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MASTER THESIS

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ENVIRONMENTAL ASSESSMENT (EA) FOLLOW-UP IN ENERGY INFRASTRUCTURES:

A Comparative Study of Practice in the Netherlands, Iceland, and Denmark

Environmental Assessment (EA) Follow-up in Energy Infrastructures: A Comparative Study of Practice in the Netherlands, Iceland, and Denmark

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Abstract

There has been a significant emphasis in planning practice on conducting pre-project impact assessments, however, there has been a reluctance to conduct ex-post impact assessments, such as Environmental Assessment (EA) Follow-up. This assessment is performed after the main consent decision to evaluate how actual impacts compare to predicted impacts. The increasing energy crisis in Europe has led to a growing number of projects related to energy infrastructure, which requires further assessment of the environmental impact. This study aims to conduct a comparative analysis of EA Follow-up in the Netherlands, Iceland, and Denmark to understand how it is practised across different countries with different contexts, including the physical-geographical and island contexts. This qualitative research utilises document analysis, interviews comprising 22 interviews with stakeholders such as EA experts, professionals in the energy sector, academics, and government officials from the Netherlands, Iceland, and Denmark, followed by a Focus Group Discussion (FGD) with experts. The findings of this study observed that in the Netherlands, Iceland, and Denmark, EA Follow-up aligns with the EU EIA-Directives and SEA Directives and is integrated into national policies. However, it is not commonly executed in practice, except for some projects with significant impacts and major uncertainty or for knowledge-acquisition purposes, as seen in case studies. The lesson to be learned from investigating the process of EA Follow-up in three countries is that the process should consider the complete practice of the EA Follow-up. This should be generally applied as a valuable step to "close the loop" in evaluation and learning for environmentally effective energy policymaking. A more generally applied EA Follow-up promotes continuous learning, a better understanding of different types and sizes of uncertainty, and bridging the gaps in implementation within the process.

Preface

Dear readers,

“What a journey!” The process of writing this thesis has been challenging yet fulfilling, and I have learned many lessons along the way. Choosing the thesis topic was difficult, but I am glad to have focused on the topics that I am passionate about; environmental sustainability and the energy sector. With the increasing need for sustainable energy innovation, it is crucial to consider the impact on the environment before and after the construction of infrastructure, which is often overlooked.

Finding inspiration for this topic was not a "Newton and the apple tree" moment. The topic was chosen after attending a lecture in the Impact Assessment class, discussing it with my thesis supervisors, flipping books in the library, and scrolling through Google Scholar. However, the decision to focus on this thesis topic was influenced by the two years of the ISLANDS program. This program started with a journey from the topical islands of Indonesia. Then, it took me to study glaciers in Iceland, observe wind farms in the Netherlands, learn about nuclear energy in Sweden, and gain insight into sustainable planning in Denmark. These experiences have greatly influenced the writing of this thesis. The process of writing this thesis began in January 2024 with the initial proposal. The research for the thesis started in February 2024, and this version of the thesis is submitted to the University of Groningen in June 2024.

I was fortunate not to embark on this journey alone from the beginning. I am grateful for the support and guidance of my supportive and dedicated supervisors, Jos Arts, Maartje van Ravesteijn, and Benjamin Hennig. I also would like to express my gratitude to all the interviewees who generously shared their time, valuable insights, and engaging discussions on the topic. Additionally, I am thankful for the opportunity to conduct this research as part of my internship at Rijkswaterstaat, the Ministry of Infrastructure and Water Management of the Netherlands, where I had the pleasure of meeting wonderful colleagues who engaged in motivating conversations about the topic. This journey has been lively with the fortnightly discussions with the student group from Denmark, who have become great friends along the way. Personally, I would like to thank my friends, especially from the ISLANDS, ReMa, and EIP programs, as well as my families, for supporting me through this endeavour.

One thing this journey has taught me is perseverance. There have been challenges along the way, such as being unable to get participants, but after all of the emails and phone calls, I was able to meet and discuss the EA Follow-up with many remarkable experts.

Just like the Icelandic saying; everything will work out in the end - *Þetta Reddast*.

Yulita Muspitasari
Groningen, June 2024.

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Abbreviations

EA : Environmental Assessment

EEA : European Economic Area

EIA : Environmental Impact Assessment

EU : European Union

FGD : Focus Group Discussion

IAIA : International Association for Impact Assessment

NAM : Nederlandse Aardolie Maatschappij - Dutch Petroleum Company

NGO : Non-Governmental Organisation

SEA : Strategic Environmental Assessment

SodM : Staatstoezicht op de Mijnen - State Supervision of Mines

UNESCO : United Nations Educational, Scientific and Cultural Organization

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I am grateful for the support from the interview participants, who provided their time and information for this research. I would like to express my gratitude to my supervisors, Jos Arts, Maartje van Ravesteijn, and Benjamin Hennig, as well as the examiner, Frans Sijtsma, for their guidance and feedback during the research.

I am thankful for the Erasmus Mundus Scholarship, which provided the funding for the MSc Double Degree program in Islands and Sustainability. I am also grateful for the opportunity to conduct this research as part of my internship at Rijkswaterstaat, the Ministry of Infrastructure and Water Management of the Netherlands, where I had the pleasure of meeting wonderful colleagues and fellow interns.

Furthermore, I want to express my appreciation to the student group from Denmark for their support and insightful discussions. I also want to thank my classmates from the ISLANDS, ReMa, and EIP programs, as well as the coordinators and program management. Most importantly, I am grateful to my family for their unwavering support.

1 Introduction

The introduction chapter of this research consists of information related to the problem statement, academic and social relevance, the chosen study areas, research objectives and questions, and a paradigm reflection of the research. This chapter aims to provide an overview of the research and to guide the reader on the importance of the study.

1.1 Background

There has been significant attention given to the pre-project impact assessment – such as Environmental Impact Assessment (EIA), Strategic Environmental Assessment (SEA), Social Impact Assessment (SIA), etc. – which is an *ex-ante* impact assessment (Morrison-Saunders, 2023). However, little attention has been paid to *ex-post* impact assessment after the main consent decision (approving a plan, programme or granting the permit); the Environmental Assessment (EA) Follow-up, which is important to understand how the actual impact compares to the predicted impact (Arts, 1998; Arts and Morrison-Saunders, 2004). Environmental Assessment (EA) Follow-up for infrastructure projects refers to the post-implementation evaluation of the actual impact of the project compared to its predicted impacts. The follow-up stage in impact assessment is crucial in mitigating the ongoing effect of the project (Morrison-Saunders et al., 2021). Furthermore, EA Follow-up ensures that lessons learned from projects, plans, and programs are applied to future practices, managing cumulative effects, acquiring knowledge, and improving public acceptance (Arts and Morrison-Saunders, 2004; Morrison-Saunders et al., 2001). This study aims to conduct a comparative analysis of EA Follow-up in the Netherlands, Iceland, and Denmark to understand how it is practised across different countries with different contexts.

In the Netherlands, conducting an EA Follow-up is a legal requirement under the Environmental Act. However, in practice, it is often treated as a mere formality rather than an effective measure to mitigate the environmental impact. The study from 2007 showed that out of 376 projects that are legally required to conduct the EA Follow-up, only 16% of them have actually done so (O'Faircheallaigh, 2007). According to the website of the Dutch EIA Commission, in 2023, there were 74 instances of environmental assessment in the Netherlands, spanning infrastructure, housing, and industrial development projects (Commissie voor de milieueffectrapportage, 2023). However, the extent to which EA Follow-up in these assessments has been conducted remains unclear. Additionally, the Netherlands is a densely populated and well-connected area that is prone to flood risks. In the energy sector, the Netherlands is innovating with various sustainable sources, for example, offshore wind farms in the North Sea and floating solar energy (Bax et al., 2022; Gușatu et al., 2021), making environmental management a unique challenge.

On the other hand, Iceland has set an example in environmental assessment, especially in the renewable energy sectors. The country has established rigorous policies, legal frameworks, and funding for geothermal energy to preserve the environment (Gudmundsdottir et al., 2017). Iceland's natural environment is relatively unique due to its isolation as an island nation and its susceptibility to natural risks like volcanic eruptions. In addition, Denmark is a country in the

Nordic region that has notable impact assessment practices, specifically in the energy sector (Kjær et al., 2006; Larsen et al., 2013). The country mainly relies on wind and biomass as renewable energy sources, making it an interesting subject for comparison with Iceland and the Netherlands (Tonini and Astrup, 2012). Thus, it would be interesting to analyse how countries approach EA Follow-up in their development and planning to mitigate the challenges they face within their energy infrastructure.

The issues related to EA Follow-up in energy infrastructure are primarily associated with implementation theory and adaptive planning. Implementation theory focuses on the execution of plans and addressing the gap between plans and practices (Chen and Rossi, 1987; Dunsire, 1978; Palumbo and Oliverio, 1989). In the context of EA Follow-up, implementation theory is related to the concept of adaptive management. This means that when there is a gap in implementation, EA Follow-up can help fill that gap by translating it into better implementation practices. Although the application of EA follow-up is crucial for improving environmental impact management through adaptive planning and learning from actual implementation, the study about the practice and case studies are limited.

This study focuses on the energy infrastructure in Europe, which has become a critical topic due to widely applied policies on energy transitions and an energy crisis following the Russian-Ukraine war. Due to a rise in efforts to transition to alternative energy sources, there is a significant focus on building new infrastructures to meet the increasing demand for energy (Guelpa et al., 2019). However, it is crucial to conduct an environmental assessment for every infrastructure project. In line with this, the role of EA Follow-up in the later stages of planning is, first of all, important to better understand issues that arise during and after implementation. Second, through EA Follow-up, the actual environmental impact can be compared to the predicted impacts. This allows learning for new ex-ante studies to predict the potential environmental impact better, making better trade-off choices about the costs and benefits of energy products. Finally, it promotes better adaptive management of energy projects by encouraging discussions and proposing policies that may lower the environmental impact once the infrastructure is active. Thus, this approach can help us learn valuable lessons for assessing the environmental impact of ongoing and future energy infrastructure projects.

1.2 Areas of study

This study aims to conduct a comparative analysis of the EA Follow-up in energy infrastructures in the Netherlands, Iceland, and Denmark. These countries are selected due to their diverse use of renewable energy sources and unique physical-geographical conditions, including the various contexts of mainland, archipelago, and island contexts within Europe. Furthermore, the selection of the Netherlands, Iceland, and Denmark as case studies is based on their location in the European continent and following the EIA/SEA Directives from the European Union. Despite varying geographical conditions, these nations have distinct energy-related priorities. For instance, the Netherlands prioritises water management and wind energy, Iceland focuses on geothermal energy, and Denmark lays a middle ground between the two, similar to its Nordic neighbour Iceland and its emphasis on wind power and offshore wind farm initiatives similar to the Netherlands. Furthermore, the Netherlands and Denmark also have many studies related to the EA Follow-up, especially with The Danish Centre for Environmental Assessment. Additionally, with the short period of the study, these three countries were selected for the study due to the availability of data and the opportunity to connect with experts in the field from the area.

1.2.1 The Netherlands

The Netherlands is situated in Western Europe and spans 41,540 km² with a population of 17,947,684 as of 2023 (Statistics Netherlands, n.d.; World Bank, 2021). The country's topography is predominantly flat, which is posing a challenge with regard to floods. Being located in Western Europe, the Netherlands is well-connected to other European countries. In addition to the mainland, the Netherlands also consists of natural and artificial islands, as well as former islands. These include the West Frisian Islands in the Wadden Sea, islands in South Holland, and former islands in Zeeland. The interplay between the mainland and the islands makes for an intriguing topic in this research because islands are used as a place for pilot energy tests or energy hubs and have different perspectives related to the energy infrastructure (Skjølsvold et al., 2020). The Netherlands was selected for this study because of its interesting interplay between the islands and the mainland, which raises questions regarding the extent to which the practice of environmental impact assessments is implemented in the country.

In the Netherlands, natural gas is the primary energy source, contributing to approximately 40% of electricity production. Another 40% comes from renewable sources such as solar, wind, and biomass, with wind power accounting for 18%, solar energy for 15%, and hydropower for 7% (Energie Nederland, 2022). The remaining electricity production is derived from coal and oil (15%) and nuclear power plants (3%) (Energie Nederland, 2022). With the increasing demand for energy and the transition to renewable sources, the Netherlands has constructed wind farms both inland and on the coast. As part of the development and management of the renewable energy strategy, the Netherlands is collaborating with other European countries to develop wind energy projects in the North Sea. Additionally, the country has integrated its energy infrastructure with other elements, such as road networks.

1.2.2 Iceland

Iceland, located in the Nordic region, is a country comprised of sub-arctic and arctic regions. With a population of 400.889 as of 20 March 2024, according to the Icelandic National Registry, Iceland covers an area of 103,000km² (Evans, 2017; National Registry, n.d.). The capital city of Reykjavik is both the largest city and the most populous one in the country, with the overall population mainly living in the capital region and its neighbouring cities. Due to its volcanic islands and abundant geothermal energy production, Iceland has a unique geographic condition. As an island nation, it is only accessible by air or sea. This remoteness is part of what makes Iceland's energy infrastructure distinctive for this comparative study, which implies the lack of connectivity in energy infrastructure compared to the countries in mainland Europe. Interestingly, Iceland is geographically in between Europe and the mainland of the American continent (Lund et al., 2017). Although the country is not part of the European Union, it is part of the European Economic Area and the Schengen Area (Iceland - European Commission, 2012). This implies that Iceland continues to engage in economic and trade activities with the EU while retaining sovereignty over its national policies and having limited direct political influence within the EU.

Iceland's energy infrastructure is mostly powered by renewable energy, which is widely available in the country. The primary renewable energy sources such as hydro (70.38%) and geothermal (29.58%) are also used (Montesdeoca-Martínez and Velázquez-Medina, 2023). Iceland has made significant contributions to the use of renewable energy, with about 99% of its electricity production coming from renewable sources (Gunnarsdottir et al., 2022). Iceland is being included in this study as an island nation. The context of the islands plays a role in the energy landscape, which could differ from that of the mainland due to remoteness and identified boundaries (Tsagkari, 2022).

1.2.3 Denmark

Denmark is a country located in the Scandinavian region of Europe and composed of both mainland and islands. The country is a member of the European Union and the Nordic region. The total population of Denmark in 2023 is 5,932,654, living within an area of 42,924 square kilometres (European Commission, 2023). The archipelago and mainland combination make Denmark a unique country for this study with its distinct geographical conditions compared to Iceland and the Netherlands. The mainland peninsula of Denmark is Jutland, and 443 islands within the archipelago (European Commission, 2023).

Denmark aims to lead in the use of renewable energy sources, with the total energy supply coming from biofuels and waste (33.6%) and wind and solar (12.4%) in 2022 (International Energy Agency, 2022). In 2020, Denmark ratified the Climate Act to achieve climate neutrality by 2050, reducing carbon emissions by 70% from 1990 levels by 2030, which is legally binding for the country (Beton Kalmaz and Adebayo, 2024). While biomass has been Denmark's most important renewable energy source, its usage has significantly increased over the past 20 years (Beton Kalmaz and Adebayo, 2024). Denmark's energy sector is globally significant due to its expertise in wind energy, featuring one of the highest capacities per capita and effectively managing energy fluctuations (Johansen, 2021; Lyhne, 2012; Sanz-Casado et al., 2013). Geographically, Denmark's location as a bridge between the Scandinavian countries and mid-Europe is crucial for studying energy infrastructure (Lyhne, 2012).

1.3. Academic and social relevance

Currently, EA Follow-up practice seems to be limited (Arts et al., 2001; Chigwanhire, 2021; Noble and Storey, 2005) and there is a lack of research on the practice of EA Follow-up, especially in energy infrastructure. Therefore, this study attempts to enhance EA Follow-up practice (focusing on the energy infrastructure) and to contribute to the literature on environmental impact assessment at the country level, as well as to the specific cases of EA Follow-up. These areas of study are crucial for future researchers and practitioners in the field of impact assessment. Although there are some studies on EA Follow-up that focus on examples from Australia or Canada, there are fewer studies within the European context (Morrison-Saunders et al., 2014). This study seeks to promote a better understanding of current EA Follow-up practices for energy infrastructure development and the existing literature on this topic through a comparative analysis of European examples. In terms of its societal relevance, this comparative analysis between different European countries can offer benchmarking for EA Follow-up. The study will investigate how physical-geographical and institutional variations can impact the implementation of EA Follow-up, thereby making these practices more adaptable in diverse policy contexts. Promoting better practices of EA Follow-up, particularly in the energy infrastructure context, can facilitate a more sustainable energy transition in the future.

1.4. Research objectives and questions

The purpose of this research is to examine the EA Follow-up practices in the Netherlands, Iceland, and Denmark related to energy infrastructures. The primary research question for this study is: **How is Environmental Assessment Follow-up for energy infrastructure conducted in the Netherlands, Iceland, and Denmark, and what lessons can be learned to**

contribute to careful implementation and adaptive management of energy infrastructure projects in these countries?

This study is guided by the following sub-research questions and the goals to be achieved:

1. ***How does adaptive planning and implementation theory shape the understanding and practice of EA Follow-up, especially in relation to energy infrastructure?***
   The question explores adaptive planning and implementation theory for developing an analytical framework to study the practice of EA Follow-up, specifically within the context of energy infrastructure. To achieve this, a literature review is conducted for environmental assessment reports from various projects in different countries to supplement the findings.
2. ***What is the current practice of EA Follow-up in the Netherlands, Iceland, and Denmark especially for energy infrastructure development?***
   This research question relates to examining the current practices of Environmental Assessment Follow-up in each country, with a specific focus on the development of energy infrastructure. This will be achieved through document analysis, interviews with participants from the Netherlands, Iceland, and Denmark and triangulated with focus group discussion.
3. ***How is EA Follow-up implemented in the Netherlands, Iceland, and Denmark, and what are the success factors and challenges for the practices of EA Follow-up in energy infrastructure projects?***
   This question is about gaining insight into the implementation of EA Follow-up procedures in three countries—the Netherlands, Iceland, and Denmark—to identify the challenges and key factors that facilitate successful EA Follow-up, taking into account each nation's distinct circumstances. This question also involves conducting interviews and document analysis based on case studies from the Netherlands, Iceland, and Denmark, and triangulated with focus group discussion.
4. ***How do physical-geographical conditions (such as 'islandness'), institutional arrangements, and stakeholder involvements in each country influence their EA Follow-up practices related to energy infrastructures?***
   This research question regards exploring how physical-geographical factors like 'islandness' and geographical conditions, institutional arrangements, and stakeholder engagement affect EA Follow-up practices. To achieve this, the research employs both interviews with participants from the Netherlands, Iceland, and Denmark and document analysis, as well as triangulation using focus group discussion.

