreements between the opposite views, and suggest an explanation for their frustration.

5.3 Data speaks *truth* to power

In this light of the models of justification for the science-policy interface, one prominent view amongst the informants reflects the *modern model*, where science is believed to speak truth to power (Funtowicz & Strand, 2007). The informants that expressed the views that coincide with the modern model are the ones that believe in the green transition to ensure a sustainable future. In their view, opening for exploration will enable further rational decision-making. In their descriptions of the modern model, Funtowicz and Strand (2007) emphasise that it presupposes a linear relationship between science and policy, whereby "science determines policy by producing objective, valid and reliable knowledge" (p. 268). Here, the scientific advice is highlighted as the source of political decision-making, but the scientific advice is not just science, but specifically *data*. The political process should not only be science-based, but data-based. It is expressed that they do not know what the *right* thing to do is, of whether or not the decision to open for DSM is good, but that in order to know what the *right and rational* solution looks like, *more data* is needed. Data is perceived as something that can be used by decision-makers to take these rational decisions. The outcome is understood to be open, both as an understanding of the current process and a belief of how it should be, and that data will determine whether or not it will be the right, rational thing to open for exploitation of deep-sea minerals.

As Strand (2020) writes, notions of the idea that science speaking truth to power is present in science-policy discourse in the EU, so this is not a new phenomenon. Pielke Jr (2007) also states that the scientist has a choice of what kind of role he or she wants to take on. In Gundersen's (2020) study of scientific experts in IPCC, he finds that they understand their own role to be, and should be, neutral, unaffected by personal values. Some similarities can be seen between my study and the findings in Gundersen (2020), because if the data is believed to be neutral and objective, the scientist providing that data would indeed also need to be value-free. However, an important difference between the findings in Gundersen (2020) and this study is that Gundersen studied the view of the scientists, but the similar views in this study is held by some of the other actors. Even though the informants did not explicitly elaborate on the conscious choice made by scientists of which role they take on in this context, I got the sense that the vision of the neutral scientist is perceives by society as the *right* way for the scientist to act.

The modern model faces a problem when complexities, uncertainties and values arise, but in this case, the issues are met with the view that they are manageable and controllable. The "jigsaw" remark by one the informants emphasise that the complexity and uncertainties of the ecosystems in question will be controllable when *more science* is gathered. In this way, uncertainties are translated into risks, thus making them controllable (Wynne, 1992). This reflects an absence of an understanding of the complexities of the ecology in the deep-sea ecosystems. In their understanding of uncertainties and what is at stake, they believe that this can and will be properly managed by the "step wise" process. The decision to open for exploration and exploitation will properly include data when *those data suits the process*. These reflections fits well with the modern model, and emphasises that the role of scientific data is to provide policymakers with the *right* and *enough information* to make decisions when they see fit. This understanding also coincides with what Strand (2022) describes as governance *of* complexity, where governing efforts are put into reducing and controlling complexity. To summarise, the informants who supports the green transition and DSM on Norway as a solution to sustainability issues related to energy and technology understand data in the context of DSM as a spokesperson for truth. They believe that this data will ensure that decision-makers make the correct, rational decisions through this step-wise process.

5.4 Data speaks *precaution* to power

The trust in data speaking truth to power is met with another view that does not believe in the objective power of scientific data in this context, but rather emphasise the need for precaution. Neither do they understand the current emphasis on the stepwise data-based (when seen needed) process to be possible, nor are they of the understanding that this is the right way to understand the interface of science and policy. The informants that supports this view believe that DSM brings with it more harm than good, and that precaution is needed when dealing with data in this context. They can be seen as implicit supporters of the precautionary model, seeing uncertainty not as a controllable risk, but as known unknowns that needs to be properly catered for (Funtowicz & Strand, 2007). Uncertainty is almost unavoidable in sustainability issues (Strand, 2022), but in this situation, there exist a consensus in scientific communities that the potential harms of DSM is too great, arguing for the precautionary principle (EASAC, 2023; Funtowicz & Strand, 2007). The informants in favour of a precautionary approach express an ecological and biological understanding that they believe is enough to know that opening for DSM would be harmful to the deep-sea environment, and possibly to the marine environment as a whole. They either express this understanding as something they hold themselves, being scientists that work with these topics, or they believe and trust the scientists that express these views.

The spokespeople of the modern model would say they the precautionary principle is accounted for in this context, both in law through the Seabed Minerals Act and the Nature Diversity Act, and in practice by the stepwise way forward. Those arguing for a precautionary approach on the other hand seem to fear what Funtowicz and Strand (2007) already has seen, namely that the precautionary principle is not strong enough in its denotation to ensure proper precaution in practice. What they fear is a slippery slope where the scientific uncertainty at every *step of the process* will be seen as controllable, thus advocating for going to the next step to collect more data rather than trusting that *the data speaks the words of precaution*. They know, or are of the understanding, that data can be understood and interpretated to give answers that fit different views. Thus, they fear that even though more data is gathered, the decision-makers perceived view of the data does not necessarily change.

It is clear, as noted, that the informants are frustrated, as they understand the ecosystems at play as so complex that regardless of how much data is collected, the puzzle will never be complete.

Their understanding and knowledge of the problem already know what the right thing to do is – to proceed with caution. In contrast to those in favour of DSM that holds a data-rational viewpoint, these people rather act from a value-rational point of view of biological understanding that advocates for precaution. They do however seem to have figured out that the system does not support this value-rational manner. Thus, they have to trust that science will speak precaution, but in order for this to happen, the right data needs to be represented. Stepping into Pielke Jr's (2007) shoes, the scientists can be seen to take on the role of the stealth advocate – the scientist that presents itself as an advocate for the objective facts, but rather advocates for their own personal believes. The scientists have had the perception from start that DSM would be harmful to the environment, but understands that the system works the way it does, thus advocating for precaution by giving advice that coincides with their understanding.

However, this categorisation of the scientists as stealth advocates seems a bit harsh in this context, as there is no personal agenda behind the stealth advocacy, but rather a hope that their advice can cause *the others* to understand the uncertainty the way they do. Similarities can be seen in the study by Gundersen (2020), where the scientific experts, despite emphasising the importance of neutrality, were conflicted in their moral responsibility as advocates for climate action. I would also argue that the fact that scientists take on the role as, or are seen as, stealth advocates could be seen as a reaction to the policy-makers practicing governance *of* complexity rather than governance *in* complexity (Strand, 2022). It seems that there would not be the same need for stealth advocates if the decision-makers themselves where able to acknowledge the dynamics of uncertainty and complexity in this issue. The concepts of *climate risk* and *nature risk* are increasingly used as initiatives to improve this integration of uncertainty in decision-making. The Norwegian Government has even appointed a specific Nature Risk Commission to gain understanding on how nature risk can best be implemented in Norwegian sectors and industries (NOU 2024: 2). Nature risk can be understood as "the danger of negative impacts for actors and societies from loss and deterioration of nature and biodiversity" (NOU 2024: 2, p. 12). The implementation of nature risk in decision-making could provide efficient tools of how to bridge uncertainties with decision-making, which aligns with the views these informants express.

Funtowicz and Strand (2007) presents two models that aim to solve this issue of value-ladenness, the demarcation model and the framing model. The informants' understandings to some extent reflect the demarcation model, solving the issue of values with a distinct demarcation of science and policy. However, what we may be seeing is that a value-free process is impossible in this context – as for sustainability issues in general – and that rather than trying to adapt to an insufficient system, one should rather advocate for pluralism (Strand, 2022). Those advocating for precaution, seeing DSM as a failure for sustainable development, believe that science should be the basis for decision-making, but in order for this to take place properly, the right expertise and the right perspectives must be represented. This brings up a double layer to the concept of *legitimacy*, – what Strand (2022) sees as the one thing neither the precautionary, framing or demarcation model can save the modern model from – that legitimacy can both be understood as normative, in the sense of what the right and legitimate process, and more descriptive or pragmatic, in the sense of what passes as consensus.

In the late 20th century, there was a debate on what type of biological knowledge should be considered correct or valid in the issue of genetically modified organisms (GMO) (Brill, 1985; Strand, 2001). There, the ecological uncertainties and risks of GMOs were either seemed as properly managed through molecular laboratory studies, or an issue that would only be understood through broader theory of ecological understanding (Brill, 1985). Similarities can be seen in the findings of this study, which show conflicting views about which scientific data or knowledge should be considered crucial and decisive. Some, the advocates for the data-based step-wise process, believe in detailed data to provide rationale for the right decision. The others, that express concern for a slippery slope and thus advocate for precaution, believe that detailed data can be tailored to fit any view and rather think that general ecological understanding should be the base for decisions in this context.

5.5 Data is power

Following the lines of the diverging problem framings and understandings of the process, the two models of justification also reflects views on co-production. The understanding of the modern model includes a vision of data to hold some "magic powers", that *eventually*, the data will create a complete understanding of DSM and its possible effects on the environment. This was reflected in my empirical material with correspondingly vague expressions of what data is and the role data should have in this context, as something rather vague that is needed for policymakers to know that their decision is the right one. As Strand (2020) marks, science is appreciated when it fits the political agenda. On the contrary, those advocating for precaution also presented a clearer view of data and the role it should have, not in the sense of a jigsaw puzzle, but as knowledge that should be considered despite being uncertain. These informants seem to also be supporters of increased implementation of *nature risk* in the decision-making on this context. As noted above, they do not believe the answer to lay in the data, but have understood that in this context, *data is power*. These visions show that how data is conceptualised is connected to how one understands process and how one imagines the interface of the two to be; in other words that they are co-produced (Jasanoff, 2004).

This is not a study of sociotechnical imaginaries *per se*, but these visions of co-production, their understandings of what data for policy should look like fits into the bigger picture of an imagined or desires future society. The first desired future involves DSM and green technology development, and were science and policy is kept as separate entities – the "magic powers" of data will ensure that the developments are sustainable and good. On the other side, informants describe a future free from DSM, in which the environment is taken better care of, and the technological investments are focused on the circular economy and reduced consumption. One could even see notions as to what world the informants imagine as desired, not only the desired solution for DSM. On one side, the sustainability challenges of today will be solved through green growth and continued technological development – having scientific data to back up the decisions. Contrary, the root of the sustainability challenges the world face today is result of our overconsumption and continued destruction of nature, and solving this means reducing consumption and leaving more room for nature. Should the future be green in terms of green growth or in terms of a thriving nature?

The cited literature provide their normative understanding of what the science-policy interface should look like. Pielke Jr (2007) advocates for the honest broker, that scientists should provide policy-makers with a wide set of alternatives and leave the value-laden choices for the policy-makers. Further, Funtowicz and Strand (2007) and Strand (2022) argues for the importance of acknowledging uncertainty and value-ladenness as inherently interconnected with science and data production. Increased implementation of nature risk in decision-making could also provide measures and tools to bridge the gap of uncertainties in the science-policy interface (NOU 2024: 2). What the *right* solution is in this case of opening for DSM in Norway is a matter for further discussion, but it seems evident that the current lack of trust between the institutions is a challenge to the quality and legitimacy of the public decision-making processes.