1.5. Paradigm reflection

After reviewing the literature and the approach of the research design, the pragmatism paradigm is the most suitable for this research (Rorty, 1995). The pragmatic paradigm emphasises the importance of understanding real-world problems rather than merely a theoretical discussion (Dewey, 1908; Kaushik and Walsh, 2019). This approach focuses on the practicality of viewing the world and is also used in a wider sense of understanding the truth (Dewey, 1908). The concept of pragmatism is crucial in preventing clashes between science and values, and it should not remain confined to theoretical debates (Rorty, 1995). Rather, it should be a practical framework with real-world applications for resolving contemporary issues (Rorty, 1995). This pragmatic approach is particularly valuable in environmental impact assessment and adaptive management, as it allows for diverse problem-solving strategies. By using a pragmatic approach, results can be achieved through various inferences as it focuses on flexibility towards the methodology. Most pragmatic scholars emphasise the understanding

of methodological pluralism, which promotes the use of mixed methods for research practices (Morgan, 2014). The key aspect of the pragmatist paradigm is to understand the complexity of reality and deal with it rather than focusing on finding absolute truth (Kaushik and Walsh, 2019). It aims to find practical solutions to real-life situations. The pragmatic approach in planning also focuses on tailoring solutions to specific circumstances, as there is no one panacea for planning problems (Beunen and Patterson, 2019).

It is also important to acknowledge that in the field of environmental assessment, there are various considerations beyond the pragmatic paradigm (Cashmore, 2004). Different philosophical beliefs and values also play a role in shaping environmental assessment theory. For instance, some adhere to logical positivism, which emphasises the importance of scientific and empirical evidence to create a more scientific basis for environmental assessment. However, Cashmore (2004) indicated that other scholars advocate the utilisation of relativism approaches for environmental impact assessment (Cashmore, 2004). The relativism approach suggests that truth is subjective and can vary based on individual experiences and perspectives, which means that what is true for one person may not be true for another (Baghramian, 2001). Interestingly, some studies suggest that impact assessments can vary depending on the person or group conducting them (Cashmore et al., 2009). Achieving a better understanding of others' perspectives during the environmental assessment process can lead to more comprehensive and effective impact assessments. This suggests that there is a wide range of theories and knowledge within environmental impact assessment, which is reflected in academic research. Environmental impact assessment can be viewed as a useful instrument in supporting the adaptability of plans for environmental protection (Morrison-Saunders and Bailey, 1999). It is not limited by a fixed approach but rather seeks to maximise its implementation and effectiveness, which then fits within the pragmatic paradigm.

Guided by the pragmatic paradigm, this research focuses on the practical applications of EA Follow-up, specifically within the energy infrastructures of the Netherlands, Iceland, and Denmark. It highlights practical solutions and understanding of the context of EA Follow-up. Additionally, the methodology and approach to planning within the follow-up and assessment process will be examined to better understand its adaptability.

1.6. Thesis overview

The thesis content is divided into six chapters, each exploring a different aspect of the study. Chapter 1, the introduction, sets the foundation by discussing the study's background, its significance in social and academic contexts, and reflective questions. Chapter 2 covers the literature review and conceptual work, including previous studies on environmental assessment in energy and infrastructure, an overview of EA Follow-up, implementation theory, and adaptive management. Chapter 3 focuses on the methodology used, including research questions, data collection process, data analysis, and the researcher's positionality statement and ethical considerations. Chapter 4 presents the results from the macro level based on data collection through document reviews, interviews, and focus group discussion. Chapter 5 highlights the micro level based on case studies of EA Follow-up in energy infrastructure in the Netherlands, Iceland, and Denmark. Chapter 6 discusses the findings in relation to the theories applied in this research. Lastly, Chapter 7 provides conclusions and recommendations based on the findings.

2 Literature Review and Theories

This chapter delves into a comprehensive analysis of various articles, journals, and studies related to impact assessment in energy infrastructures and the EA Follow-up. Additionally, the literature discusses the relevant theories for this study; the implementation theory and adaptive management.

2.1 Environmental Assessment for energy infrastructures

The term Environmental Assessment (EA) is often used interchangeably with Environmental Impact Assessment (EIA), as it differs between various organisations and institutions depending on the scope of the EIA and the implementation of the EIA (Glasson and Therivel, 2013). In line with common practice in the field, in this study, Environmental Assessment (EA) is used as the general umbrella for denoting both Environmental Impact Assessment (EIA) for projects and Strategic Environmental Assessment (SEA) for policies, plans and programmes (Arts and De Vries, 2023). According to the International Association for Impact Assessment (IAIA), the definition of EIA is "the process of identifying, predicting, evaluating and mitigating the biophysical, social, and other relevant effects of development proposals prior to major decisions being taken and commitments made" (Senécal et al., 1999, p.2). Another definition of the EIA from the United Nations mentioned that the EIA is the assessment of the impacts towards the environment related to the activities and plans (Mareddy et al., 2017). The EIA aims to evaluate the impacts of the proposed projects on our environments in an in-depth and detailed manner (Geneletti and others, 2002). The scope of EIA includes the individual aspects of the environment, such as the population, the ecological aspects, landscape, climate, and our surroundings (Morris and Therivel, 2001). This tool has been an acceptable method for environmental management for assessing the impacts of programs, plans, and projects on the environment (Wathern, 2013). There are a variety of Impact Assessments that have been developed since the 1970s, including the widely used one which is the Strategic Environmental Assessment (Morgan, 2012). Strategic Environmental Assessment (SEA) is promoted for the impact assessment at the higher level of the decision-making process, including within the policies, plans and programs, which includes the formal administrative assessment (Morgan, 2012; Partidário, 2000). While different definitions and the scope of the EIA cover different areas, the main goal of the assessment remains the same: minimising the negative impacts on the environment.

Research related to environmental assessment of energy infrastructures is a growing topic in Europe. A study by Uhlmann (2015) suggested that it is important to understand whether the energy supply projects align with environmental protection, especially with the ongoing changes toward renewable sources in Europe. The energy infrastructure plan includes the environmental impact assessment for energy projects, which provides benefits for project developers and the public regarding permits and procedures (Aumann, 2014). A study by Lyhne (2012) investigated meaningful ways of applying strategic environmental assessment to the Danish energy sector. The study suggested that a multidisciplinary approach is necessary in the decision-making process, while there are still challenges related to the application of strategic environmental assessment regarding timing and flexibility. The study primarily focused on the Danish energy sector, specifically offshore wind power and natural gas infrastructure.

Nefedova and Solovyev (2020) highlighted the impact of climate change on energy infrastructures and emphasised the need to promote renewable energy systems for sustainable growth. The duration of impact assessment related to energy infrastructure projects varies, and a study by Scott et al. (2023) suggests that longer projects usually require a more comprehensive impact assessment. Malakar et al. (2023) state that energy infrastructure projects are complex and recommend using an integrated council network approach to address the environmental and social impacts associated with energy infrastructure. Another approach to environmental impact assessment related to energy projects is carried out by Baynova (2021), who suggests that conducting a strategic environmental assessment in the early stages of the infrastructure project is crucial for promoting long-term sustainability. There is a growing interest in research in the energy sector and its intersection with EIAs, as well as understanding the cumulative impacts (Gușatu et al., 2021). However, most studies only focus on the assessment prior to the project, and less attention is given to the assessment after the project has been conducted. Therefore, there is a need to conduct a study on the post-project decision to better understand the actual environmental impacts.

2.2 Overview of Environmental Assessment Follow-up

Environmental assessments are commonly split into two types: ex-ante and ex-post evaluations. *Ex ante evaluations* are carried out before projects, plans, and programs begin and are designed to predict the project's impact on the environment (Arts, 1998). This helps us to understand the potential consequences that the project may have. On the other hand, *ex-post evaluations* are carried out after the project is constructed and in operation and focus on analysing the actual project's impact on the environment. This type of evaluation is also known as monitoring, auditing, or follow-up evaluation. Within the ex-post evaluation, monitoring involves observing and measuring the project or activity to understand if the predicted impacts have occurred (Arts, 1998). Auditing, which is also used in the financial sector, verifies the data to ensure that the practice is compliant with the expected standards. Evaluation is the general process of gathering and analysing information and appraising that information after the project is completed (Arts, 1998). It involves auditing and monitoring but also includes providing feedback and making adjustments to adapt to the changing environment (Arts, 1998).

This study focuses on EA Follow-up as it includes compliance monitoring and auditing (evaluation of conformance) and the effects of monitoring and auditing (evaluation of performance), as seen in Figure 1. The follow-up stage in environmental assessment is crucial in mitigating the ongoing effect of the project (Morrison-Saunders et al., 2021). Thus, EA Follow-up has been an integral part of adaptive environmental management (O'Faircheallaigh, 2007).

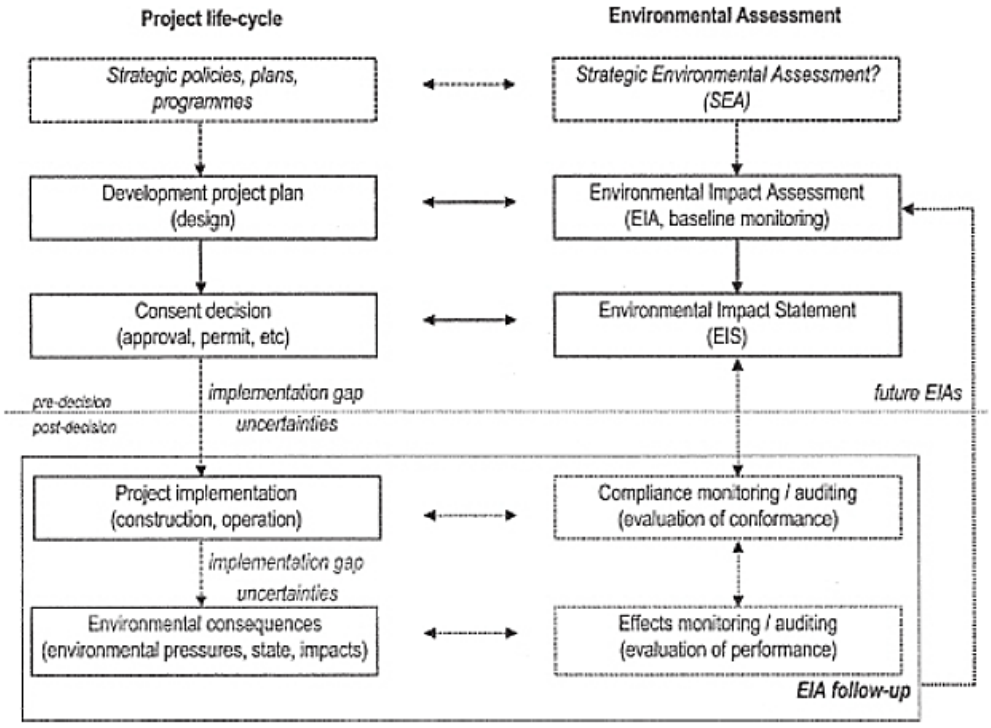

Figure 1. EA Follow-up within the project life cycle (Source: Arts et al., 2001; See also Arts and Morrison-Saunders, 2004; Morrison-Saunders and Arts, 2004).

EA Follow-up is a concept in the fields of environmental assessment (and management and planning), and gained its popularity in the early twenty-first century with the emergence of adaptive planning management and a focus on environmental impact assessment (Morrison-Saunders and Arts, 2004). EA Follow-up aims to understand the impact of a project/plan based on the EA that was carried out. This allows to better understand the actual environmental effects of a project/plan and how they differ from the predicted impact during the initial environmental assessment (Arts and Morrison-Saunders, 2004). Such Follow-up involves monitoring and evaluations, which serve as a critical mechanism for learning from past experiences and improving future environmental assessment practices. The process helps to determine the extent to which the environmental assessment has been implemented and carried out accordingly, while also serving as a learning mechanism to identify what has been done correctly and what needs improvement, including the adaptive capability of the project (Arts and Morrison-Saunders, 2004). EA Follow-up is crucial because it helps to address the implementation gap (see Figure 1) and ensures that the project/plan and its implementations are carried out as foreseen, and adjusted accordingly to achieve the desired outcomes (Arts and Morrison-Saunders, 2004). Additionally, EA Follow-up is important in addressing the uncertainties in the planning process (Arts and Morrison-Saunders, 2004; Fraser and Russell, 2016). This helps us to learn from our experiences and make more sustainable decisions by adapting to changes and learning from the process in order to reduce uncertainty in the process.

The International Association for Impact Assessment's best practice principles contain fifteen principles that guide the practices of EA Follow-up in different countries (Arts and Morrison-Saunders, 2022). Recently, these points have been further refined in relation to specific best practice principles for public engagement in EA Follow-up (Morrison-Saunders et al., 2023). Although having best practice principles is important, there are limited examples of EA Follow-up practices (Morrison-Saunders et al., 2003). One study on EA Follow-up found that it can enhance the effectiveness of environmental management in the Ekati Diamond Mine, Canada (Macharia, 2005). Another study conducted in Canada focused on the evidence of EA

Follow-up with a greater emphasis on community involvement (O'Faircheallaigh, 2007). The paper focuses on the involvement of community participation in environmental management by involving them in the negotiation process and ensuring the practice of EA Follow-up takes place (O'Faircheallaigh, 2007). The limited evidence on EA Follow-up makes it difficult to monitor whether expected impacts are materialising or not. However, EA Follow-up can help respond to anticipated impacts and be more adaptive in the planning process. Additionally, EA Follow-up can help take advantage of unexpected opportunities arising from environmental outcomes, thereby enhancing those opportunities.

Various studies literature have discussed best practices and key principles of Environmental Assessment Follow-up (Arts and Morrison-Saunders, 2004; Morrison-Saunders et al., 2003). However, the focus has primarily been on how to conduct the assessment itself rather than on various examples or case studies. It is crucial to understand how real-life case studies in European countries have carried out the follow-up assessment. This knowledge will help us understand to what extent they have implemented the key principles mentioned in previous studies and what additional practices can be identified that could be novel to the research. The goal is to find additional practices for Environmental Assessment Follow-up in European countries with different contexts. For example, Iceland's geographical characteristics and policies have influenced the rigorous environmental impact assessment (Gudmundsdottir et al., 2017). Meanwhile, the Netherlands has recently passed new environmental laws, while Denmark is working towards achieving its renewable energy goals through its latest Climate Act. These countries' unique characteristics and pressing issues make them interesting subjects for comparative research.

2.3 Implementation theory

Implementation theory in the context of planning aims to bridge the gap between planning and policy realisation (Chen and Rossi, 1987; Palumbo and Oliverio, 1989). Vedung (2017) Suggests that the theory of implementation focuses on the effective implementation of policies and practices to bring programs to realisation and how different actors come together to achieve the desired outcome. This theory takes into account not only the implementation process itself but also the individuals involved, the necessary resources, and institutional aspects such as policies and mechanisms required to meet the goals of implementation. Furthermore, implementation theory evaluates the actionable plan of the policy being implemented to determine the most effective means of execution.

According to Palumbo and Oliverio (1989), there are various types of implementation theories that pertain to planning, including top-down, bottom-up, adaptive, and evolutionary. The *top-down* approach focuses on the central government creating policies that are then enforced upon the population. This approach also goes hand in hand with technical rationality, where planning experts have a greater degree of control in the decision-making process. The second aspect of implementation theory is the *bottom-up approach*, which focuses on the role of citizens in implementing policies (Pissourios, 2014). This approach is also related to communicative planning, where citizens have greater involvement in adapting policies to suit local conditions and making them more practical and contextualised toward reality (Koontz and Newig, 2014). The third type of implementation theory is *adaptive*, which centres around continuous evaluation and adaptation to changing circumstances (Chen and Rossi, 1987; Palumbo and Oliverio, 1989). This approach combines elements of both top-down and bottom-up approaches to ensure that all stakeholders involved in the implementation process are content. Lastly, the fourth implementation theory is *evolutionary*, which involves transforming systems and organisations to be more progressive and adaptable in planning and implementation in

order to achieve desired outcomes (Alexander, 1985). Based on these four types of implementation theory, adaptive planning is the most relevant for the EA Follow-up as it provides the opportunity for continuous improvement and development.

Implementation theory plays a crucial role in translating the recommendations and planning of EA into actionable strategies in order to minimise implementation gaps. It helps to transform environmental impact assessment reports into more practical and implementable actions while also guiding compliance in implementation procedures (Wood, 2003). Studies suggest that implementation theory provides a framework for implementation that outlines the necessary steps, such as stakeholder engagement, including the public, assessing the required resources, and developing strategies to achieve the goal (Nilsen, 2015; Palerm, 2000). Within the implementation of plans, effective stakeholder engagement is important to ensure that the project engages relevant stakeholders and addresses them with the appropriate communication style to ensure that all stakeholders are on the same page to achieve the desired outcome (Lewis, 2007). Moreover, considering the implementation plan is helpful in understanding whether certain steps for impact assessment are practical and can be carried out considering factors such as available resources, technical expertise, and regulatory constraints (Hertin et al., 2009). This helps in ensuring that the project is implemented successfully.

In relation to the concept of implementation theory, there is an element of the implementation gap, which refers to the gap that can occur between policy formulation and its successful execution (Gilg and Kelly, 1997). An implementation gap may arise due to several factors, including inadequate (human) resources, ambiguous policy planning, opposition from stakeholders, or uncertainties in project scope (Abdullahi and Othman, 2020; Baier et al., 1986; Berke et al., 2006; De Winter, 2022; Makinde, 2005)**.** Additionally, the difference in locations where policies are implemented can contribute to how the results of the implementation (Khan and Khandaker, 2016; Thomas and Grindle, 1990). Implementation theory can help us understand the root causes of this discrepancy in detail, which is related to the implementation gap.

The implementation of the Environmental Assessment (EA) Follow-up best practice involves following the 15 principles laid out in the guidance published by the International Association for Impact Assessment (IAIA). The aim of this guidance is to provide direction to impact assessment practitioners on how to implement the EA Follow-up effectively (Arts and Morrison-Saunders, 2022; Morrison-Saunders and Arts et al., 2024). A helpful visual representation of these principles can be found in Figure 2. This guidance provides information on the different parties involved in carrying out the EA Follow-up. These include the proponent-led follow-up, carried out by the project proponent; the EA regulator-led follow-up, carried out by the regulatory body; the community-led follow-up, which includes public and citizen-led initiatives; the indigenous-led follow-up, which includes the indigenous community; and independent-led follow-up, which includes auditors, academia, and experts (Arts and Morrison-Saunders, 2022; Morrison-Saunders and Arts et al., 2024). These 15 principles are crucial elements in the implementation of EA Follow-up.