6. Conclusion

This thesis has explored the topic of DSM by studying how central actors imagine data in decision-making with the following research question:

> *How do central actors imagine the use and importance of scientific data in decision-making on the context of deep-sea mining in Norway?*

The findings in this study indicates that the use and importance of data in decision-making for DSM in Norway is imagined differently by different actors. Despite a common belief amongst the informants in the importance of data, diverging understandings arise in their perceptions of what data is and how it should best be used in decision-making. These diverging views are connected to how they understand the issue of DSM, and what they perceive as good decision-making processes – their visions are the result of co-production of science and society. Frustration towards *the others* was voiced by all informants, which can be explained by the diverging understandings of data is and what role it should have. Two diverging imaginations can be seen, with the main demarcation of whether or not they believe that opening for DSM in Norway is the *right thing to do*.

Those in favour of the opening process and that advocated for DSM to be important for the green transition argued for *data speaking truth to power*. They expressed an understanding of data as objective information than will ensure rational and good decisions in the step-wise opening process; more data will complete the jigsaw puzzle called the *deep-sea ecosystems*. On the other side, the informants that expressed concern for the marine environment advocated for *data speaking precaution to power*. In their view, scientific data was not just information, but knowledge, and in this case knowledge as in understanding of deep-sea ecosystems. They understood data as more subjective – something that can be understood to comply with any view. Thus, they advocated for precaution, expressing concern for a slippery slope towards exploitation of minerals in unknown ecosystems. In their view, DSM is not to be found in a sustainable future, where the focus should be on less exploitation of natural resources.

This thesis does not provide grounds for generalisation, neither has that been the purpose, but it touches up on some understandings of the science-policy interface in the topic of DSM that would be interesting for further studies. It would be interesting to look more into how, if at all, scientific advice will be included in later stages of the opening process, and if this is a symptom of general conflicts in Norwegian marine management or nature management, or if it is a unique problem in this context. In addition, the decision-making processes considering DSM in Norway would also be interesting to study further in the light of nature risk and the implementation and integration of nature risk in decision-making.

References

Achberger, A.M., Jones, R., Jamieson, J., Homes II, C.P., Schubotz, F., Meyer, N.R., Dekas, A.E., Moriarty, S., Reeves, E.P., Manthey, A., Brünjes, J., Fornari, D.J., Tivey, M.K., Tonner, B.M. & Sylvan, J.B. (2024). Inactive hydrothermal vent microbial communities are important contributors to deep ocean primary productivity. *Nature Microbiology, 9,* 657-668. https://doi.org/10.1038/s41564-024-01599-9

Amon, D.J., McCauley, D.J., Blasiak, R. & Österblom, H. (2024). Replace Norway as co-chair of High Level Panel for a Sustainable Ocean Economy. *Nature, 626*, 480. https://doi.org/10.1038/d41586-024-00403-2

Andaur, K., Havåg, H., Gulowsen, T., Gylver, G., Steel, C., Sund-Henriksen, K., Åsnes, E., Riise, A.B., Pleym, F., Skadal, M., Aasland, S.G. & Kroglund, A. (n.d.). *Høringskommentarer til Konsekvensutredning for mineralvirksomhet på norsk kontinentalsokkel og utkast til beslutning om åpning av område* [Comments to consultancy for the Impact assessment for mining activity on the Norwegian continental shelf and draft to decision on opening of area]. WWF and more. https://www.regjeringen.no/contentassets/613111b7e02c464ca95b3e5bb364cc14/wwf-med-flere.pdf?uid=WWF_med_flere

Andersen, G., Dale, B. & Kristoffersen, B. (2019). *Kunnskapsbaserte beslutningsverktøy*? [Knowledge-based decision-tools?]. NORCE (Report No. 30-2019). https://norceresearch.brage.unit.no/norceresearch-xmlui/browse?type=dateissued

Barbier, E. (2011). The policy challenges for green economy and sustainable economic development. *Natural Resources Forum, 35(3),* 233-245. https://doi.org/10.1111/j.1477-8947.2011.01397.x

Bergfald, B. & Kristensen, K. (2023, January 16). *Kommentarer til konsekvensutredninng for dyphavsmineraler* [Comments to impact assessment for deep-sea minerals]. Bergfald miljørådgivere. https://www.bergfald.no/wp-content/uploads/2023/01/Kommentarer-til-utvalgte-problemstillinger-vedrorende-Konsekvensutredning-for-dyphavsmineraler-002.pdf

Bjørnsen, V. (n.d.). *Den norske Nordhavsekspedisjonen* [The Norwegian North-Sea Expedition]. Norsk polarhistorie. Retrieved May 2, 2024, from https://polarhistorie.no/ekspedisjoner/Den%20norske%20nordhavsekspedisjonen.html

Bjørnstad, L. & Kjørstad, E. (2023, November 29). *Gruvedrift på havbunnen: - Pinlig å være norsk forsker* [Deep-sea mining: Embarrassing to be a Norwegian scientist]. Forskning.no. Retrieved May 12, 2024, from https://www.forskning.no/havet-teknologi/gruvedrift-pa-havbunnen-pinlig-a-vaere-norsk-forsker/2278526

Blaikie, N. & Priest, J. (2019). *Designing Social Research* (3rd ed.). Polity Press.

Boetius, A. & Haeckel, M. (2018). Mind the seafloor. *Science,* 359*(6371)*, 34-36. https://10.1126/science.aap7301

Bouchet, P., Decock, W., Lonneville, B., Vanhoorne, B. & Vandepitte, L. (2023). Marine biodiversity discovery: the metrics of new species descriptions. *Frontier Marine Science, 10*. https://doi.org/10.3389/fmars.2023.929989

Braun, V. & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology, 3*(2), 77-101. https://doi.org/10.1191/1478088706qp063oa

Brill, W.J. (1985). Safety Concerns and Genetic Engineering in Agriculture. *Science, 277*(4685), 381-384. http://www.jstor.org/stable/1694355.