1. State the objective of each impact assessment follow-up activity and the overall program.
2. Be tailored to context.
3. Commence early in the impact assessment process.
4. Be carried out throughout the project or plan life-cycle.
5. Be transparent.
6. Be accessible to all impact assessment stakeholders.
7. Provide clear accountability for impact assessment follow-up responsibilities.
8. Provide clear, pre-defined and well-justified performance criteria.
9. Specify enforcement provisions.
10. Promote continuous learning from experience to improve future practice.
11. Facilitate adaptive management.
12. Be flexible according to emerging needs.
13. Inform and be informed by follow-up for other relevant activities at different levels of decision-making.
14. Address cumulative effects.
15. Consider the overall effects of the project or plan.

Figure 2. The 15 principles of EA Follow-up. (Source: Arts & Morrison-Saunders, 2022; see also Morrison-Saunders and Arts et al., 2024).

In addition to implementing a project based on a plan, implementation theory is also studied within the project management literature, which helps in assessing and mitigating risks (Dey et al., 2013). It also helps understand to what extent the risks have been mitigated and what additional mitigation strategies need to be implemented (Anderson and Narasimhan, 1979). Additionally, implementation theory leads to effective monitoring and evaluation because EA is the standard for policy implementation instruments (Alberts, 2020)This ensures that the strategies being implemented align with the recommended environmental assessments and project goals. It also helps address any issues that may arise during project implementation and learn from them. Therefore, the implementation theory is closely related to the theory of adaptive planning, which is a foundational framework for this research.

2.4 Adaptive management theory

According to Holling and Walters (1978), adaptive management for environmental issues is an important process within the project management, where not everything is fixated in the beginning of the project. Usually, there are various kinds of projects that involve testing models and is necessary to adapt and improve the models based on the information gathered through trial and error. This helps in finding the best possible outcome (Holling and Walters, 1978). When embarking on a project, it is crucial to take into account its environmental impact, which enables the team to gain insight into the ecological variables that could influence the project's course and make any necessary adjustments. Additionally, continuous learning about the current state of the project is key to mitigating the project's adverse effect on the environment (Holling and Walters, 1978). Adaptive planning is a process that involves evaluating and monitoring new information and then adjusting strategies or goals based on the results of the evaluation (Lessard, 1998). This process is continuous and is aimed at improving the project to achieve the desired outcome. Adaptive management is a useful approach that allows for flexibility in coping with uncertain planning situations (Allen et al., 2011). It also helps to develop different management approaches that are more adaptable and acknowledge the inevitable changes that occur during project implementation (Allen et al., 2011). The theory of adaptive management was introduced in the late 1970s through series of workshops and was mainly focused on natural resources and ecosystem management (Holling and Walters, 1978; Kato and Ahern, 2008). Over time, the concept of adaptive management has been expanded

from focusing to mainly ecology and natural resources to include planning landscapes and resilient infrastructures (Giordano, 2012; Kato and Ahern, 2008).

Adaptive management has been widely applied in infrastructure planning, particularly in the areas of climate adaptation and resilience (Beheshtian et al., 2018; Giordano, 2012). This includes ensuring the adaptive capacity of energy infrastructure and formulating resilient infrastructures (Trejo, 2023). One key discussion in the energy context is related to the capacity needed to meet energy demand, which is where adaptive management practices come into play (Yan et al., 2021). This involves planning for adaptive capacity in the energy networks and grids to improve performance and allocate resources effectively. In addition, studies have focused on the impact of climate change on energy infrastructure vulnerability and the need to address these issues accordingly toward more resilient infrastructures (Brockway and Dunn, 2020). Another area of research looks at how to enhance the resilience of energy infrastructure using an adaptive robust optimisation model in order to maintain a resilient energy infrastructure system and adjust the high demands of seasonal spikes (Riepin et al., 2022).

According to Miles (2013) who adapted the concept from Nyberg (1999), an adaptive management cycle involves several steps. The initial step in designing a program or plan involves outlining its overall structure, exploring available methodologies for developing predictive models or assessment tools, establishing criteria for option evaluation, formulating a monitoring strategy, and ultimately executing the plan. While implementing the plan, field tests or pilot projects should be conducted, and selected management alternatives should be monitored and evaluated (Miles, 2013). The results of the monitoring plan should be reported, and assessors should review the results to evaluate if they align with the expected outcomes. If there are discrepancies, adjustments should be made based on the new information received during the evaluation process. The cycle continues by assessing the adjustments made and determining whether or not the necessary goals have been achieved, as seen in the Figure 3.

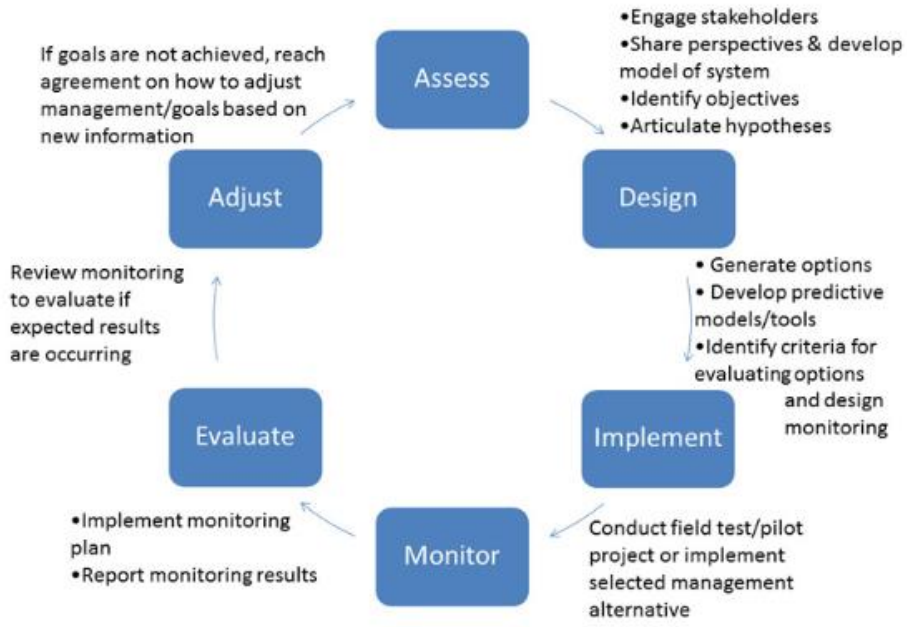

Figure 3. Adaptive management cycle. Source: Miles (2013), adapted from Nyberg (1999)

According to Williams (2011) and Williams and Brown (2014), one of the most crucial aspects of adaptive management is the learning process, which helps to understand what plan has been implemented and make adjustments when necessary. The studies from Williams (2011) and Williams and Brown (2014) offer valuable insights into the adaptive management framework

by highlighting the significance of both technical and social learning in the process (Figure 3). The framework consists of two phases: the deliberative phase and the iterative phase (Williams, 2011; Williams and Brown, 2014). The deliberative phase involves planning, which is a critical component for making informed decisions. This phase includes identifying stakeholder objectives, considering alternative models, and establishing monitoring protocols. During the iterative phase of a project, decision-making and learning take place. This phase involves monitoring and assessing progress and is closely related to the planning phase. Monitoring progress, learning about the system and evaluating the decisions that have been made are the crucial elements. If necessary, adjustments are made based on the assessment to improve the decision-making process. One of the highlights of this model is the follow-up monitoring. It is an important component of the iterative phase as it provides valuable information about the available resources and helps to learn from past decisions (see Figure 4). This information can guide future decision-making and ensure that the projects and plans stay on track to achieve the desired outcomes. Additionally, the study by Hansman et al. (2006) discussed that the infrastructure system is a complex matter that involves both technical and social structures. Therefore, when designing the built environment, it is crucial to take a multidisciplinary approach and consider multiple domains to assess the complexity of the infrastructure. To better understand the nexus between technical and social challenges of infrastructure and spatial development, the research approach requires a comparative analysis of different infrastructure projects.

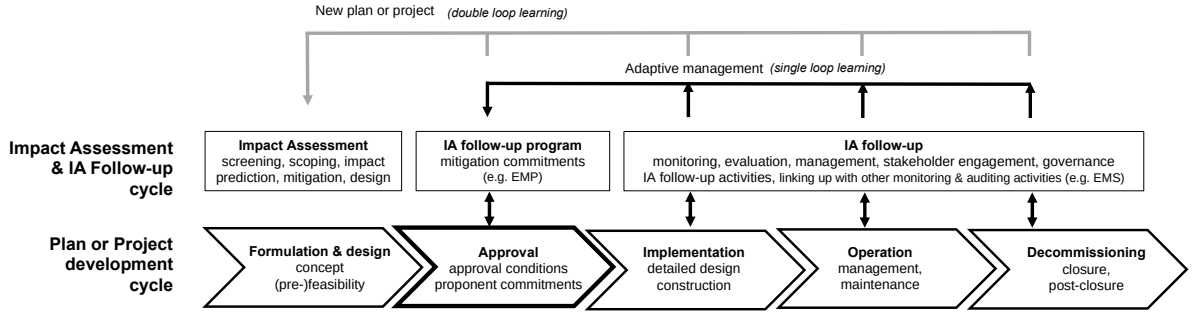

Figure 4. Development life cycle (of projects or plans), Environmental Assessment and Follow-up cycle and Adaptive management (Arts et al., Forthcoming)

The study of adaptive planning underlines the presence of uncertainty. While uncertainty can be seen as a challenge in adaptive planning, it also can be seen as an opportunity. Uncertainty is a challenge because it is unpredictable and thus disrupts the nature of planning in order to achieve the expectation (Peterson et al., 2003). To deal with uncertainty, it is important to embrace it by acknowledging its existence and learning to respond to the unpredictability nature of planning. The first step towards embracing uncertainty is to recognise that it exists within the planning process. It is important to acknowledge that uncertainty is often outside of our control, however, we can take measures to better understand and respond to it (Scoones and Stirling, 2020). The concept of embracing uncertainty and turning it into an opportunity emphasises responding to uncertainty by innovating and creating new solutions (Scoones and Stirling, 2020).

2.5 Conceptual framework

The conceptual framework of the research is drawn upon theories and guidelines from previous research and the International Association for Impact Assessment (Arts and Morrison-Saunders, 2004; Morrison-Saunders et al., 2021; Morrison-Saunders and Arts, 2004) as seen

in Figure 5. In the project cycle (see Figure 1), environmental and social consequences often emerge as a result of project implementation or construction processes. By using the umbrella of implementation theory, it is important to identify any implementation gap and acknowledge the uncertainties in project planning and execution to manage these consequences and minimise the negative impacts. In order to assess the impact, EA Follow-up should be integrated into both the ongoing assessment during project implementation and the ex-post impact assessment cycle. The process of EA Follow-up is guided by a framework that includes fifteen key principles of the EA Follow-up implementation published by the IAIA (Morrison-Saunders and Arts, 2021).

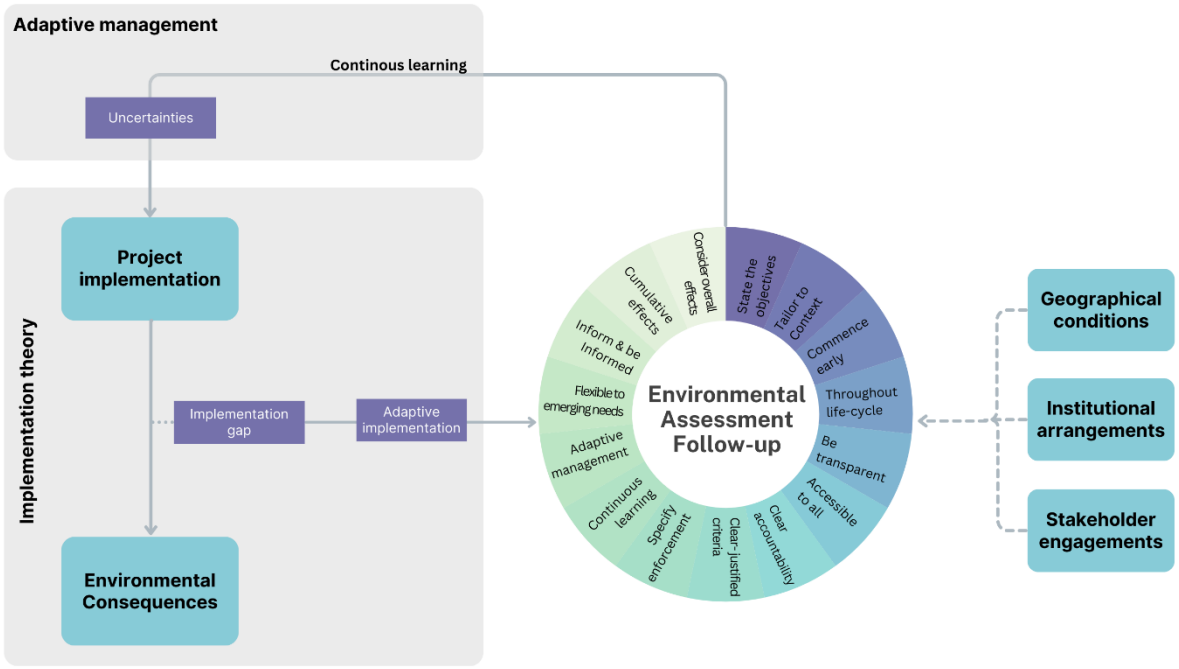

Figure 5. Conceptual Framework (Author's depiction adapted from Arts & Morrison-Saunders, 2004; Morrison-Saunders et al., 2021)

EA Follow-up is an important approach to adaptive management and planning, as this allows organisations to adjust their strategies based on assessment outcomes and promote continuous learning. When addressing the implementation of EA Follow-up, three critical factors play an essential role in influencing the assessment outcomes: geographical conditions, institutional arrangements, and stakeholder engagements (Abdullahi and Othman, 2020; Baier et al., 1986; Berke et al., 2006; De Winter, 2022; Gilg and Kelly, 1997; Khan and Khandaker, 2016; Makinde, 2005; Thomas and Grindle, 1990). These factors are context-specific and vary by country, making it essential to conduct a comparative study to better understand the practice of EA Follow-up and its influences.

2.6 Theoretical application: Implementation theory and adaptive management on EA Follow-up

Based on the literature review, the energy crisis in Europe necessitates the development of additional energy infrastructure to meet the rising demand. As a result, the study of sustainable energy transitions is becoming more important, which leads to a growing interest in the impact

assessment of energy infrastructures. There is a lack of research on impact assessment, especially with regard to the follow-up aspect of the assessment. While there are studies about EA Follow-up practices in Canada or Australia, limited studies regarding this related to a comparative analysis (Macharia, 2005; Morrison-Saunders et al., 2004; O'Faircheallaigh, 2007). Meanwhile, it is crucial to understand what factors influence the practices of EA Follow-up in different contexts. To answer the research question, a comparative study is conducted guided by two theories: the implementation theory and the adaptive planning theory. The implementation theory is directly linked to the execution of EA Follow-up, while the adaptive planning theory emphasises the use of results from EA Follow-up to encourage more adaptive management.

The literature review in this chapter helps to answer the first research question on how adaptive planning and implementation theory shapes the understanding and practice of EA Follow-up. The concepts of implementation theory and adaptive management provide a foundation for the research related to environmental assessment. EA Follow-up provides guidance on how to conduct an ex-post assessment based on the planning in the EIA. The process involves checking whether the planned activities are being implemented in the field, and assessing whether they are being conducted according to the plan. This relates to implementation theory, including the four types of implementation approaches: top-down, bottom-up, adaptive, and evolutionary. In literature about (the practice of) EA Follow-up, the adaptive approach is particularly focused on and related to shaping the understanding of how to implement the ex-post assessment effectively.

The theory of adaptive management is useful for understanding the EA Follow-up process because it involves adapting the results obtained from monitoring and evaluation to facilitate continuous learning and taking action. Adaptive management is particularly relevant in this context because it helps to manage uncertainty, which is an inherent aspect of planning and EA. By using the monitoring results and promoting continuous learning, the uncertainties and knowledge gaps that arise during the planning process can be better understood and addressed.

The focus of this study is on energy infrastructure, due to the current energy crisis and energy security in Europe (Calanter and Zisu, 2022). To address this, efforts are being made to develop a more sustainable energy infrastructure. However, it is crucial that the development is carried out in an environmentally sustainable manner. This can be achieved by implementing the EA Follow-up process. Additionally, the current energy transition is driving the development of new energy production technologies, which brings many unknowns. To effectively manage these uncertainties, insights from adaptive management theory should be applied. In this way, the EA Follow-up process can help gather new knowledge and promote continuous learning within the context of energy infrastructure. This approach will ensure that projects and programs aimed at achieving sustainable energy transition are carried out in a sustainable way.

3 Research Methodology

This research is a comparative study of the Netherlands, Iceland, and Denmark in relation to their energy infrastructures and impact assessment practices. Comparative studies are a research method that involves analysing multiple cases in order to examine the similarities and differences (Knight, 2001). The main advantage of comparative studies is the ability to generate more generalisable results compared to a particular scope of research (Denscombe, 2017). When conducting comparative studies, there are three types of comparisons that can be made: horizontal, vertical, and transversal. The horizontal comparison focuses on comparing multiple cases, such as individuals, groups, organisations, partnerships, or social movements (Bartlett and Vavrus, 2017; do Amaral, 2022). The vertical comparative case studies delve into how different levels interact, while transversal comparison focuses on a comparison of development over time (Bartlett and Vavrus, 2017; do Amaral, 2022). This approach examines how similar phenomena evolve in different places or social contexts, which is applicable to this research (Bartlett and Vavrus, 2017). This research focuses on horizontal comparison with three stages of research operationalisation because it examines the Environmental Assessment Follow-up in the context of energy infrastructures.

3.1 Data collection

The research utilises multiple data collection methods to gain a comprehensive understanding of the practices of EA Follow-up in energy infrastructure by combining literature review, document review, semi-structured interviews, and Focus Group Discussion (FGD) (Heigham and Croker, 2009). The use of these three methods for data collection helps to triangulate the findings. To answer the research questions, the study first conducts a systematic literature review in order to gain insight into the existing literature on the EA Follow-up and the theories. Afterwards, the study conducts a document review to identify the EA Follow-up practices in the Netherlands, Iceland, and Denmark. The document review process analyses impact assessment reports, administrative records, and policy brief documents (See Appendix G). Only publicly available data are obtained from official government websites and archives, and databases of professional associations, such as the International Association for Impact Assessment. Once the document review is complete, the research focuses on the specific context of EA Follow-up related to energy infrastructure projects in the Netherlands, Iceland, and Denmark. This helps to gain a better understanding of how the EA Follow-up practices have been implemented.