Burns, R., Dalton, C.M. & Thatcher, J.E. (2017). Critical Data, Critical Technology in Theory and Practice. *The Professional Geographer, 70*(1), 126-128. https://doi.org/10.1080/00330124.2017.1325749

Clark, T., Foster, L. & Bryman, A. (2019). *How to do your Social Research Project or Dissertation.* Oxford University Press.

EASAC. (2023, June). *Deep-Sea Mining: assessing evidence on future needs and environmental impacts.* https://easac.eu/fileadmin/user_upload/EASAC_Deep_Sea_Mining_Web_publication_.pdf

Eriksen, E., van der Meeren, G.I., Nilsen, B.M., von Quillfeldt, C.H. & Johnsen, H. (2021). *Særlig verdifulle og sårbare områder (SVO) i norske havområder - Miljøverdi* [Particularly valuable and vulnerable areas (SVO) in Norwegian seas – Environmental values]. Institute of Marine Research (Report No. 2021-26). https://www.hi.no/templates/reporteditor/report-pdf?id=45755&67942503

Funtowicz, S. & Strand, R. (2007). Models of Science and Policy. In T. Traavik & L.C. Lim (Eds.), *Biosafety First – Holistic Approaches to Risk and Uncertainty in Genetic Engineering and Genetically Modified Organisms.* Tapir Academic Press.

Grønmo, S. (2004). *Samfunnsvitenskapelige metoder* [Social Science Methods] (2^{nd} ed.). Fagbokforlaget.

Gundersen, T. (2020). Value-Free yet Policy-Relevant? The Normative Views of Climate Scientists and Their Bearing on Philosophy. *Perspectives on Science, 28*(1), 89-118. https://doi.org/10.1162/posc_a_00334

Harvard. (n.d.). *What is STS?* Retrieved April 10, 2024, from: https://sts.hks.harvard.edu/about/whatissts.html

Havbunnsmineralloven. (2019). *Lov om mineralvirksomhet på kontinentalsokkelen* (Seabed Minerals Act) (LOV-2019-03-22-7). Lovdata. https://lovdata.no/dokument/NL/lov/2019-03-22-7

Head, B. (2008). Wicked Problems in Public Policy. *Public Policy, 3*(2), 101-118. https://www.researchgate.net/publication/43502862_Wicked_Problems_in_Public_Policy

HUB Ocean (n.d.a). *Annual Report 2022*. Retrieved April 28, 2024, from https://www.hubocean.earth/annual-report-2022

HUB Ocean (n.d.b). *Mission.* Retrieved April 28, 2024, from https://www.hubocean.earth/centre/mission

IEA. (2022). *The Role of Critical Minerals in Clean Energy Transitions.* https://www.iea.org/reports/the-role-of-critical-minerals-in-clean-energy-transitions

Jaeschke, A., Jørgensen, S.L., Bernasconi, S.M., Pedersen, R.B., Thorseth, I.H., Früh-Green, G.L. (2012). Microbial diversity of Loki's Castle black smokers at the Arctic Mid-Ocean Ridge. *Geobiology, 10*(6), 548-561. https://doi.org/10.1111/gbi.12009

Jamieson, J.W. & Gartman, A. (2020). Defining active, inactive, and extinct seafloor massive sulfide deposits. *Marine Policy, 117*, 103926. https://doi.org/10.1016/j.marpol.2020.103926

Jasanoff, S. (2004). *States of Knowledge: The Co-Production of Science and the Social Order.* Routledge. https://ebookcentral.proquest.com/lib/bergen-ebooks/reader.action?pq-origsite=primo&ppg=4&docID=200656

Jasanoff, S., Markle, G.E., Peterson, J.C. & Pinch, T.J. (1995). *Handbook of Science and Technology Studies.* SAGE Publications. https://ebookcentral.proquest.com/lib/bergen-ebooks/reader.action?docID=996269

Jasanoff, S. & Kim, S. (2009). Containing the Atom: Sociotechnical Imaginaries and Nuclear Power in the United States and South Korea. *Minerva, 47*, 119-146. https://10.1007/s11024-009-9124-4

Jasanoff, S. & Kim, S. (2015). Future Imperfect: Science, Technology, and the Imaginations of Modernity. In S. Jasanoff & S. Kim (Eds), *Dreamscapes of Modernity. Sociotechnical Imaginaries and the Fabrication of Power.* University of Chicago Press.

Johansen, E. (2023). Juridisk vurdering av en eventuell åpningsbeslutning [Legal assessment of a potential opening decision]. *Wikborg Rein*. https://media.wwf.no/assets/attachments/Juridisk-vurdering-av-en-eventuell-%C3%A5pningsbeslutning18500451.1.pdf

Knežević, M., Ulvin, P.B., Helledal, E.J. & Honningsøy, K.H. (2023, June 20). Åpner for gruvedrifti havet: - En svart dag for norsk natur [Opens for mining in the ocean: - A black day for Norwegian nature]. *NRK*. Retrieved May 12, 2024, from https://www.nrk.no/norge/apner-for-gruvedrift-i-havet_-_-en-svart-dag-for-norsk-natur-1.16439887

Kutti, T., Mork, K.A., Chierici, M., Børsheim, K.Y., Bagøien, E., Knutsen, T., Broms, C.T., Klevjer, T., Strand, E., Gjøsæter, H., Stenevik, E.K., Høines, Å., Windsland, K. & Frie, A.K. (2021). *Pelagiske økosystem i De nordiske hav* [Pelagic ecosystems in the Nordic seas]. Institute of Marine Research (Report No. 2021-41). https://www.hi.no/templates/reporteditor/report-pdf?id=48697&20944319

Kvale, S. & Brinkmann, S. (2021). *Det Kvalitative Forskningsintervju* [The Qualitative Research Interview] (3rd ed.). Gyldendal.