Since the second, third, and fourth research question requires information related to detailed projects and the experience of the project managers and government officials on the practices of EA Follow-up, it is essential to conduct interviews (Denscombe, 2017). In order to answer research questions related to 'how' and 'why', it is essential to gather detailed information which is applicable by using a qualitative approach (Shahrad, 2024). The interviews are in-depth and semi-structured, allowing for detailed information and flexibility to seek clarification while still following a set of clear questions (Denscombe, 2017) (See Appendix A and B for interview guides). This is because, at the beginning of the study, the research is more exploratory in nature due to the limited information available about the extent of EA Follow-up practices in these three countries. The semi-structured interview provides information about several aspects that need to be researched (See Appendix A and B), while also allowing for flexibility to expand on questions based on the information that arises during the interview.

There are 22 interviews, consisting of 10 informants from the Netherlands, 5 from Iceland, and 7 from Denmark (See Appendix F). The interviews involve EA experts, stakeholders including professionals in the energy sectors, academics, and government officials who have participated in the EA Follow-up projects (See Appendix F). The participants are selected from diverse backgrounds to provide various perspectives and share their experiences on EA Follow-up from academic, practice, and government viewpoints. The approach to engaging participants is based on reaching out to experts and project proponents with experience in EA Follow-up. It is crucial to emphasise that the study participants possess expertise and/or experience in Environmental Impact Assessment (EIA), energy infrastructures or energy sector issues, and EA Follow-up. Given the limited number of practitioners and experts meeting these criteria of expertise in the Netherlands, Iceland, and Denmark, contact begins with suggestions from professors and supervisors who act as gatekeepers to help establish connections with the participants. Additionally, other contacts are suggested by participants, individuals active in the International Association for Impact Assessment (IAIA), and those involved in EIA follow-up practice based on the publication or reports. This method contributes to broadening the sources of information, diversifying the expertise of participants, and ensuring a more comprehensive data collection process.

This research also included conducting a focus group discussion (FGD) with six experts from the Netherlands and Denmark to validate the findings and gain a deeper understanding of their perspectives (see Appendix J – Participants of FGD). This method is selected because it allows diverse perspectives from participants at the same time with interactive settings (Hennink, 2013). Participants are given the chance to give their feedback on the opinions of others, which will help to enhance the results. The FGD was also used to elaborate on the findings and enrich the recommendations. The process of the FGD lasted approximately one and a half hours and addressed four main issues (see Appendix H—Concept Notes of FGD). The information provided confirmed the initial findings from the literature reviews, document analysis, and expert interviews.

3.2 Data analysis

Document reviews are analysed with the content analysis method using deductive code based on the theories and terms from the literature review. Content analysis is used for this research because it helps to find the information within documents in systematic ways and helps in providing the conclusion (Stemler, 2001). The data are coded using deductive coding for which the program ATLAS.ti[1] was used with predefined codes because it helps provide consistency over the analysis and is replicable across different documents (See Appendix E).

The data obtained from the interviews and focus group discussion were transcribed and analysed based on deductive and inductive coding and the thematic analysis method (See Appendix E). Thematic analysis was chosen because it allows for systematic identification and assessment of the data that are relevant to the conceptual framework (Braun and Clarke, 2012). The interviews were analysed using two coding schemes—deductive and inductive. The deductive codes were based on terms found in the literature review (see Chapter 2). Additionally, any new terms not covered by the deductive coding but found during the analysis of documents and interview transcripts are included as inductive codes in the coding scheme

[1] ATLAS.ti is qualitative data analysis software, primarily used for assigning codes to data such as interviews, documents, and meeting notes in order to identify patterns and themes (ATLAS.ti, n.d.).

(Appendix E) to enable more comprehensive thematic analysis. To assist with coding the data, the research used ATLAS.ti software.

3.3 Operationalisation

The study consisted of four phases aimed at identifying the practices for EA Follow-up in energy infrastructure for the Netherlands, Iceland, and Denmark. Before commencing the initial phase of the study, a systematic literature review was carried out to collect relevant information on the topic and related theories. This was the first phase of the study and attempted to answer the first sub-research question, and the findings are discussed in Chapter 2. Afterwards, during the second phase, the research addressed the second research questions, which involves the understanding and practice of EA Follow-up. The second phase was conducted using general interviews and document analysis from EIA reports, monitoring websites, government information, and previous relevant research within the same scope. The focus of this phase was to uncover the definition and approach to EA Follow-up, while providing examples of its application in the aforementioned countries. In addition, this phase seeks to gain a broader understanding of the context, including physical-geographical conditions, institutional arrangements, and stakeholder involvement in EA Follow-up in these three countries at the macro level. The findings are used to address sub-research questions 2, 3, and 4 at the country level.

The third phase of the study focused on addressing the research questions that relate to the physical-geographical conditions, institutional arrangements, and stakeholder involvements, as well as the implementation and barriers of EA Follow-up. This addresses sub-research questions 2, 3, and 4 through case studies from projects, plans, and programs (micro level) that implement EA Follow-up. The third phase was conducted by using semi-structured interviews as the main data collection method with an addition of document analysis. This part of the research is particularly centred on the energy infrastructure context, given the current shift towards energy transition and the requisite for conducting impact assessments for each of these initiatives. Additionally, this phase aims to investigate the role of the physical-geographical conditions, institutional arrangements, and key stakeholders in the practice of EA Follow-up within energy infrastructure projects. This focus allows for a more comprehensive grasp of the challenges and obstacles associated with implementing EA Follow-up within particular contexts.

The fourth component of this research involves conducting a focus group discussion to address all research questions as well as confirming the findings based on the previous phase of the study. Additionally, the focus group discussion also aims to assist in the triangulation process by presenting the preliminary findings and verifying the outcomes with experts. In this phase, focus group discussion is an effective means of collecting information from diverse participants who offer unique perspectives (Onwuegbuzie et al., 2009). The details of each phase of the study can be found in Figure 6.

Stages	Focus	Methodologies	Research question addressed	Details
1. Theoretical orientation	• Overview of Environmental Assessment (EA) • EA Follow-up • Implementation theory • Adaptive management	Systematic literature review	RQ1: How does adaptive planning and implementation theory shape the understanding and practice of EA Follow-up, especially in relation to energy infrastructure?	• Brief explanation of EIA and SEA, focusing on their linkage with energy infrastructure development. • Discuss EA Follow-up based on existing work on EA Follow-up, focusing on implementation theory and adaptive management. • Discuss implementation theory • Discuss adaptive management
2. Comparison at Country Level	• Generic practice of EA in the Netherlands, Iceland, and Denmark	• Document analysis of policy documents, evaluation, and scientific publications • General semi-structured interviews	RQ2: What is the current practice of EA Follow-up in the Netherlands, Denmark and Iceland, especially for energy infrastructure development? RQ3: How is EA Follow-up implemented in the Netherlands, Iceland, and Denmark, and what are the success factors and challenges for the practices of EA Follow-up in energy infrastructure projects? RQ4: How do physical-geographical conditions (such as 'islandness'), institutional arrangements, and stakeholder involvements in each country influence their EA Follow-up practices related to energy infrastructures?	• Analyse policy documents and evaluation reports (e.g., EU evaluations of EIA/SEA systems). • Conduct interviews with participants from the Netherlands, Iceland, and Denmark.
3. Case Comparison	Case studies as illustrations (exemplars)	• Document analysis of cases with two cases for each country • Interviews with professionals involved in the cases		• Analysis of documents for each country's case study. • Interviews with professionals and stakeholders in the energy sector involved in the cases from the Netherlands, Iceland, and Denmark.

4. Triangulation and recommendations	Validation and triangulation of findings, and refinement of recommendations	• Focus group discussions	All the research questions.	• Conduct a focus group discussion with 6 professionals to discuss the main findings and recommendations to triangulate the results and refine the findings.

Figure 6. The Operationalisation of the Research

3.4 Positionality

As a Research Master's student, it is crucial to address the issue of positionality in the research process. This section aims to provide an overview of the researchers' point of view to help the reader comprehend the perspectives that may impact this study.

As a woman from the Global South researching the impact assessment of infrastructure projects in European countries, the researcher believes it could affect the interaction with participants. Since infrastructure planning is a male-dominated field, being a woman might create barriers during data gathering, but it also presents an opportunity for a fresh perspective. For instance, the researcher's previous education has helped her gain a multidisciplinary understanding of my topic. The researcher pursued a Bachelor's degree in Political Economy, followed by a Master's degree in Public Policy, which has enabled her to comprehend the government's perspectives related to infrastructure issues. The researcher has also taken courses related to infrastructure planning and environmental issues, which has given her a comprehensive view of the topic related to infrastructure projects which respect the environment. It proved to be helpful to explore impact assessment research from a comprehensive and multidisciplinary perspective as the EIA aspects comprised various disciplines and engaged with many stakeholders. The thesis is being conducted as part of a research internship at the Rijkswaterstaat, the Netherlands, to establish credibility and build connections with key informants. However, it is important to acknowledge the potential for bias related to Dutch practices, which are aimed to mitigate by closely collaborating with a student research group from Denmark and engaging in discussions with experts from Iceland throughout the study, outside of the interview process. This approach is designed to minimise any potential bias.

With regard to scholarship, the researcher highly values nature and believes that every development project should be respectful towards it. The researcher is interested in researching how the environmental assessment of infrastructure projects is carried out to ensure that development occurs within the boundaries of nature. However, the researcher understands that personal bias towards the importance of nature and its boundaries might result in overlooking the effectiveness of the projects. Therefore, the researcher is seeking advice from my supervisors for this research and discussing the matter with other scholars from various disciplines to diversify the viewpoint for this research.

3.5 Ethical considerations

This research will adhere to the ethical principles outlined in the guidelines from the University of Groningen.

Before data collection

Prior to beginning the data collection process, ethical considerations must be carefully reviewed. While this research proposal has already identified the positionality of the researchers, it is essential to create a well-designed informed consent process and seek guidance from both the supervisor and the data protection officer (DPO), when necessary,

to address any ethical concerns that may arise during the research. Participants are provided with informed consent and written information about the research (See Appendix C and D).

Before collecting data, the researcher attempts to comprehend the context of the participants and their situations by looking into various perspectives through document analysis. This step is taken to ensure the high quality of data and develop the interview design; additionally, it allows the researcher to carefully consider each phase of the research process.

During data collection

During the process of collecting data, the researchers will prioritise making the participants feel comfortable. They will emphasise that there are no right or wrong answers, and ask the participants to ensure their own comfort throughout the study. Additionally, participation in this research is completely voluntary.

Participants have the right to withdraw their participation from the data collection process during the research process. As the participants come from different countries, the researchers will ensure that there is no bias and that everyone is treated equally. For the document analysis, we will only collect publicly available data, such as the final report and approved policy briefs. We will collect data through official channels, such as official websites, library archives, and written correspondence.

After data collection

Once the data collection process is complete, all collected data will be kept anonymous, and securely stored. Participants in the research study will be granted the opportunity to review the transcript before the results are published, if they are willing to. They will also have the opportunity to clarify or withdraw their participation from the study. This will enable them to have control over which parts of their participation are published. As for secondary data, the researchers will ensure that proper credit is given to the sources.

Although this research made an effort to consider all ethical considerations, there may be some incidents that need to be addressed. For instance, if participants request data retrieval beyond the specified time frame, such as after publication, we will handle such cases on a case-by-case basis in consultation with the DPO and the supervisor.

4 Findings Macro-level: EA Follow-up in the Netherlands, Iceland, and Denmark

This chapter presents the results of the research question regarding the EA Follow-up in the macro level of the country and system in the Netherlands, Iceland, and Denmark. This chapter covers both the general state of the art of EA Follow-up in these three countries and the specific focus on the energy infrastructure. The data was collected through document analysis, interviews, and focus group discussion. Additionally, this chapter explores the lessons learned from the EA Follow-up, which contribute to the careful implementation of adaptive management for energy infrastructure projects in these countries.

4.1 The current practice of EA Follow-up

This section describes the current practices of EA Follow-up in the Netherlands, Iceland, and Denmark. The aim is to identify the extent to which Follow-up assessments are being conducted. In general, the practices of environmental impact assessment in each of these countries are quite similar because they are European countries and follow the EU EIA directive. This is also the case in Iceland, even though Iceland is not part of the European Union; however, as it is part of the EEA, it still follows the EIA Directive (European Parliament and Council of the European Union, 2011, 2014).

4.1.1 The Practice in The Netherlands

In the Netherlands, the EA procedure is derived from the EU Directive, which involves two types of assessments: strategic environmental assessment for policies and plans, and general environmental impact assessment programs (European Parliament and Council of the European Union, 2011, 2014). In the Netherlands, monitoring and valuation are typically conducted after project implementation, which is done at the final stage when the project or plan has been completed, as seen in Figure 7 (Rijkswaterstaat, n.d., n.d.; wetten.overheid.nl, 2024). The national regulation related to the *"monitoring for plans and programmes is embedded in article 16.42a of the Environmental and Planning Act (Omgevingswet), and article 11.5 Omgevingsbesluit. Monitoring for projects it is laid down in article 16.53a of the Environmental and Planning Act, and article 11.20 Omgevingsbesluit"* (NL 8, NL 9). This is being conducted for both the project and plan. Despite the regulation, the EA Follow-up is relatively few cases being applied in the Netherlands in practice (NL 8, NL 9, Antea, 2024). In the Netherlands, the term used for EA Follow-up is '*Monitoring en evaluatie*' (NL 4). The participant mentioned that the meaning is related to the scope of monitoring and evaluation in the Netherlands (NL 1).

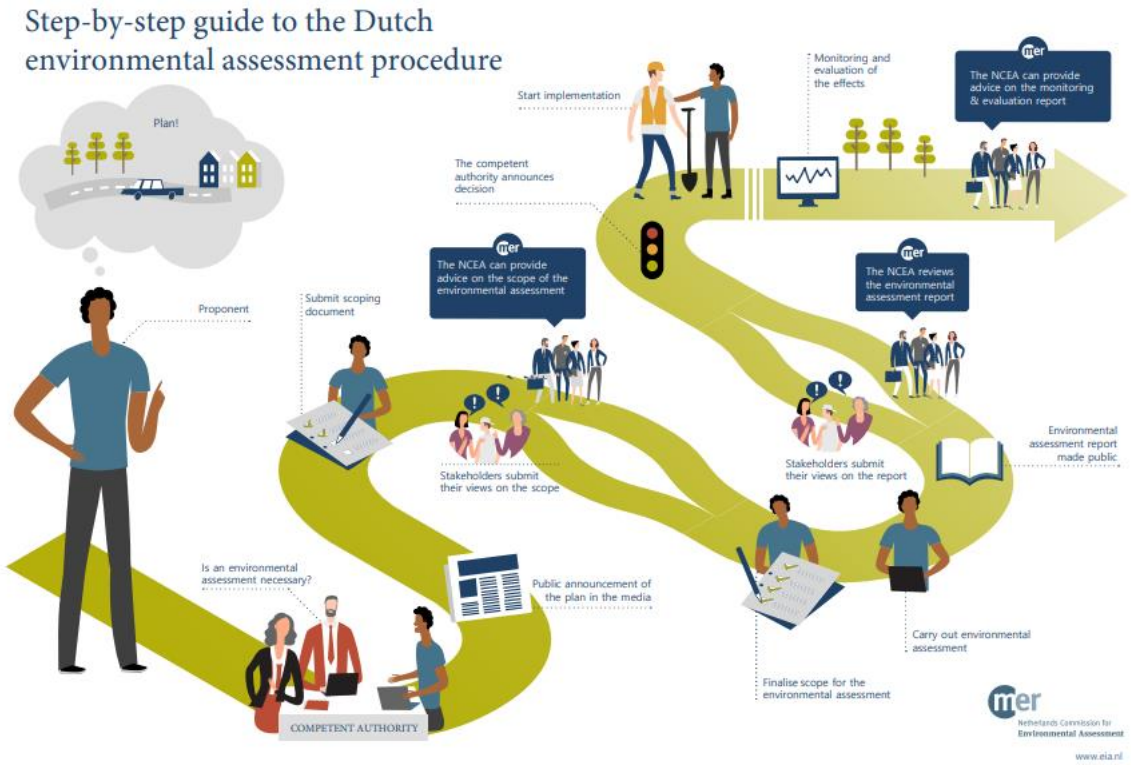

Figure 7. Procedure of EA in the Netherlands. Source: Netherlands Commission for Environmental Assessment, n.d.

4.1.2 The Practice in Iceland

Environmental assessment (EA) is an important process in **Iceland,** involving both SEA and EIA with "regulation on environmental assessment of projects and plans, no. 1381/2021, Regulation no. 773/2023 amending regulation 1381/2021" (skipulag.is, n.d.). While it is often associated with licensing and permits, it can also be a standalone procedure (see Figure 8). Projects undergo screening to determine if they require environmental assessment, considering both their potential impacts and the type of projects. If the project requires EA, then the process is being conducted before the proponent proceeds to apply for the licenses. EA Follow-ups are being conducted after the project is completed, depending on whether it is required to obtain the license or advised by the National Planning Agency. Additionally, monitoring is the primary term used for EA Follow-up in Iceland and is usually conducted for projects involving well-known developers or national agencies; thus, the practice of EA Follow-up is common (IS 2, IS 4). Municipalities are mainly responsible for ensuring that Follow-up is carried out as it is related to the licenses obtained by the proponents, with the term "monitoring" or "watching" (*vöktun* – Icelandic) being commonly used in this context (IS 2).

Figure 8. Overview of the EIA process in Iceland (Vegagerðin, n.d.)

4.1.3 The Practice in Denmark

In Denmark, environmental assessment practices adhere to the EU directive, with the type of assessment varying according to project size (see Figure 9 for the procedure) (DK 1). The two most commonly used assessments are the Strategic Environmental Assessment (SEA) and the Environmental Impact Assessment (EIA). To determine the extent of a project's environmental impact after the project is conducted, monitoring is employed as part of the EA Follow-up practice. In Denmark, the term for EA Follow-up is related to the term *Overvågning,* which is translated as monitoring (DK 2, DK 3). Nonetheless, it is important to understand that a general nature monitoring program exists in Denmark, which is distinct from EIA and has a narrower scope (DK 1). In the past, the practice of EA Follow-up, especially monitoring programs, was more common for offshore wind parks as an explorative way to gather knowledge in this sector (DK 3). In Denmark, the practice of EA monitoring is limited and limited case studies in this case can be identified (DK 1, DK 3, DK 5). The reason for the limited practice of EA Follow-up is that *"the majority of the cases, we would end up concluding that there is no significant impact"* (DK 3). However, there has been an increasing discussion about the need for EA Follow-up, as the public is becoming more aware of the importance of monitoring environmental impacts (DK 7).

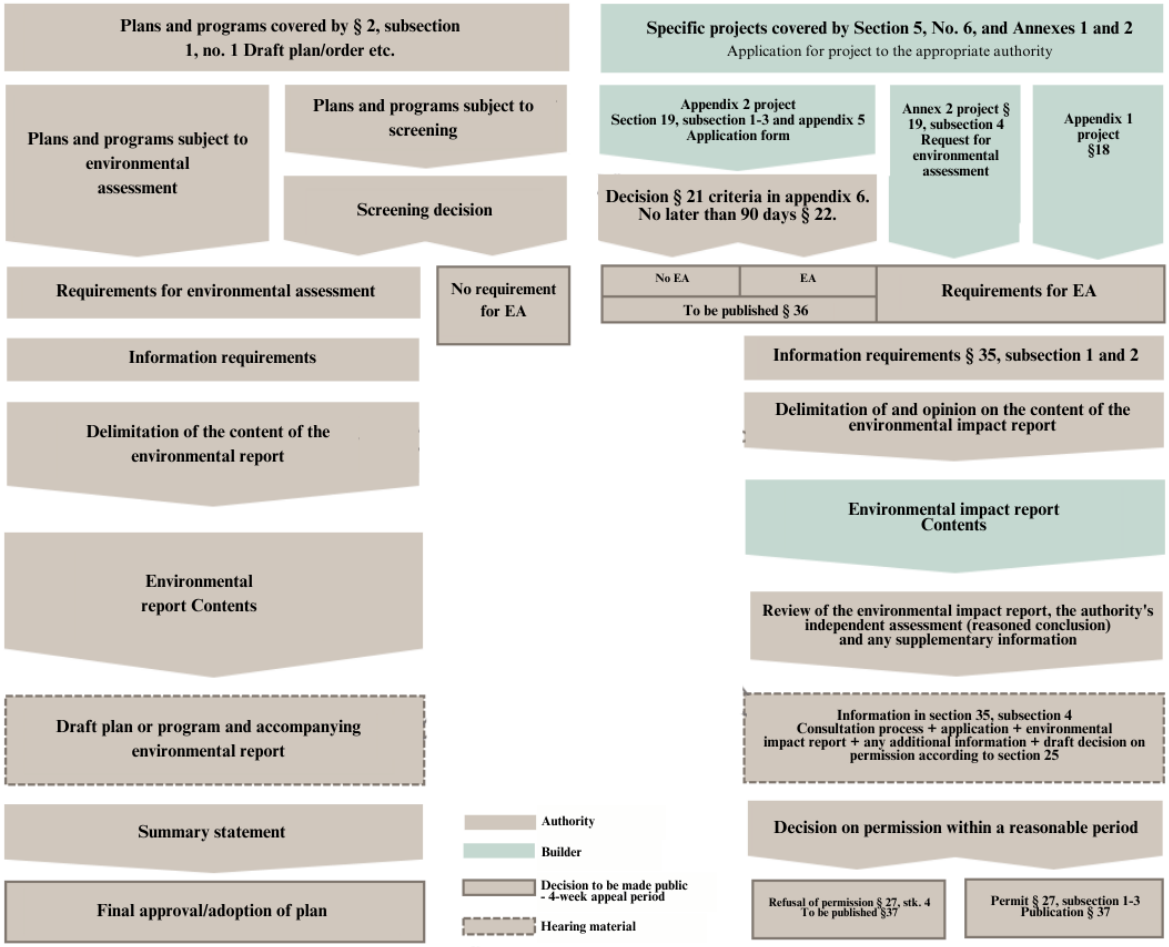

Figure 9. Guide to the Act on Environmental Assessment in Denmark. Author's modification of the original figure from Miljøministeriet (2023)

4.1.4 The Overall Practice of EA Follow-up

In Iceland, the Netherlands, and Denmark, the practice of EA Follow-up is conducted after a project, which mainly includes monitoring and evaluations based on the participants' understanding (NL 3, IS 2, DK 1, skipulag.is, n.d., Rijkswaterstaat, n.d., n.d., wetten.overheid.nl, 2024). While the process of EA Follow-up is not legally binding, it may be required as part of permits (IS 2). However, there is some ambiguity regarding who bears the responsibility for ensuring EA Follow-up is conducted. In Denmark, EA Follow-up tends to be reactive and focused on addressing issues that arise during projects (DK 1). In Iceland, the data from the monitoring is also used for reactive measures to the projects. IS 4 said, *"What they do with the data is just to make sure that we are within the parameters that we predicted. So, we are still within something that we call acceptable. If something changes …. then, you will use the opportunity to react."* Furthermore, EA Follow-up in energy infrastructure is also being conducted due to the problems arising (reactive), such as the H2S (IS 1). Contrariwise, in the Netherlands, EA Follow-up is both reactive and proactive/preventative, with projects being required to conduct Follow-up if it is deemed necessary (NL 1). NL 7 provided an example of how the large-scale projects/proponents could *"cause large-scale environmental pollution. So, when you would have done a good follow-up of those EIA through the years and would have given good insight into the possible*

pollution, and also coupled with certain measurements on an annual basis, for example. I think you would have prevented bigger problems than now."

EA Follow-up processes involve not only monitoring outcomes but also engaging in adaptive planning, which utilises the data gathered to enhance the project's performance. This approach ensures that the project remains responsive based on real impacts and monitoring results. IS 3 mentioned, *"All the monitoring, it could be part of the follow-up, but the follow-up could be wider."* This crucial process, commonly referred to as "closing the loop," involves incorporating lessons learned from monitoring (NL 3). In these countries, the term 'Follow-up' may only encompass the monitoring aspect of the Environmental Impact Assessment in general, rather than focusing on what occurs after the monitoring process (NL 3, IS 2, DK 1). As a result, the focus of EA Follow-up within the context of environmental impact assessment can be limited, with few practices in place to ensure follow-through after program implementation. NL 2 mentioned, *"Take the opportunity to learn because when you do it once you have the environmental impact is predicted. Well, that's very nice. But when you don't know what the actual impact is in, for example, five years, then there's not a lot of learning effect either".* It is important to have adaptive planning not only for the current project but also for the subsequent project. However, it is worth noting that adaptive planning may not always be feasible. Sometimes, when the outcome of the EA Follow-up does not match the prediction, mitigation measures can be taken. Other times, the outcome may be beyond control due to other unforeseen factors (NL 4).

In the Netherlands, Iceland, and Denmark, EA Follow-up practices are primarily integrated into the environmental assessment process. This approach entails monitoring specific aspects related to a project's environmental impact, rather than all aspects. For instance, Denmark considers bird collisions for energy infrastructure projects, while the Netherlands focuses on noise pollution. In Iceland, wetlands are closely monitored for their impact. However, all three countries share the view that Follow-up involves consideration of all monitoring results to enhance project or plan adaptation and improvement.

The reason for EA Follow-up is mainly based on the significant impact or when things are assessed to have a negative impact (NL 4, DK 3). The implementation of EA Follow-up mostly depends on the proponent, as seen in Iceland, where proponents who are more likely to have a lot of experience will actually conduct EA Follow-up (IS 2). In Denmark and the Netherlands, the reason for monitoring or follow-up is mostly related to the uncertainty about the project's effects or extent on the environment (DK 1, NL 1). It could also be necessary due to the environmental impact predicted by the plan, which required the proponents to conduct monitoring due to the advice or obligation related to licenses (IS 2, NL 3).

Based on the triangulation with the findings from the FGD (see Section 3.1 and Appendix H), it was confirmed that EA Follow-up practice in the Netherlands, Iceland, and Denmark, although follow-up practices are limited. However, this is not always the case. For example, in Denmark in the early 2000s, there were multiple instances of EA Follow-up for knowledge gatherings (FGD 6). Follow-up is carried out when specific knowledge needs to be gathered, particularly in sensitive contexts, such as near habitat directives or in projects with limited knowledge (FGD 3, FGD 6). These projects often require more monitoring. One of the examples comes from the first offshore wind farm in the world, FGD 6 mentioned,

> *"Back at the beginning of 2000, the government asked the utility companies to build …. the first offshore wind farms in the world … There was actually the monitoring program set up, so there was the EIA, there were permits and everything, but there was also a monitoring program and that went on for before the wind farms were built; during the wind farm were built; and then afterwards, approximately 6 years after…. That provided a lot of information about offshore wind and environmental effects. A lot of aspects were looked at: birds and fish, marine mammals, benthic, and fisheries. So, a lot of knowledge was gathered, and all that knowledge was used subsequently by the Danish Authorities when they did the permitting and the EIA."*

The practice of EA Follow-up is constrained by a lack of direct consequences for non-compliance (FGD 5). Additionally, the competent authority fails to recognise the significant value of follow-up (FGD 2), which is essential for the practice. When people do not perceive any added value, they may not be inclined to engage in the process. The limited consideration of EA Follow-up during the planning process is another reason for its restricted implementation after the project (FGD 5, FGD 3). These constraints may be attributed to the scarcity of resources, both financial and human resources (FGD 2).

The FGD participants confirmed that EA Follow-up practices are currently limited, resulting in a need to promote them more effectively. In the FGD, it was suggested that providing more knowledge to proponents would be very helpful in ensuring that follow-up actions are carried out. Thus, in order to achieve this, there is a need for workshops, improving the website about follow-up, and providing practical guidance and examples (FGD 1, FGD 2, FGD 3, FGD 4). These resources could potentially be used at the national level. It is important to ensure that follow-up serves as adaptive management, employing adaptive management to add value and generate genuine interest from project proponents (FGD 6, FGD 2).

4.2 Success factors and challenges

4.2.1 Success factors of EA Follow-up

The definition of success factors within this study differs between participants. The results from the interviews show conditions for successful EA Follow-up. When conducting EA Follow-up on an environmental assessment, it is crucial to compare predicted outcomes with actual results to determine the success of the assessment process. In order to achieve this, it is essential to conduct a thorough baseline study and gather sufficient scientific data (DK 7). This comparison allows us to evaluate whether project plans and programs were properly formulated and designed for monitoring purposes (DK 1). DK 1 mentioned,

> *"We can predict how we think the perfect monitoring should be done, but when it is implemented, it might be that, too many days are cloudy or wind conditions are wrong or whatever, so it's very important that either we are good at predicting the possible practical implications of monitoring that we prescribed, or we have some kind of flexibility and how it can be implemented. I think …. especially when we talk about monitoring across a lot of years, we should be very attentive to how we prescribed the monitoring."*

Through this process, proponents can identify areas of improvement, which can help enhance the accuracy of future predictions and design more effective monitoring systems (DK 1, IS 2). This process also includes addressing uncertainties and unknowns associated with the program; proponents can improve the overall practice of EA Follow-up (DK 1, NL 3, NL 6).

Furthermore, when approaching a program, it is crucial to take into account all the elements that require monitoring. By discerning which aspects hold the greatest influence, proponents can effectively prioritise and determine which battles to pick (NL 1). In order to ensure the smooth implementation of EA Follow-up, it is important to embed a clear decision-making system within the project (NL 4). This also includes having a clear baseline at the beginning and seeing the prolonged impacts (DK 5). In certain programs, projects, and plans, the task of monitoring can be simplified and made more cost-effective by utilising the available data (NL 1).

Ensuring the success of Environmental Assessment (EA) practices requires careful consideration of the reasons for conducting Follow-up. This includes assessing available resources, such as financial and human resources, as well as the expertise of those involved (NL 1, IS 2). Additionally, the competence authority or proponents can impact the EA Follow-up process, with larger institutions or companies often having more influence as they have more resources (IS 2). Another key factor for successful EA Follow-up is tying it to obtaining a permit (NL 1, IS 1). IS 1 said, *"I think the success is mostly due to the fact that this industry and these activities are all on the permits, that's where the actual follow-up happens."* Proponents who fail to conduct the necessary monitoring evaluation will be unable to obtain the permit, which incentivises them to follow through with the EA Follow-up process.

Demand from the public for participation and monitoring is also a significant influence on EA Follow-up practices (NL 2). For example, in the Netherlands, people demanded monitoring for a wind turbine project in Drenthe to understand potential environmental impacts (NL 2). Finally, EA Follow-up that has added value to the overall process is critical for its success (NL 1). By providing valuable insights and data, EA Follow-up can help shape future decisions and improve environmental outcomes.

4.2.2 Challenges of EA Follow-up

One challenge in conducting Follow-up assessments for environmental impact is the limited availability of human and financial resources (IS 1, DK 1, DK 4, NL 1, NL 4). These assessments can be costly, making it less likely for them to be carried out if funding is not available. Furthermore, the lack of mandatory requirements for Follow-up assessments and ambiguity on what the consequences are if EA Follow-up is not being conducted is a significant factor contributing to their neglect (NL 4). The European Union directive on environmental acts stipulates that project monitoring is only mandatory when applicable (NL 2, NL 3). Moreover, there is no clear information on what happens if things go beyond the limit (IS 4), and who is writing the EIA is not necessarily the one doing the Follow-up (IS 3).

Another reason for Follow-up not being conducted is related to whether EA Follow-up activities may not be deemed necessary because it is not required or the pre-existing monitoring efforts (NL 2, NL 3, DK 7). For instance, there have been several monitoring

activities conducted, such as air quality or noise level monitoring. In the Netherlands, the air quality is already being monitored nationally. Therefore, it would be easy to determine if the air quality within the area of projects is sufficient. Thus, there is no need for additional measures, as the projects can already rely on the national or regional general monitoring outcome (NL 2). One example of an existing monitoring program is the *Klimaatmonitor* by Rijkswaterstaat (NL 10). This program can be used to monitor energy infrastructure and understand the levels of CO2 and greenhouse gas emissions (NL 10). Moreover, the size of the government or organisation may also hinder Follow-up activities. For instance, in smaller cities in Iceland, conducting EA Follow-up activities may not be feasible because of limited resources and personnel (IS 2). This might also result in power imbalances between the authority with limited resources compared to the prominent project proponent (IS 3).

Another challenge is there is a concern among some proponents that if a program starts monitoring the environmental impact of its projects, it will have to continue doing so in the future (NL 1). This concern can discourage them from conducting EA Follow-up. Moreover, EA Follow-up are usually conducted or initiated by the project proponents. Therefore, it ultimately depends on their willingness to figure out how their project has impacted the environment. If proponents are sceptical or not interested in monitoring the impact of their project, they are less likely to conduct follow-up assessments. This lack of interest may stem from the concern that if the impact is greater than expected, they may face pressure to change or stop the project (DK 1). Furthermore, there is a perception that conducting monitoring may indicate insecurity about the conclusion of the projects, giving the impression that *"if you start monitoring, it is kind of a signal that you don't know for sure"* (DK 5).

In addition to the challenges related to monitoring, there is also a challenge in not following up on the monitoring. This can be due to the resource limitations of both financial and human resources, the regulatory frameworks which did not clearly mandate the EA Follow-up, and the lack of added value toward Follow-up (NL 1, IS 1, IS 2, DK 1). One of the challenges in carrying out follow-up activities after monitoring an Environmental Impact Assessment (EIA) is that many people lack interest in using and investing in the gathered information. This can lead to difficulties in tracing, acquiring, and utilising new knowledge gained from the monitoring process. A central system for sharing data on monitoring could help to create a knowledge base for the next EIA. This relates to the fact that the impacts of not following up can be concentrated on one problem only and eliminate the possibility of further complications, and the measures taken to mitigate the impact can actually have a greater impact overall (NL 2).

4.2.3 Advantages of Conducting EA Follow-up

In addition to the conditions for successful EA Follow-up and the challenges mentioned above, the informants' interview results highlighted several advantages to conducting EA Follow-up. Being aware of these advantages helps raise awareness about the added value of EA Follow-up.

One of the advantages of the EA Follow-up can help to understand the effects of uncertainty in the environmental context (DK 1). Additionally, monitoring as part of the EA Follow-up can provide a reactive element to address unexpected or critical conditions, leading to additional measures and actions when necessary (DK 1, NL 2). All of these benefits can only

be achieved through proper monitoring of the project and eventually help in learning better methods for better monitoring of similar programs, projects, and plans (DK 1).

According to participants, conducting EA Follow-up has several advantages. One of these is related to public transparency. If the assessment is done correctly, it will create more trust in institutions and authorities. This will ensure that those who have the authority actually know what they are doing and are trustworthy to the public (DK 1, NL 3). As one participant stated, *"It is a question of involvement, joint fact-finding"* (NL2). Public transparency is important because people need to be convinced of the scientific integrity of the monitoring program (NL2). This requires public involvement to have joint fact-finding so that people will trust the research that has been done. Transparency to the public is also related to the acceptance of the monitoring program because environmental issues often relate back to the situation of the people living in the nearby area (NL2). However, when it comes to environmental matters, scientists need to offer impartial guidance and maintain transparency when sharing their monitoring outcomes (NL 2). Openness with the public is key, as it guarantees that the conclusions are accessible and can be acted upon (IS 2). This also includes having a clear instruction that people are able to respond to the findings (IS 2). Ensuring a good quality of the programs, projects, or plans by connecting them to monitoring helps to understand how the project is going to progress, how the quality is and whether or not it is in accordance with the planning (NL 3).

A good practice of EA Follow-up can help us understand the unknown aspects and reduce uncertainties (NL 3). This will provide clarity and have better "build-up knowledge" to better the management of the project, plans, and programs (IS 2). This is an important aspect because *"a permit was given for an environmental impact that was known at that time. I think, let's say this 20 years later, there are new insights on what certain things …. but that was an unknown-unknown at that time"* (NL 6). Thus, continuous learning from the monitoring of EA is important to provide continuous check and balances and *"forward-looking tool"* (NL 8, NL 9) of the impact toward the environment (NL 6, NL 7). With the lack of monitoring, it hinders the progress of acquiring new knowledge (DK 3). In order to do this, an important aspect of good monitoring is having clear guidance on who is responsible for carrying out the monitoring exercise and a clear timeframe (IS 2). Furthermore, it is also important to have clear guidance in the knowledge sharing from the monitoring program (DK 4). Additionally, according to the participants, a good Follow-up process involves conducting every step with careful implementation and following through on all necessary actions. This means not only monitoring but also evaluating and deciding whether the implementation needs to be adapted within the management. In other words, it is important to "close the loop and not just do one thing" (NL 3).