Landström, C., Hauxwell-Baldwin, R., Lorenzoni, I. & Rogers-Hayden, R. (2015). The (Mis)understanding of Scientific Uncertainty? How Experts View Policy-Makers, the Media and Publics. *Science as Culture, 24*(3), 276-298. https://doi.org/10.1080/09505431.2014.992333

Levin, L.A., Mengerik, K., Gjerde, K.M., Rowden, A.A., Van Dover, C.L., Clark, M.R., Ramirez Llodra, E., Currie, B., Smith, C.R., Sato, K.N., Gallo, N., Sweetman, A.K., Lily, H., Armstrong, C.W. & Brider, J. (2016). Defining "serious harm" to the marine environment in the context of deep-sea mining. *Marine Policy, 74*, 245-259. https://doi.org/10.1016/j.marpol.2016.09.032

Levin, L.A. (2019). SUSTAINABILITY IN DEEP WATER. The Challenges of Climate Change, Human Pressures, and Biodiversity Conservation. *Oceanography, 32*(2), 170-180. https://www.jstor.org/stable/26651193

Martin, W., Baross, J., Kelley, D. & Russell, M.J. (2008). Hydrothermal vents and the origin of life. *Nature Reviews Microbiology, 6,* 805-814. https://10.1038/nrmicro1991

McVeigh, K. (2023, October 30). UK backs suspension of deep-sea mining in environmental U-turn. *The Guardian*. https://www.theguardian.com/environment/2023/oct/30/uk-backs-suspension-of-deep-sea-mining-in-environmental-u-turn

Meld. St. 21 (2023-2024). *Helhetlige forvaltningsplaner for de norske havområdene* [Holistic management plans for the Norwegian seas]. Ministry of Climate and Environment. https://www.regjeringen.no/contentassets/9c72daf967d54641bcc1fe7793a85659/no/pdfs/stm202320240021000dddpdfs.pdf

Meld. St. 25 (2022-2023). *Mineralverksemd på norsk kontinentalsokkel – opning av areal og strategi for forvaltning av ressursane* [Mineral activities on the Norwegian continental shelf – opening of areas and strategy for management of the resources]. Ministry of Energy. https://www.regjeringen.no/no/dokumenter/meld.-st.-25-20222023/id2985856/?ch=1

Melgård, M. & Berglihn, H. (2023, June 21). Regjeringen åpner for gruvedrift på havbunnen: Sjokkerende uansvarlig [The Government opens for deep-sea mining: - Shockingly irresponsible]. *Dagens næringsliv*. Retrieved May 12, 2024, from https://www.dn.no/politikk/terje-aasland/store-regjeringen/havbunnsmineraler/regjeringen-apner-for-gruvedrift-pa-havbunnen-sjokkerende-uansvarlig/2-1-1470182

Mengerink, K.J., Van Dover, C.L., Ardron, J., Baker, M., Escobar-Briones, E., Gjerde, K., Koslow, J.A., Ramirez-Llodra, E., Lara-Lopez, A., Squires, D., Sutton, T., Sweetman, A.K. & Levin, L.A. (2014). A Call for Deep-Ocean Stewardship. *Science 344*(6185), 696-698. https://10.1126/science.1251458

Miller, K.A., Brigden, K., Santillo, D., Currie, D., Johnston, P. & Thompson, K.F. (2021). Challenging the Need for Deep Seabed Mining From the Perspective of Metal Demand, Biodiversity, Ecosystems Services, and Benefit Sharing. *Frontiers in Marine Science, 8,* 706161. https://10.3389/fmars.2021.706161

Ministry of Energy. (2022, October 27). *Konsekvensutredning - undersøkelse og utvinning av havbunnsmineraler på norsk kontinentalsokkel* [Impact assessment – exploration and extraction of seabed minerals on the Norwegian continental shelf]. https://www.regjeringen.no/contentassets/dbf5144d0fbc42b5a4db5fc7eb4fa312/horingsdokument-konsekvensutredning-for-mineralvirksomhet-pa-norsk-kontinentalsokkel-l1415388.pdf

Ministry of Energy. (2024a, January 10). *Norway gives green light for seabed minerals.* Government. Retrieved April 30, 2024, from https://www.regjeringen.no/en/aktuelt/norway-gives-green-light-for-seabed-minerals/id3021433/

Ministry of Energy. (2024b, April 12). *Åpning av område på norsk kontinentalsokkel for mineralvirksomhet* [Opening of area on the Norwegian continental shelf for mineral activity]. Government. Retrieved May 1, 2024, from https://www.regjeringen.no/no/aktuelt/apning-av-omrade-pa-norsk-kontinentalsokkel-for-mineralvirksomhet/id3033970/

Nagelsen, V. (2021, April 14). *Gruvedrift på havbunnen: Stor mangel på kunnskap om områdene* [Deep-sea mining: Big lack of knowledge of the areas]. Institute of Marine Research. Retrieved May 12, 2024, from https://www.hi.no/hi/nyheter/2021/april/gruvedrift-pa-havbunnen-stor-mangel-pa-kunnskap-om-omradene

Nature Editorial. (2024, January 16). Norway's approval oof sea-bed mining undermines efforts to protect the ocean. *Nature, 625*, 424. https://doi.org/10.1038/d41586-024-00104-w

Naturmangfoldloven. (2009). *Lov om forvaltning av naturens mangfold* (Nature Diversity Act) (LOV-2009-06-19-100). Lovdata. https://lovdata.no/dokument/NL/lov/2009-06-19-100