The findings from the FGD confirm the success factors, challenges, and advantages of EA Follow-up mentioned above. During the discussion, it was suggested to improve the EA Follow-up process by conducting it earlier, during the planning phase, and before decision approval (FGD 1). Having clear planning also helps to understand the maximum capacity in the planning process and what areas require further adaptive management in the future (FGD 3). Additionally, it is crucial to utilise the outcomes of the EA Follow-up to improve the project (FGD 3). Citizen science was proposed as one of the methods to ensure that the outcome of the EA Follow-up is being used. FGD 2 mentioned,

> *"I see multiple purposes. So, not only to collect knowledge or scientific research but also for communications. So citizen science, we saw in one of the projects in*

Amsterdam …. They also use this citizen science and use monitoring for communication."

Moreover, as indicated by FGD 3, it is crucial to define the scope of the EA Follow-up to understand why it is necessary and ensure its usefulness within the project. It is also important to be very clear about the purpose of the monitoring and ensure that there is a direct correlation between the impacts and the practical information, such as the number of bird collisions and the number of people who were impacted (FGD 5, FGD 6).

To ensure the public's trust and understanding of the project's importance, the FGD participants argued that promoting EA Follow-up measures is crucial, especially for industrial projects with ecological effects (FGD 2). Increased public involvement in monitoring and implementing measures will help to maintain standards and address impacts such as cumulative impacts. Furthermore, having concrete data will encourage the EA follow-up process by raising awareness and understanding of the potential positive effects, including taking action to reduce the impacts (FGD 5).

4.3 Physical-geographical conditions, institutional arrangements, and stakeholders' involvements

4.3.1 Physical-geographical conditions: Islandness and transboundary impacts

The monitoring of transboundary impacts is a critical aspect that requires close attention and has been discussed by participants (NL 2, IS 2). These effects can have far-reaching consequences beyond countries' own borders and impact neighbouring countries and surrounding areas. As such, it is essential to maintain a record of these impacts (NL 2). This can be seen, for instance, in the case of an offshore wind farm in the North Sea, which then has an impact on other countries related to noise, electromagnetic fields toward fish, and bird migration. In cases where a country shares a more prominent boundary with another, such as the Netherlands, providing notifications and monitoring the transboundary effects of EIA becomes necessary (NL 2). The impact of these effects is contingent on the type and scale of the project, particularly those of common interest projects and programs. In this case, the Espoo Convention places a significant emphasis on monitoring for transboundary effects (NL2). For international projects such as high voltage cables across the sea, guidelines and monitoring are in place on an international level (NL 2, IS 2). Similarly, guidelines and monitoring are also in place on a European level. However, the level of interest in monitoring varies depending on the project's scope and whether it is of local or international importance (NL 2). For instance, projects involving the construction of nuclear power plants, or the storage of nuclear waste will attract wider interest from surrounding countries compared to the impact of small-scale wind farms (NL 2).

In the context of islands, the transboundary impact becomes less prominent, but other environmental impacts come into play. For instance, in the case of Iceland, the country's remote island location means that transboundary effects are less of a major concern unless it is related to the water boundary with the neighbouring country (IS 4). As a result, the

monitoring of such effects is influenced by the country's physical condition and geography (IS 2). Another participant mentioned that the implication of being an island is that *"it makes things a bit simpler"* because Iceland does not really have to bother with the transboundary impact of being an island (IS 4). On the other hand, islands also have key issues related to related to the dependencies over particular industries such as fisheries. In Iceland, one of the key issues that have come up over the years is related to the nuclear power plant in the neighbouring country that could affect the sea and the fishing ground (IS 4). Furthermore, to reflect on the lack of connectivity with the energy infrastructure, the energy supply in islands can be vulnerable because they are separated from the international or continental networks.

In considering the environmental assessment within the island's context, it is important to take into account not only the transboundary effects but also any special interests that come into play. For example, in the Netherlands, the Wadden Sea and Wadden Islands are part of a World Heritage area that requires additional measures to protect it (NL 2, NL 3). The extraction of natural gas from the area is not permitted by the Ministry of Economic Affairs due to the protected status of the region (Klimaat, 2024). Additionally, the wilderness is included in the Natura 2000 areas, which come with special regulations (NL 3). While an island may be extra protected, this is often due to a variety of factors that elevate the importance of the surrounding area, and not merely due to specific island characteristics. Furthermore, in the context of Iceland as an island nation, the influence of the EU law related to the EU EIA Directive is prominent, which means it is being translated into the national laws regardless of the islandness conditions of Iceland (IS 1). IS 1 mentioned,

> *"I actually don't think it matters whether we are an island or a continent. I think the largest influence of play here is the fact that we are under the EU law. Through the EEA agreement. This means that a lot of the environmental legislation that is passed in the EU is also transposed into the Icelandic legal framework, so this is true for a lot of the things that pertain to EIA and even the EIA Act itself is actually a transposition of the EIA directive that stems from the EU."*

Therefore, regardless of the transboundary effect, this signifies that the regulation of the EU EIA Directives comes first regardless of the islandsness effects.

Besides the islandness, another aspect of physical-geographical conditions is an important factor in the EA Follow-up. NL 8 and NL 9 mentioned,

> "*In a more complex environment, follow-up can be more valuable. In the research regarding follow-up and the new Environmental and Planning Act in the Netherlands, conducted by the Antea group, it became clear that follow-up appears to be particularly relevant for plans and projects in which long-term ambitions and objectives are pursued, especially when projects take place in complex environments, such as inner-city urban developments (Haven-Stad), projects on the North Sea (Coastline care) and industrial projects with significant environmental effects."*

One example related to the influence of geographical-physical conditions on the EA Follow-up practices is the diversity of the water bodies around Denmark (DK 7). The North Sea, Danish inner waters, and the Baltic Sea each have distinct water properties and conditions. Therefore, monitoring strategies must be tailored to each area's unique geographical and physical attributes.

4.3.2 Institutional arrangements

Regulations related to EA Follow-up in the Netherlands, Iceland and Denmark are all derived from the EU EIA Directive; although Iceland is formally a non-EU member, it is part of the EEA (DK 1, IS 2, NL 2). Based on the EU EIA Directive, the implementation of EA Follow-up is being translated into the national laws. The regulations related to monitoring are ambiguous and depend on the projects and the competent authorities responsible for them (DK 1, IS 2, NL 2). However, the participants agreed on the applicability mainly when the project has significant environmental impacts (DK 1, DK 2, DK 3, DK 4, IS 2, IS 4, NL 1), many uncertainties (DK 1, IS 1, IS 4) and for knowledge gathering (DK 3). For example, in the Netherlands, NL 3 mentioned, "*Deciding what is applicable depends per case, but I think good indicators are things that are that are now like a double negative or negative*". For example, in the case of assessing air quality, if the air quality is negative and the predicted impact is negative, it is important to monitor the situation. Another reason for monitoring is to account for unpredictable impacts that are beyond the control of the project team, such as the impacts of climate change (NL 3). It was noted that specific environmental impacts such as air quality, noise pollution, nature conservation, water, and habitats must be monitored (DK 1, DK 3). Although the project team cannot control these external factors, it is important to monitor their effects and any uncertainties that may arise, in order to minimise the risks to the project (NL 2).

In general, implementing EA Follow-up within a project or program is seen as "if applicable" (NL 3, IS 2, NL 2), and it is legally binding when it is linked to permits or licenses. This means that if the permit is required to conduct the EA Follow-up but is not being implemented, then the permit can be revoked. However, the revocation of the permit depends on the authority responsible for the license the surveillance of the project and how it is being carried out in operations. However, there is an ambiguity on what entails or the consequences of not conducting EA Follow-up (NL 6, 7, IS 4). When asked if there is a specific case where the permit has been revoked, the participants do not have a particular case study regarding that (NL 2, NL 3, NL 4, IS 1, IS 2, DK 1).

Furthermore, the impact on an island region does not necessarily result in the implementation of specific legal policies (IS 2, NL 3). Although geographical conditions have an effect on monitoring practices related to physical aspects, they are not the dominant factor in legal and policy matters as similar legislation is applied to the islands or the mainland area (DK 3). For instance, even though Iceland is an island, it still has to follow the EIA EU directive in terms of law, policy, and regulations, which means it has to adhere to the environmental impact assessment directive of the European Union (IS 2). This is because Iceland is part of the EEA, and the trades and economic activities are often related to the process of EA.

In the focus group discussion, it was suggested that institutional arrangements can improve the implementation of EA Follow-up in various ways, particularly when they are useful and pragmatic (FGD 3). However, it is crucial to have clear regulations that govern this practicality and effectiveness. FGD 3 mentioned,

> *"I think a lot of people kind of; we also have to monitor the entire [projects], that's such a lot of work. So, I think if they see, perhaps, it is not that much work and it is useful, then that might do. And then, of course, legislation help."*

Therefore, having clear guidance on what to do and how to follow up, such as using a simple template, can be highly beneficial and could also related to permits (FGD 4). For example, in Denmark, the Danish Energy Agency acts as a knowledge broker and a one-stop shop for permitting agencies which are related to other urgent matters, such as environmental protection agencies (FGD 6). FGD 6 explained,

> *"It does make it easier that just one authority coordinates and also that one authority has a lot of knowledge about these types of projects. So that's also about having authority to gather knowledge and is able to use that knowledge to discuss with other authorities and coordinate."*

Since it is mostly related to permits, it also helps to ensure that any monitoring obligations will be implemented. The FGD participants indicated that a knowledge broker could also help to manage knowledge properly to ensure that knowledge about follow-ups on environmental assessments is actually being used to improve most projects and learn from other projects (FGD 6).

Another way to ensure that institutional arrangements enhance the practice of follow-up, mentioned during the FGD, is to establish independent institutions to review and monitor the arrangements. A neutral independent review board can oversee the monitoring process to ensure that the promises made at the beginning of the project are being implemented. This independent review should be separate from the government and project proponents to provide an unbiased perspective on the results. This also includes monitoring the follow-up activities to ensure accountability (FGD 5). It helps ensure that there is a body responsible for checking the follow-up activities. This oversight can be conducted by a regulatory body, and failure to comply can lead to consequences, as seen in the case of Denmark (FGD 6).

4.3.3 Stakeholder involvement

There are various stakeholders involved in Follow-up practices, and in most countries, the primary figure responsible for EIA is an institution or agency. In the Netherlands, it is the Dutch Commissioner for EIA; in Iceland, it is the Planning Agency; and in Denmark, this is the Danish Environmental Protection Agency and the Danish Energy Agency – related to energy projects (NL 1, DK 1, IS 2). That being said, the role of the national level is particularly important when it comes to nationwide monitoring or monitoring cumulative effects. DK 5 said,

> *"Everyone is saying that there is so much that we do not know, and we do not know the long-term impacts, and we do not know the cumulative impacts when putting up so many wind farms. And that's another thing … you cannot put [cumulative impacts] on one project. That has to be a national project looking into cumulative impacts and … part of the national monitoring program, in my opinion."*

Besides these agencies and the central government body, the Follow-up process also depends on the project and the stakeholders involved. For instance, in smaller countries like Iceland, Follow-up is more likely to occur in larger projects than local government projects because the local government units are smaller (IS 2). However, in the Netherlands, Follow-up practices even occur within municipalities and local levels. Another important stakeholder in the EA Follow-up process is the public, who participate in the assessment process (NL 2).

In the Netherlands, for example, the public demands that an assessment occur which then forces the government to conduct the monitoring.

In Iceland, monitoring involves various agencies, including the municipality where projects are conducted and the Environmental Agency (IS 1, IS 4). The involvement of stakeholders depends on the specific case and may include relevant agencies, authorities, local municipalities, and landowners with clear ownership over the area (IS 4). For instance, land erosion would involve the Land Reclamation Office (IS 4). Similarly, in Denmark, the Environmental Impact Assessment (EIA) process requires approval from different agencies depending on the permits required. For example, in an energy project, the EIA requires approval from the Environmental Protection Agency and the Danish Energy Agency (DK 3). Since there are various stakeholders and a lot of data involved in a project, having integrated data, especially related to energy infrastructure or a specific sector, is crucial for a better monitoring system (NL 10).

It is important to raise awareness among project proponents and relevant stakeholders about the significance of Environmental Assessment (EA) Follow-up (IS 5, NL 7). In Iceland, stakeholders related to the projects are engaged monthly, bi-monthly, or annually, which include licensors, permitting bodies, local authorities, and settlers in the area, to discuss the impact on the environment. When project proponents are aware of the importance of stakeholder engagement in the EA Follow-up process, *"They're not mandatory at all. It is just something that the [project proponent] came up with to strengthen the ties with the with key stakeholders" (IS 1).*

In Iceland, the most common practice for EA Follow-up is project proponent-led monitoring. This is done to present a positive image and provide transparency to the public (IS 3, IS 5). Similarly, in Denmark, project proponents are also responsible for monitoring (DK 3). In the Netherlands, project proponents are responsible for EA Follow-up, but there are cases where EA Follow-up is conducted due to pressure from the public (NL 2). To conclude, stakeholder involvement in EA Follow-up is complex and varies based on the type and scale of projects, who is involved and who is responsible for monitoring programs on a case-by-case basis.

During the FGD, it was stressed that when conducting EA Follow-up, it is important to ensure that the information is effectively communicated and made available (FGD 6). When conducting a follow-up, it is important to take necessary actions based on the information gathered in the monitoring process. As FGD 6 indicated, in Denmark, there is a consultation process for the Environmental Impact Assessment (EIA) and engagement with stakeholders, including the local community, is crucial. FGD 6 explained,

> *"There are several consultations during the EIA. So, there you have to reach out to stakeholders. And it's of course also depending very much on your project. Is it onshore? Do you have landowners? Do you actually need to engage with landowners to agree that you can actually put down a cable, ... or do you have a wind farm that's visible and is maybe 20 kilometres from the shore? Nevertheless, you would have a consultation period; you would always have an interest in having a good relationship with the community."*

Additionally, good stakeholder management is especially important for companies that aim to effectively manage stakeholders in the long term. Fair treatment of landowners is

essential, and there are various legally required schemes for local participation and compensation in Denmark.

Another crucial aspect of stakeholder involvement, discussed during the FGD, is to inquire during the planning phase about what should be monitored and the appropriate monitoring methods (FGD 2). In the context of energy justice, public monitoring can be implemented, and consistent follow-ups can add value (FGD 2). For instance, a permanent watch group, such as the one operated by an NGO in the Wadden Sea, can be established to conduct regular checks (FGD 5). Additionally, to promote EA Follow-up practices, it is essential for environmental regulatory agencies at the national and regional levels to play a proactive role (FGD 1).

5 Findings Micro-level: Case Studies of EA Follow-up for Energy Infrastructure

This chapter focuses on discussing selected case studies of EA Follow-up for energy infrastructure at the micro level, which covers the projects, plans, and programs in the Netherlands, Iceland, and Denmark (Arts et al., Forthcoming; Morrison-Saunders and Arts, 2004). These case studies were chosen based on the availability of information gathered during general interviews with participants and their relevance, as mentioned by the participants. There are six cases of EA Follow-up discussed in this section, including two case studies for each country. The selection of two cases for each country is based on the fact that during the general interviews, it was mentioned that there are commonly two types of Follow-up practices. The first scenario is when the project/plan/program is subject to EIA, and the EA Follow-up is conducted in the *standard scenario*, where it follows the general procedure with an EIA before the plan, the project commission and then followed by the EA Follow-up. The general interviews revealed that this scenario is not very common in those countries. Based on the information provided by the participants, the selected cases of the first choices are Wind farm De Drentse Monden and Oostermoer in the Netherlands, Power line 3 – 220 kV high voltage line in Iceland, and the Horns Rev and Nysted offshore wind farms (Danish Offshore Wind Key Environmental Issues – a Follow-up program) in Denmark.

The second type of case study is related to Follow-up practices in a *distinctive scenario*. That is worth to be mentioned to understand that the practice of EA Follow-up is sometimes unique. For example, in the Netherlands, the continuous Follow-up practices related to gas extractions have impacted the current and future environmental impact assessment practices of new projects. In Iceland, the environmental impact assessment of a project is followed by a broader monitoring program that goes beyond the EIA to monitor the sustainability of the project area. Meanwhile, in Denmark, the case study of BioValue provides an assessment of the practice of environmental assessment instruments, specifically, the Follow-up and monitoring practices.

5.1 The Netherlands

5.1.1 Wind farm De Drentse Monden en Oostermoer

Overview of the case

The Wind farm De Drentse Monden en Oostermoer comprised of 45 wind turbines located in the Drentse Veenkoloniën, in municipalities of Borger-Odoorn and Aa en Hunze. The wind farm is a manicure between the two initiatives within the Drentse Veenkoloniën: De Drentse Monden wind farm and Oostermoer wind farm (Commissie voor de milieueffectrapportage, n.d.). The woodmark has six line configurations and is spread over 50 square kilometres (Windpark De Drentse Monden en Oostermoer, n.d.). The proposed plan is being reviewed by the Environmental Impact Assessment (EIA) committee of the Netherlands. The committee was first consulted on June 1st, 2011 for their advice. In

September 2011, the Dutch commissioner issued files specifying the scope and level of detail required for the EIA process. Following the committee's advice, the EIA process was carried out and concluded in September 2015 with the submission of an EIA report (Commissie voor de milieueffectrapportage, n.d.).