NESH. (2021). *Forskningsetiske retningslinjer for samfunnvitenskap og humaniora* [Guidelines for Research Ethics in the Social Sciences and the Humanities] (5th ed). https://www.forskningsetikk.no/globalassets/dokumenter/4-publikasjoner-som-pdf/forskningsetiske-retningslinjer-for-samfunnsvitenskap-og-humaniora.pdf

Norwegian Environment Agency. (2023, January 27). *Høring - konsekvensutredning for mineralvirksomhet på norsk kontinentalsokkel og utkast til beslutning om åpning av område. Miljødirektoratets kommentarer* [Hearing – impact assessment for mineral activities on the Norwegian continental shelf and draft for decision to open areas. Comments from the Norwegian Environment Agency]. https://www.regjeringen.no/contentassets/613111b7e02c464ca95b3e5bb364cc14/miljodirektoratet.pdf?uid=Milj%C3%B8direktoratet

Norwegian Offshore Directorate. (2023, January 23). *Ressursvurdering havbunnsmineraler* [Resource assessment seabed minerals]. https://www.regjeringen.no/contentassets/a3dd0ce426a14e25abd8b55154f34f20/ressursvurdering-havbunnsmineraler.pdf

NOU 2024: 2. (2024). *I samspill med naturen* [In interaction with nature]. Norway's Nature Ris Commission. https://www.regjeringen.no/contentassets/a653320aa3f949038bb0e7ad92de1234/no/pdfs/nou202420240002000dddpdfs.pdf

OECD. (2011, May). *Towards green growth*. OECD publishing. https://doi.org/10.1787/9789264111318-en

Öberg, C. (2011). *Interdisciplinary Environmental studies – a primer.* Wiley-Blackwell.

Pardo, A. (1967, November 1). United Nations General Assembly. Twenty-second session. *United Nations*. https://www.un.org/depts/los/convention_agreements/texts/pardo_ga1967.pdf

Pedersen, R.B., Rapp, H.T., Thorseth, I.H., Lilley, M.D., Barriga, F.J.A.S., Baumberger, T., Flesland, K., Fonseca, R., Früh-Green, G.L. & Jørgensen, S.L. (2010). Discovery of a black smoker vent field and vent fauna at the Arctic Mid-Ocean Ridge. *Nature Communications, 1,* 126. https://doi.org/10.1038/ncomms1124

Pedersen, R.B., Olsen, B.R., Barreyre, T., Bjerga, A., Denny, A., Eilertsen, M.H., Fer, I., Haflidasson, H., Hestetun, J.T., Jørgensen, S., Ribeir, P.A., Steen, I.H., Stubseid, H., Tandberg, A.H.S. & Thorseth, I. (n.d.). *Fagutredning mineralressurser i Norskehavet. Landskapstrekk, naturtyper og bentiske økosystemer* [Expert assessment mineral resources in the Norwegian sea. Topographical features, nature types and benthic ecosystems]. Center for Deep Sea Research, University of Bergen. https://www.regjeringen.no/contentassets/a3dd0ce426a14e25abd8b55154f34f20/landskapstrekk-naturtyper-og-bentiske-okosystemer_senter-for-dyphavsforskning-uib.pdf

Petersen, S., Krätschell, A., Augustin, N., Jamieson, J. Hein, J.R. & Hannington, M.D. (2016). News from the seabed – Geological characteristics and resource potential oof deep-sea mineral resources. *Marine Policy, 70*, 175 – 187. https://doi.org/10.1016/j.marpol.2016.03.012

Pielke Jr, R.A. (2007). *The Honest Broker. Making Sense of Science in Policy and Politics*. Cambridge University Press. https://doi.org/10.1017/CBO9780511818110

Prop. 106 L (2017-2018). *Lov om mineralvirksomhet på kontinentalsokkelen* (havbunnsmineralloven) [Law on mineral activity on the continental shelf (Seabed Minerals Act)]. Ministry of Energy. https://www.regjeringen.no/contentassets/741c4188ffa341b7b57c13c30e6c9d6c/no/pdfs/prp201720180106000dddpdfs.pdf

Purvis, B., Ma, Y. & Robinson, D. (2019). Three pillars of sustainability: in search of conceptual origins. *Sustainability Science 14*, 681-695. https://doi.org/10.1007/s11625-018-0627-5

Ramirez-Llodra, E., Brandt, A., Danovaro, R., De Mol, B., Escobar, E., German, C.R., Levin, L.A., Martinez Arbizu, P., Menot, L., Buhl-Mortensen, P., Narayanaswamy, B.E., Smith, C.R., Tittensor, D.P., Tyler, P.A., Vanreusel, A. & Vecchione, M. (2010). Deep, diverse and definitely different: unique attributes of the world's largest ecosystem. *Biogeosciences 7*, 2851-2899. https://doi.org/10.5194/bg-7-2851-2010

Ramirez-Llodra, E., Tyler, P.A., Baker, M.C., Bergstad, D.A., Clark, M.R., Escobar, E., Levin, L.A., Menot, L., Rowden, A.A., Smith, C.R. & Van Dover, C.L. (2011). Man and the Last Great Wilderness: Human Impact on Deep Sea. *PloS ONE, 6*(7). https://doi.org/10.1371/journal.pone.0022588

Ramirez-Llodra, E., Hilario, A., Paulsen, E. Costa, C.V., Bakken, T., Johnsen, G. & Rapp, H.T. (2020). Benthic Communities on the Mohn's Treasure Mound: Implications for Management of Seabed Mining in the Arctic Mid-Ocean Ridge. *Frontiers Marine Science, 7*(490). https://doi.org/10.3389/fmars.2020.00490

REV Ocean. (n.d.). *REV Ocean Strategy 2.0.* Retrieved April 28, 2024, from https://www.revocean.org/wp-content/uploads/2024/04/REV_Ocean_Strategy_2024.pdf

Rio Declaration on Environment and Development. (1992, August 12). https://www.un.org/en/development/desa/population/migration/generalassembly/docs/globalcompact/A_CONF.151_26_Vol.I_Declaration.pdf

Rittel, H. W. J. & Webber, M. M. (1973). Dilemmas in a General Theory of Planning. *Policy Sciences, 4*(2), 155-169. https://10.1007/BF01405730

Rohracher, H. (2015). Science and Technology Studies, History of. *International Encyclopedia of the Social & Behavioral Sciences (2nd ed), 21*, 200-205. https://doi.org/10.1016/B978-0-08-097086-8.03064-6

Rommetveit, K., Strand, R., Fjelland, R. & Funtowicz, S. (2013). *What can history teach us about the prospects of a European Research Area?*. Publications Office of the European Union. https://10.2788/1057

Schander, C., Rapp, H.T., Kongsrud, J.A., Bakken, T., Berge, J., Cochrane, S., Oug, E., Byrkjedal, I., Todt, C., Cedhagen, T., Fosshagen, A., Gebruk, A., Larsen, K., Levin, L., Obst, M., Pleijel, F., Stöhr, S., Warén, A., Mikkelsen, N.T. (…) Pedersen, R.B. (2010). The fauna of hydrothermal vents on the Mohn Ridge (North Atlantic). *Marine Biology Research, 6*, 155-171. https://10.1080/17451000903147450

Skjølsvold, T. M. (2015) Vitenskap, teknologi og samfunn. En introduksjon til STS [Science, technology, and society. An introduction to STS]. Cappelen Damm Akademisk.

Strand, R. (2001). The role of risk assessments in the governance of genetically modified organisms in agriculture. *Journal of Hazardous Materials, 86*, 187-204. https://10.1016/s0304-3894(01)00258-8

Strand, R. (2022). *Indicator dashboards in governance of evidence-informed policymaking: Thoughts on rationale and design criteria.* Publications Office of the European Union. https://publications.jrc.ec.europa.eu/repository/handle/JRC129902

Tandberg, A.H.S., Vader, W., Olsen, B.R. & Rapp, H.T. (2018) *Monoculodes nousfieldi* sp. N. from the Arctic hydrothermal vent Loki's Castle. *Marine Biodiversity, 48*, 927-937. https://doi.org/10.1007/s12526-018-0869-6

United Nations. (n.d.). *The 17 Goals.* https://sdgs.un.org/goals

United Nations Convention on the Law of the Sea. (1982, December 19).. https://www.un.org/depts/los/convention_agreements/texts/unclos/unclos_e.pdf

van der Meeren, T., Mork, K.A., Kutti, T., Knutsen, T., Bagøien, E., Frie, A.K., Gjøsæter, H., Bienfait, A.M., Storesund, J., Dunlop, K.M., Windsland, K., Hallfredsson, E.H., Helle, K., Höffle, H., Junge, C., Serigstad, B. & Chierici, M. (2021). *Innspill til høring – Forslag til program for konsekvensutredning for mineralvirksomhet på norsk sokkel* [Hearing document – Proposed program for environmental assessment regarding mineral extraction on the Norwegian continental shelf areas]. Institute of Marine Research (Report No. 23). https://www.hi.no/templates/reporteditor/report-pdf?id=45412&95043079

World Commission on Environment and Development (1987). *Our Common Future.* https://sustainabledevelopment.un.org/content/documents/5987our-common-future.pdf

World Resource Institute. (2023, December 2023). *Ocean Panel Calls for Nations to Adopt 100% Sustainable Ocean Management Target*. Retrieved May 2, 2024, from https://www.wri.org/news/release-ocean-panel-calls-nations-adopt-100-sustainable-ocean-management-target

WWF. (n.d.). *Gruvedrift på havbunnen* [Deep-sea mining]. Retrieved May 9, 2024, from https://www.wwf.no/dyr-og-natur/hav-og-fiske/gruvedrift-pa-havbunnen

Wynne, B. (1992). Uncertainty and environmental learning: Reconceiving science and policy in the preventative paradigm. *Global Environmental Change, 2*(2), 111-127. https://doi.org/10.1016/0959-3780(92)90017-2