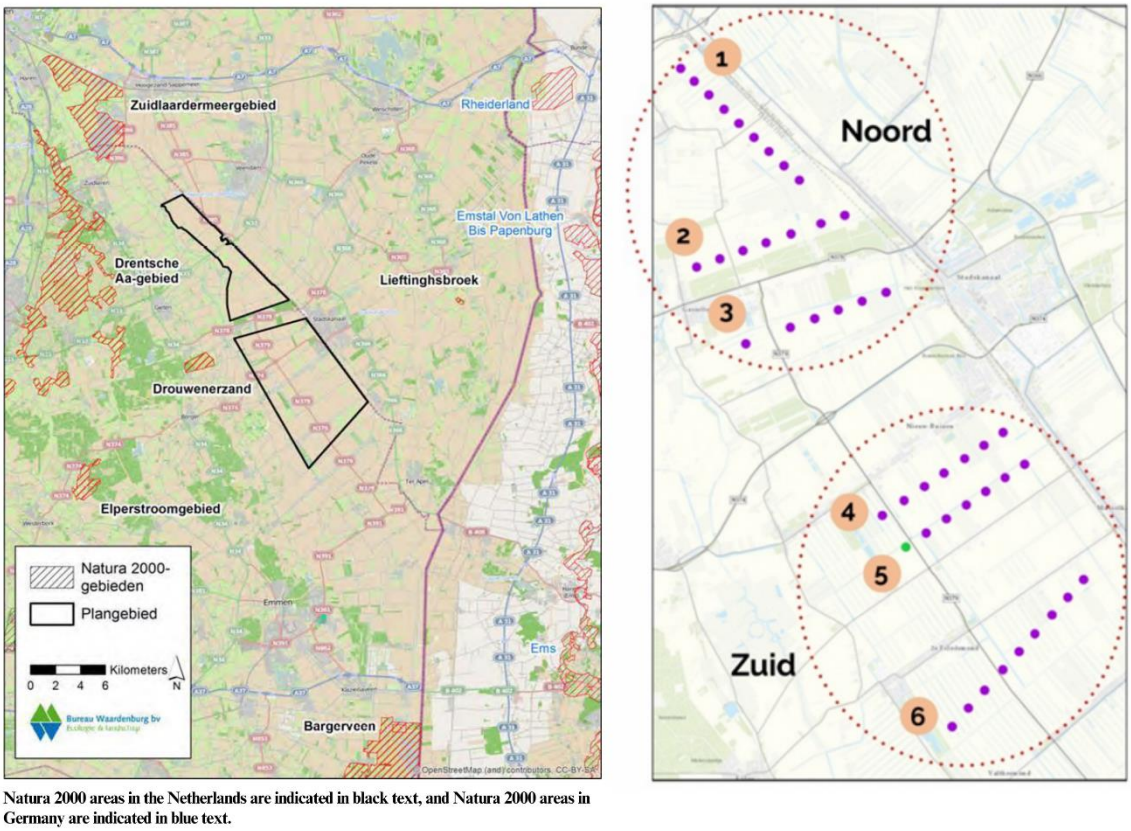

Figure 10. The Natura 2000 around the windpark (left) and the location of the wind turbines (right). (Jansen and Pigge, 2015; Windpark De Drentse Monden en Oostermoer, n.d.).

The Environmental Impact Assessment (EIA) for a wind farm project included an analysis of various factors, including noise emissions. This analysis is a standard part of EIA's for wind farm projects. However, the project faced opposition from the local community, and the issue escalated to the point of criminal activity (NL 2). The residents argued that the turbines produced low-frequency noise, which could potentially affect their health (NL 2). Therefore, they requested monitoring to determine the actual impact.

A recent study related to monitoring the impact of the wind farm was conducted in 2023 to evaluate the impact of wind farm noise pollution on the municipalities of Aa en Hunze and Borger-Odoorn (Dijkstra, 2023). The study aimed to determine the effect of low-frequency noise before and after the wind farms were constructed (Dijkstra, 2023). Data collection was carried out from April 28, 2020, to August 1, 2022, in the vicinity of the wind park location. The study concluded that:

> *"This shows that the low-frequency noise level for the very lowest frequencies (6 to 40 Hz) is of little relevance and is probably not perceptible. For the frequencies from 40 to 80 Hz, the low-frequency noise level may be noticeable, but the levels may also*

be lower than expected. For the higher frequencies of the low-frequency region (100 and 125 Hz), the levels are noticeable and in some points also higher than expected. However, the levels are lower than the guideline values used for low-frequency noise and can therefore be regarded as acceptable. The study also shows that it is unlikely that the legal noise standard is being exceeded" (Dijkstra, 2023).

The monitoring results aligned with the anticipated impact assessment, indicating that the noise levels of the work would not significantly affect the residents in the area (NL 2) and are unlikely to exceed legal standards (Dijkstra, 2023). However, these findings have sparked controversy and differing opinions, leading residents to call for further monitoring (Oortwijn et al., 2023). The results of the study aimed to determine whether the noise levels were within the standard and provide information to the surrounding community about their concerns regarding the wind farm project (NL 2).

Success Factors and Challenges

The success of the assessment Follow-up in this case depends on the involvement of the local people and how they wanted the monitoring to be conducted (NL 2). The push factor why the monitoring was conducted is because this case is very personal to the people, and they demand the monitoring (NL 2). The local government and the acoustic research team also provided support in this regard. The people were actively engaged in monitoring the results as it potentially directly affected them and was a matter of concern. The monitoring was transparent, and the wind farm's website provided access to the data and reports. However, the community-led Follow-up became a challenge as the residents demanded more monitoring, hoping it would help resolve the ongoing controversy surrounding the project (NL 2).

Physical-geographical Conditions, Institutional Arrangements, and Stakeholders Involvement

The wind park is located near Germany (see Figure 10), and the Environmental Impact Assessment (EIA) recommends examining the visibility of the wind turbines. They will be visible not only within the municipality but also in neighbouring municipalities and Germany. Additionally, the wind park's location is close to the Natura 2000 area of Germany (Jansen and Pigge, 2015). Thus, cross-border effects are taken into account (see Figure 10).

This project involves several key stakeholders, including the Sustainable Energy Production Foundation Exloërmond, Raedthuys Group, and Windpark Oostermoer Exploitatie BV. The Ministry of Economic Affairs, Ministry of Infrastructure and Water Management, and the Municipalities of Borger-Odoorn, Aa en Hunze provide oversight of the project. Additionally, public involvement is crucial, and the community supports monitoring to ensure transparency and accountability.

5.1.2 Monitoring natural gas extraction under the Wadden Sea

Overview of the case

The "hand-on-the-tap" (*hand-aan-de-kraan* – Dutch) principle is a crucial part of monitoring mining and gas extraction in the Wadden Sea (see Figure 11). Its purpose is to detect any land subsidence or negative effects in a timely manner, to prevent irreversible damage

(Staatstoezicht op de Mijnen, 2021). The Wadden Sea is an important area in the Netherlands as it is part of the UNESCO heritage (NL 2, NL 5). Essentially, this principle dictates that if something goes wrong, extraction must be reduced or even stopped. Therefore, when assessing mining company plans, authorities ensure constant monitoring of potential negative effects. The aim of this system is to properly monitor the impact of mining under the Wadden Sea, taking into account various factors such as soil subsidence, plateau area, soil life, and birds (Klimaat, 2021). State Supervision of Mines (*Staatstoezicht op de Mijnen* - SodM) and the Audit Committee are responsible for overseeing the process and providing advice to the Ministry of Agriculture, Nature and Food Quality (LNV) (Staatstoezicht op de Mijnen, 2021).

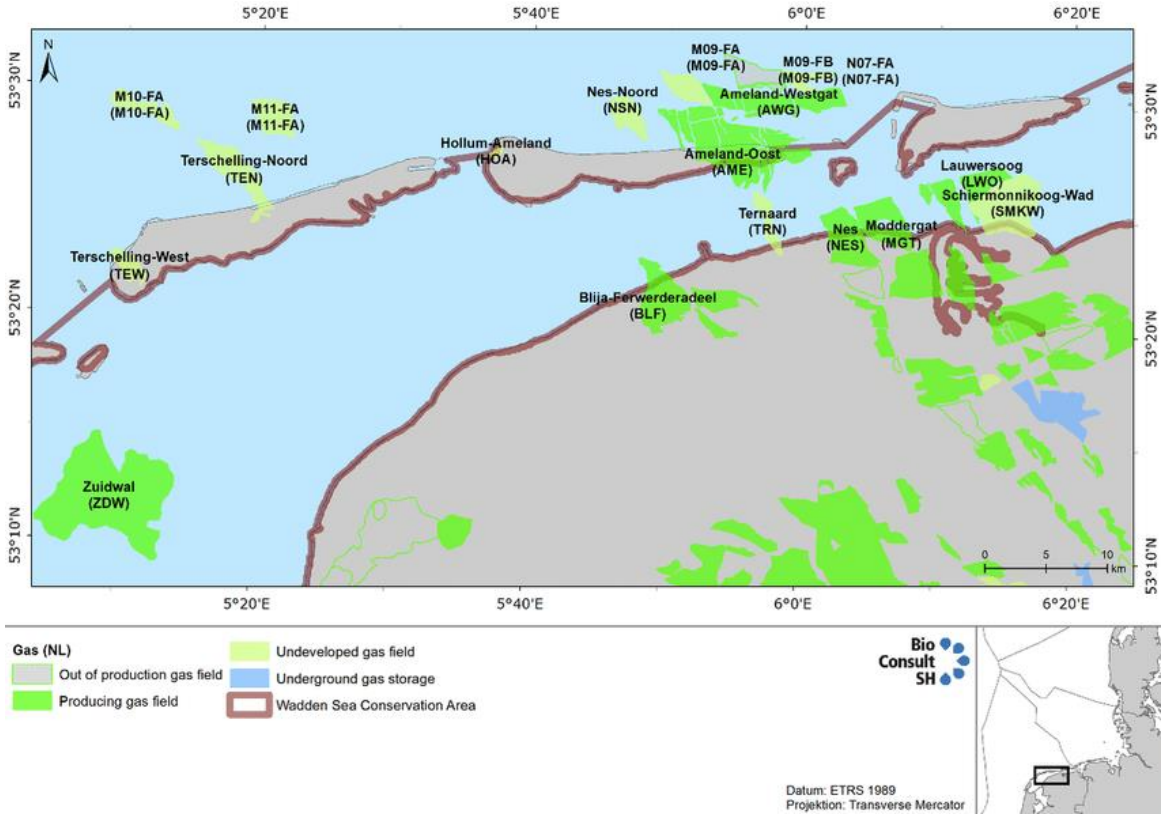

Figure 11. The map of gas extraction in the Wadden Sea area (Nehls, 2017)

Since 2006, the SodM has played a key role in developing guidelines for monitoring natural gas extraction (Staatstoezicht op de Mijnen, 2021). This process involves receiving reports from mining companies and conducting annual assessments via an audit committee. For instance, in 2016 and 2023, the Dutch Petroleum Company (NAM) extracted natural gas from Moddergat, Lauwersoog, and Vierhuizen, which were subject to this monitoring process (Advice -Commissioner.nl, n.d.). The EIA Commission is a member of the Audit Committee and oversees the monitoring process at the request of the Minister of Economic Affairs and Climate on an annual basis. However, this monitoring process is distinct from the environmental impact assessment, as noted on the Commissioner of Environmental Impact Assessment's website, where it is stated that there is no EIA in this case, but the advice was requested from the Commissioner (Advice -Commissioner.nl, n.d.).

As a result of the monitoring with the hand-on-the-tap principle, the environmental impact of extraction activities in the Wadden Sea area is being carefully monitored to prevent any

harmful impact on the environment. To this end, a report has been created as a guide to determine when to reduce or stop extraction to prevent further damage and is published annually (NL 5). As advised by SodM in a letter to the House of Representatives, NAM has not been granted permission to extract in Ternaard for the time being (Klimaat, 2024). In 2021, the Minister of Economic Affairs and Climate requested the EIA Committee to evaluate the environmental consequences of the project before approving permits (Advice - Commissioner.nl 3152, n.d.)In this case, the project's ongoing monitoring is being utilised to provide pertinent information for the new EIA report.

Success factors and challenges

The Wadden Sea area, which is of significant importance, benefits greatly from an ongoing monitoring project. Yearly, a report is produced that pertains to the continuous monitoring of various sea level scenarios that could potentially affect the Wadden Sea (NL 5). Moreover, NGOs have been established to systematically gather people's concerns and effectively voice them out (NL 2). This organised approach has proved effective in ensuring that the people's voices are being heard and attended to and the environmental impacts are regularly being monitored. On the other hand, the project faces a challenge in assessing uncertainty, specifically in dealing with the unknown factors related to the environmental conditions (NL 2). There are several uncertainties surrounding the project, particularly in relation to climate change and sea level rise. Furthermore, other factors, such as gas extraction and dredging activities, can also influence the condition of the Wadden Sea, making it difficult to measure the impact accurately (NL 2).

Physical-geographical Conditions, Institutional Arrangements, and Stakeholders Involvement

The Wadden Sea, as a UNESCO heritage site consisting of islands that are vulnerable to changing environmental conditions, is subject to many influences, such as sea level rise. This makes monitoring the physical-geographical condition of the area very important (NL 2). The recent gas extraction project, coupled with the shift towards more sustainable energy, has made monitoring a political decision (NL 2). In the future, if there is another energy crisis that calls for increased gas production, the decision to allow such extraction becomes a topic of debate. Furthermore, stakeholders involved in monitoring projects are faced with a complex situation as the Wadden Sea is subject to layers of protection as a UNESCO Heritage and Natura 2000 site. Therefore, various ministries at the national level and NGOs representing the people who live in the Wadden area are involved (NL 2).

5.2 Iceland

5.2.1. The Power line 3 – 220 kV high voltage line

Overview of the case

Power line 3 (*Kräflulína 3* – Icelandic) high voltage line was constructed to improve the stability of the electricity system in the North and East regions of Iceland by providing more interconnectedness of the electricity supply in the area. Power line 3 is a 220 kV high-voltage line that directs from the substation at the region of Kräfluvirkjun in Þingeyjarsveit (formerly

Skútustaðahreppi) to the substation at Fljótsdalsstöð in Fljótsdalshreppi in the North and East of Iceland (see Figure 12). The proposal for the evaluation plan for this project started in 2013, and the initial EIA and preliminary assessment report was conducted in 2017 (Skipulagsstofnun, n.d.). The project design of the line was completed in the fall of 2017, and the Planning Agency published its opinion on the assessment of its environmental impact in December 2017 (Skipulagsstofnun, n.d.). Following the opinion, changes were made to the municipalities' master plan, and all the permits required for construction were due by the summer of 2019 (Mannvit, 2023). Within the EIA, monitoring was part of the EIA procedure to ensure that the projects have minimal effects on the environment.

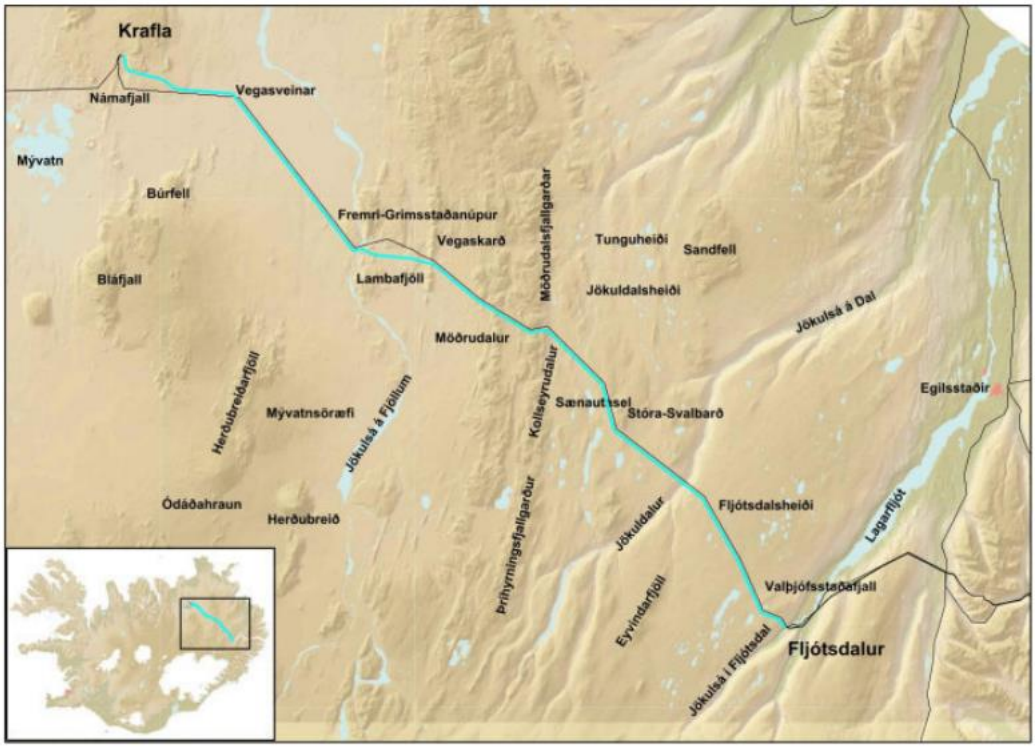

Figure 12. Map of the line route of Krafla line 3

This EIA Follow-up is conducted by the proponent, Landsnet. Mannvit, the consultant for the EIA Follow-up, has completed an environmental assessment for the construction of Kraflu line 3 (KR3) at the request of Landsnet (Mannvit, 2023). The EA Follow-up was conducted in two stages: desk audits and field audits. The desk audit summarises the promises and conditions made during the permit and implementation process, as well as the mitigation measures that were implemented (Mannvit, 2023). A field audit was then carried out with a site visit on August 22 and 23, 2023, which included various stakeholders (Mannvit, 2023). Environmental assessment licensors, the project proponents, consultants, the Environmental Agency, the Natural History Institute of Iceland and representatives from the municipality were invited to participate in the visit and were provided with the desk audit results in advance (Mannvit, 2023). During the visit, the construction area was inspected to assess compliance with Landsnet's promises regarding mitigation measures and completion and the conditions imposed during the construction permit process (Mannvit, 2023). Meanwhile, in the desk audit, the information related to the monitoring of various potential environmental impacts and their mitigation are being studied. The monitoring covered the information related to vegetation, bird life, archaeological remains, earth formations,

landscape and appearance, nature conservation, water protection and drinking water, land use, chemical use and waste, ground wire, mining, and the overall project wrap-up (Mannvit, 2023).

The results of the Follow-up on the Power line 3 are being used as a valuable lesson for the upcoming Hólasands Line 3 project (Mannvit, 2023). One of the lessons learned from this project is actually related to the use of how the project predicted the wide path for the line and related to the impact on wetlands and grasslands (IS 5). This lesson helps in referencing the number for the future calculation. Other lessons learned from the previous project include increasing the use of rock bolts, updating the tender document's contractual requirements for contractors, and negotiating directly with landowners for levelling instead of going through the contractor (Mannvit, 2023). Additionally, another lesson learned was suggested that there should be proper consultation with landowners before and after construction, especially during sensitive times like when there is frost or when there is a risk of damaging the trails (Mannvit, 2023). This case serves as an example of how EA Follow-up and reflections can be used to improve future projects.