Appendix

Appendix 1: Background documents for the strategic selection of informants

Official documents
White paper Meld. St. 25 (2022-2023). *Mineralverksemd på norsk kontinentalsokkel – opning av areal og strategi for forvaltning av ressursane* [Mineral activities on the Norwegian continental shelf – opening of areas and strategy for management of the resources]. Ministry of Energy. https://www.regjeringen.no/no/dokumenter/meld.-st.-25-20222023/id2985856/?ch=1
Impact assessment Ministry of Energy. (2022, October 27). *Konsekvensutredning - undersøkelse og utvinning av havbunnsmineraler på norsk kontinentalsokkel* [Impact assessment – exploration and extraction of seabed minerals on the Norwegian continental shelf]. https://www.regjeringen.no/contentassets/dbf5144d0fbc42b5a4db5fc7eb4fa312/horingsdokument-konsekvensutredning-for-mineralvirksomhet-pa-norsk-kontinentalsokkel-l1415388.pdf
Resource estimate Norwegian Offshore Directorate. (2023, January 23). *Ressursvurdering havbunnsmineraler* [Resource assessment seabed minerals]. https://www.regjeringen.no/contentassets/a3dd0ce426a14e25abd8b55154f34f20/ressursvurdering-havbunnsmineraler.pdf
Background documents for the impact assessment
Pedersen, R.B., Olsen, B.R., Barreyre, T., Bjerga, A., Denny, A., Eilertsen, M.H., Fer, I., Haflidasson, H., Hestetun, J.T., Jørgensen, S., Ribeir, P.A., Steen, I.H., Stubseid, H., Tandberg, A.H.S. & Thorseth, I. (2023). *Fagutredning mineralressurser i Norskehavet. Landskapstrekk, naturtyper og bentiske økosystemer* [Expert assessment mineral resources in the Norwegian sea. Topographical features, nature types and benthic ecosystems]. Center for Deep Sea Research, University of Bergen. https://www.regjeringen.no/contentassets/a3dd0ce426a14e25abd8b55154f34f20/landskapstrekk-naturtyper-og-bentiske-okosystemer_senter-for-dyphavsforskning-uib.pdf
van der Meeren, T., Mork, K.A., Kutti, T., Knutsen, T., Bagøien, E., Frie, A.K., Gjøsæter, H., Kutti, T., Mork, K.A., Chierici, M., Børsheim, K.Y., Bagøien, E., Knutsen, T., Broms, C.T., Klevjer, T., Strand, E., Gjøsæter, H., Stenevik, E.K., Høines, Å., Windsland, K. & Frie, A.K. (2021). *Pelagiske økosystem i De nordiske hav* [Pelagic ecosystems in the Nordic seas]. Institute of Marine Research (Report No. 2021-41). https://www.hi.no/templates/reporteditor/report-pdf?id=48697&20944319
Skaar, K.L., Bakke, G., Finne, P. & Lilleng, D. (2021). *Fiskeriaktiviteten i utredningsområdet* [The fisheries activity in the area of investigation for deep-sea mining]. Directorate of Fisheries. https://www.regjeringen.no/contentassets/dbf5144d0fbc42b5a4db5fc7eb4fa312/vedlegg-1.-fiskeridirektoratet.-fiskeriaktivitet-i-utredningsomradet.pdf
Laugesen, J., Aasly, K. & Ellefmo, S. (2021). *Teknologirapport havbunnsmineraler* [Technology report deep-sea minerals]. DNV. https://www.regjeringen.no/contentassets/dbf5144d0fbc42b5a4db5fc7eb4fa312/vedlegg-7.-dnv.-teknologirapport-havbunnsmineraler.pdf

Open hearing on the White paper
Committee on Energy and Environment. (2023, October 26). *Open hearing in the Parliament's Committee on Energy and environment Thursday October 26th 2023 kl. 09.00.* [Video]. Government. https://www.stortinget.no/no/Hva-skjer-pa-Stortinget/videoarkiv/Arkiv-TV-sendinger/?h=10004943&dateid=10005248&del=1&rtid=085800&msid=0

Appendix 2: Interview guide

Background
Q1: What is your relation to the ocean? Q1.a: Could you very briefly tell me a bit about your background and your work? Q1.b: What is marine sustainability to you?
Topic 1: Data
Marine sustainability
Q2: What are your thoughts about the existing data and data availability in relation to marine data in general, and specifically in Norwegian waters?
Q3: What type of data would you say are important for marine sustainability?
Deep-sea mining
Q4: What types of data are you aware of related to the extended Norwegian continental shelf (anything from mineral assessments to biodiversity)?
Q5: What data sources are you familiar with regarding deep see mining, in relation to environmental/resource assessment/technology/governance? Q5.a: Is the data open access?
Q6: Do you think all gathered data is available and accessible? Why, why not?
Q7: How do you use the data? If you don't, why is that?
Q8: How would you describe the current state of data regarding deep-sea mining? Are there any clear data gaps that you know of? Q8.a: Do you think there are any data gaps you do not know of, and if so, where?
Q9: Who has been gathering the data up until now, and who should be gathering the data? Q9.a: How should the data be gathered?
Topic 2: Visions and imaginaries
Q10: How important would you say data is for marine sustainability and specifically for the case of deep-sea mining? *Specification:* What role would you give the data in the decision process? What position does, or should it take/be given, (for example in relation to other factors such as economic, social, etc.)? (Does it have a premise giving role or does it come second to other factors?)
Q9: What is the data important for? Q9.a: What kind of data is the most important? Q9.b: How can or should the data be used?
Q10: How do data currently contribute to our (all stakeholders) understanding of deep-sea mining and the impacts on the ocean?
Q11: What is your perception of how other stakeholders view and relate to the data? Q11.a: How do you think the knowledge gaps affect the society's perception and understanding of deep-sea mining and its impacts?
Topic 3: General reflections
Q12: Wikborg Rein (law firm) has on request from WWF, looked into the legal grounds of the opening process, and concluded that the knowledge base the impact assessment relies on is not valid in terms of Norwegian law. What do you think about this?
Q13: The technology needed for mining on SMS and crusts – the two mineral deposits we have in the region, is essentially different, and neither are ready for mining in the next few years. What are your thoughts on the technology readiness for deep-sea mining?
Q14: One of the arguments *for* deep-sea mining in Norway, is the need for minerals for green and clean energy and technology – the green shift. A counterargument is that these

minerals will be too late for the green shift, and that added up, the negative consequences outweighs the positive. What is your take on this?
Q15: In the end, the decision is up to the politicians and their own personal opinions. In a dream world, how should this decision be made, and by whom?
Q16: What do you think about deep-sea mining as a potential new industry in Norway? Q16.a: How, if possible, can deep-sea mining contribute to sustainability in general, and marine sustainability specifically? Q16.b: How should the opening process proceed? What is the dream scenario going forward? Q16.c: What do you think will happen in the next steps of the process?