Success Factors and Challenges

The success of this project is largely attributed to the fact that the proponent conducted not only the environmental impact assessment before the construction but also ensured that they monitored it after the project was completed. Although this should be a standard practice, it is not often the case in Iceland. Therefore, the fact that the proponent conducted the overall environmental impact assessments in the beginning and continued to monitor the project's progress is a remarkable achievement in itself (IS 4). Furthermore, the project proponent conducted the project by learning from the previous project. IS 5 mentioned, *"When we go to a new project, we can say how we did it here last time and then that went almost well, and we have learned from it."* Another factor that drives the practice of EA Follow-up is related to the idea of being transparent to the public. This factor serves as a significant factor for organisations to be more open and transparent about the impacts on the environment (IS 5).

One of the main challenges identified in relation to this project is related to calculating the predicted impacts during the EIA process and how to measure them during the Follow-up process (IS 4). Furthermore, in other challenges in relation to this project but also for a broader EA Follow-up in Iceland is related to the scale of the municipality and its organisational structure. For instance, a small municipality does not have many human resources (IS 4), which means it lacks the capacity to carry out environmental supervision throughout the project. As a result, EA Follow-up mostly relies on the project proponent to provide information, instead of the municipality conducting the Follow-up (IS 4). This approach can be challenging because it mostly relies on the proponent, and if they are not doing the monitoring well, the information can get lost or forgotten (IS 4). Additionally, the different authorities involved in the organisational structure have different focuses. For example, the environmental agency focuses on ecosystems and landscapes, while the archaeological institute focuses on archaeological sites. Therefore, conducting EA Follow-up can be complicated because it needs to go through different authorities. IS 4 mentioned, *"The follow-up can be complicated when you cut many different authorities, all with their different focus, and you have to make sure that nothing gets forgotten."*

Physical-geographical Conditions, Institutional Arrangements, and Stakeholders Involvement

In the process of monitoring environmental impact, assessments are made based on the existing conditions and potential impact of the area. If negative effects are observed in certain areas, tailored monitoring or mitigation strategies will be suggested, which may differ depending on the project's location (IS 4). For example, if the project is related to archaeological sites, landscapes, or ecosystems, special attention is required. In constructing power lines, the access roads are built with specific dimensions and materials to prevent any impact (IS 4). Assessors are involved in the Follow-up and monitoring process to ensure that road construction does not have any further negative impact. Physical factors, such as wetlands, are also taken into account, and power lines are routed around them to avoid any disturbance (IS 4). Thus, the level of monitoring required is determined by the physical conditions of the project.

The EA Follow-up process, in this case, is being led by the project proponent, but it also involves experts and authorities related to the project. During field visits to the site, representatives from the district planning agency, land reclamation network, Real History Institute of Iceland, anthropology experts, and the project proponent are present to ensure everything is in accordance with the standards and what is promised within the EIA plan (Mannvit, 2023, IS 4). The monitoring process results are also published on the municipality's website, making them accessible to the public (IS 4).

5.2.2. The Sustainability Project of Alcoa Fjarðaál and Landsvirkjun – Kárahnjúkar power plant

Overview of the case

This is a follow-up project related to the EIA located in the East of Iceland, focused on a hydropower plant. It has been in operation since 2007 and is commonly referred to as a "sustainability project", although one of the pillars of those monitoring was initiated based on the EIA (IS 4). The Alcoa Fjarðaál and Landsvirkjun sustainability project was established to monitor the Kárahnjúkar power plant and the smelter in Reyðarfjörður's impact on society, the environment, and the economy in East Iceland (see Figure 13). In this project, various aspects are being monitored, including the community, environment, economy, and the company. Based on the environmental monitoring, the six main things being monitored included (Sjálfbærniverkefni Alcoa Fjarðaáls ogLandsvirkjunar, n.d.):

- Water (Groundwater and Surface Water, Water Level and Flow in Rivers, Groundwater Levels in Holes, Flow in Waterfalls)
- Land (Riverbank Erosion, Coastline of Héraðsflói Bay, Sediment Deposition in Hálslón, Sand Encroachment by Hálslón, Extent of Wilderness)
- Air (Dust Pollution, Suspended Particulates)
- Sealife (Contaminant Levels in Marine Organisms, Marine Benthic Fauna in Héraðsflói Bay)
- Animals on Land (Reindeer, Pink-Footed Goose, Breeding Birds at Úthérað, Freshwater Ecology in Jökulsá á Dal and Lagarfljót)
- Vegetation (Fluoride in Vegetation, Vegetation in Snæfellsöræfi and Fljótsdalshreppur, Vegetation in Úthérað, Land Restoration)

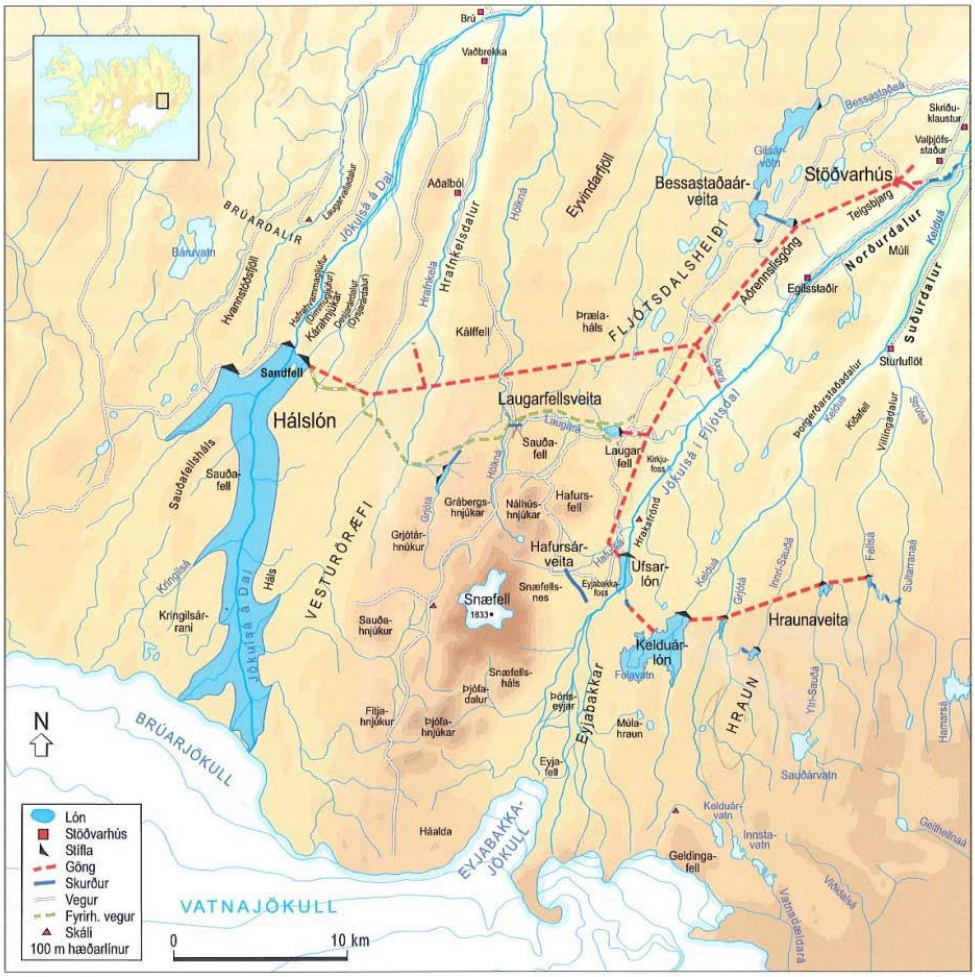

Figure 13. Overview map of the Kárahnjúka power plant (Aðalsteinsson and Landsvirkjun, 2017)

The purpose of the Sustainability project as the Follow-up is to support Alcoa Fjarðaál and Landsvirkjun's policy of making sustainable development a guiding principle. The aim of this monitoring program is to establish a plan that will assist companies in implementing sustainable development policies and tracking their progress. IS 4 mentioned,

> *"They do it in cooperation with other companies, so also with the aluminum factory. So the aluminum factory and other project owners are also a part of the same program. Which means that they are holistically trying to monitor the impact of the cumulative effects of not only the power plant, but also the other kind of related projects."*

The results are used to communicate the progress of environmental monitoring in the area, as well as to ensure the level of impact on the environment. The outcomes are also discussed annually in the report and meetings and several times a year in the Streeting group meeting. The minutes of meetings are also available for the public on the website (Sjálfbærniverkefni Alcoa Fjarðaáls ogLandsvirkjunar, n.d.).

This type of extensive monitoring program is not common in Iceland, but it is possible for larger projects, depending on the proponents of the projects (IS 2 and IS 4). For instance, the National Power Company of Iceland has launched two sustainability monitoring programs—

one in the east and one in the Northeast – to attract more public participation. They do this monitoring, which involves taking into account social and economic indicators based on a specific project and the outcomes of an environmental assessment. Therefore, while it is not a day-to-day approach, it is not an uncommon practice either.

Success Factors and Challenges

When it comes to assessing and monitoring environmental impact, there are three key factors, although this is not just particularly about this project but also about the practice in general. Firstly, it is crucial to establish a strong link between the proposed applications in the environmental assessment and the monitoring plan that is put into action. This plan should comprehensively cover all the requirements mentioned in the EIA (IS 4). Secondly, it is essential to have a solid action plan in place to address any environmental issues that may arise based on the findings of the EIA. This plan should clearly outline the steps to be taken if certain limits are exceeded. Finally, effective information sharing and transparency are vital for the monitoring process to be successful. Apart from these three, having the necessary resources is also crucial for such extensive projects. Moreover, providing wider indicators also offers information about the project's benefits and its real value, as IS 4 mentioned,

> *"It is an extra advantage that you expand this to take other considerations as well, such as social welfare, public health, social implications, economic and so on. These are not necessarily constructed based on the EIA. But they still give you a really good indication of what kind of value are these projects providing to the community."*

When undertaking a project in general, a major obstacle can be the ambiguity of the requirements for the EA Follow-up and which projects are subject to it and which are not. It can be challenging to discern precisely what is expected of the project proponent and who will be overseeing the progress. Another challenge is the lack of clear repercussions for falling short of the requirements. As a result, it is necessary to have a comprehensive grasp of the project's aims and the implications of non-compliance to ensure a successful outcome.

Physical-geographical Conditions, Institutional Arrangements, and Stakeholders Involvement

The sustainability project is the result of the project proponent-led Follow-up, where companies come together to ensure that the project has a positive impact on the economy in the project area. The start of construction on the power plant, smelter, and transmission lines received a lot of attention at that time. However, it was also recognized that the project's environmental impact needed to be reduced and countermeasures needed to be taken independently (Sjálfbærniverkefni Alcoa Fjarðaáls ogLandsvirkjunar, n.d.). The sustainability project was established to ensure that monitoring obligations are met. While it was initially focused on environmental impact assessment, monitoring now extends beyond that to cover social and economic aspects as well (Sjálfbærniverkefni Alcoa Fjarðaáls ogLandsvirkjunar, n.d.).

The project involved people from different disciplines and residents near the project area. The project team holds annual meetings to discuss the results of the monitoring and ensure that everything is in accordance with the standards. The meetings and the annual reports are available to the public on the project's website and provide detailed information, including

minutes of the meetings leading up to the international report (Sjálfbærniverkefni Alcoa Fjarðaáls ogLandsvirkjunar, n.d.).

5.3 Denmark

5.3.1 The Horns Rev and Nysted offshore wind farms

Overview of the case

In 1997, the Danish Energy Agency released its initial plan for a significant expansion of offshore wind power (Larsen et al., 2013). Although smaller wind farms at sea had already been established, this project aimed to concentrate wind production on a larger, more economically efficient, and environmentally friendly farm to protect the coastal environment (Larsen et al., 2013). Two Danish utility companies executed the project in 1998, ultimately selecting The Horns Rev and Nysted offshore wind farms for the programs. In 1999, the Danish Energy Authority conducted a preliminary survey of the site. In 2000, the Environmental Impact Assessment of both sites was submitted, and the application to build the wind farms was approved in 2001 (Kjær et al., 2006). The location of the windfarms is in the North Sea in the southwestern part of Denmark (see Figure 14).

Figure 14. Location of the offshore wind farm (Kjær et al., 2006).

The offshore wind farm was carefully planned using an extensive Environmental Impact Assessment (EIA) and an ambitious environmental monitoring program was conducted between 2002 and 2006 (Kjær et al., 2006). The monitoring of this project was conducted with the “Danish Forest and Nature Agency, the Danish Energy Authority, Vattenfall and DONG Energy” (Kjær et al., 2006, p. 10). The results of this program were published, detailing the comprehensive monitoring study which utilised the "before-after-control-

impact - BACI" design method. This method was used to understand the impact of human-induced changes on the environment by estimating the environmental conditions both before and after wind farm construction and comparing changes at the reference site with the actual area of impact (Kjær et al., 2006). The monitoring takes into account the studies of benthic fauna and flora, fish distribution, distribution of feeding and resting birds, bird migration pattern, the behavioural study of the marine mammals, the impact of electromagnetic in the fields on fish, coastal morphology, and the social and economic impacts (Kjær et al., 2006). The results from the monitoring of the Horns Rev and Nysted wind farms are utilised as lessons learned to update the Action Plan of Offshore Wind Power (Kjær et al., 2006).

As a continuation of the monitoring program, between 2007 and 2012, a Follow-up study was conducted on the Horns Rev and Nysted wind farms based on experts' recommendations (Larsen et al., 2013). The purpose of this Follow-up program was to investigate the environmental issues and cumulative effects of offshore wind farms. The study focused on examining fish populations, noise disturbances, and the impact of large-scale offshore wind farms on marine mammals and birds in the region (Larsen et al., 2013). DK 6 mentioned, *"The main result of this follow-up program was to actually start the thinking and method development in terms of; being able to consider cumulative effects for future offshore wind farms."* Thus, the findings of this study have provided a strong foundation for the spatial planning of offshore wind farms in Denmark.

Success Factors and Challenges

This is a long-term project that covers the entire lifecycle of an offshore wind farm, including monitoring and Follow-up. The project is aimed at stakeholders not only in Denmark but also across Europe in order to ensure that the guidelines and information produced as a result of this monitoring are in compliance with European standards. The report involves major energy companies in Denmark, as well as the Danish Energy Agency, NGOs, and experts, which indicates the involvement of various parties (Larsen et al., 2013). DK 6 mentioned,

> *"We [stakeholders] are sort of sitting together, deciding what it is we need to know and agree on how we want to do it. I think [with this approach], there is a much higher chance that it is something that is both useful and will be applied, will be used in practice, and what comes out of it."*

The support of stakeholders and various prominent institutions is incredibly helpful in ensuring that the project is carried out properly. Furthermore, the monitoring program provides extensive data that is accessible to the public (Kjær et al., 2006).

As the project involved various stakeholders from academia and industry, it was challenging to ensure that the interests of both parties were aligned within the research, both in an academic context and in practice (DK 6). Additionally, there is a challenge in the process of assessing the environmental impact of new technology. The key area of focus includes studying the effect of the wind farms in the harbour, especially related to noise and construction impact on local wildlife, particularly seabirds. The report mentioned that the challenge is related to the complexity of modelling such information, relying on various information and simplifications of the area (Larsen et al., 2013). There are many unknown factors that need to be addressed.

Physical-geographical Conditions, Institutional Arrangements, and Stakeholders Involvement

Denmark's physical-geographical conditions along the North Sea and the potential for wind farms make this country an ideal location for offshore wind energy production. In order to achieve this goal, it is important to gather knowledge related to this technology to ensure that the offshore wind farm is reliable and sustainable for the environment (Larsen et al., 2013). Therefore, extensive monitoring and evaluation are required to provide new knowledge for the Danish offshore wind project. This new knowledge provides guidance on sustainable construction practices while minimising ecological impact. These physical-geographical conditions drive Danish offshore wind energy production and enable more sustainable energy production in Denmark.

The comprehensive monitoring and Follow-up programs involve various stakeholders from multidisciplinary backgrounds to ensure that the environmental impact can be mitigated. This approach provides valuable knowledge and ensures that the shared information is tested and credible not only in Denmark but also internationally. The results of the Follow-up are cross-checked with other international experts, which enhances the credibility of the findings. The knowledge gathered in the Follow-up practice is not only useful for Danish practices but also for global environmental protection efforts. Furthermore, it has strong support from the government, particularly with the active involvement of the Danish Energy Agency. DK 6 said, *"There was a government in place at the time that was really sort of devoted to wind and renewables; and was really pushing that. So, they were sort of receptive and willing to set aside a budget for it."* The strong support from regulators as the stakeholders help make the EA Follow-up happen.

5.3.2. BioValue – Environmental Assessment Instrument (EAI)

Overview of the case

The BioValue project aims to promote biodiversity and increase its protection through transformative changes in spatial policy planning practices and infrastructure development and by valuing biodiversity to support the European Union's strategic actions on biodiversity (Larsen et al., 2022). The BioValue project identifies various ways to determine biodiversity value by recognizing different factors that are important. DK 2 mentioned,

> *"The goal of the project is to determine how and to what extent biodiversity values are expressed in environmental assessments. In the project, we identified different themes that were important for assessing impacts on biodiversity. And one of those themes was monitoring…"*

One of the themes of BioValue focuses on monitoring, as highlighted in the report published on benchmarking for integrating biodiversity and environmental assessment instruments (Larsen et al., 2022). The benchmark serves three purposes: to identify the best practice guidance for integrating biodiversity into environmental assessment instruments, especially those related to spatial planning; to compare the best practice guidance to current actual practices with the aim of improving them; and to establish improved best practice guidance (Larsen et al., 2022). The project is funded by the European Union under the Horizon Europe research and innovation program and has several partners from different countries, including Denmark. The Danish partners in the project are focused on environmental assessment

instruments. While the BioValue project has a broad focus on complex problems related to valuing biodiversity, this case study only focuses on the Denmark case of environmental assessment instruments within the BioValue project.

The assessment instrument used in the study of BioValue is different from other case studies because it involves a monitoring of the EA instruments, including one of the aspects of this study is evaluating the process of monitoring. Although the BioValue project looked at different kinds of plans and projects, some of them are related to energy infrastructures such as pipelines, solar farms, and both offshore and onshore wind farms (DK 2). In this project, there are different indicators under the monitoring and Follow-up on biodiversity impact (Larsen et al., 2022). The first indicator is how the EA specifies monitoring the biodiversity impact. It aims to examine whether the environmental impact assessment plan expresses the plan to conduct monitoring, and to what extent it has clear targets, indicators, and responsibilities for monitoring. Within the preliminary findings, it was found that most of the reports that were studied in Denmark showed potential for improving monitoring practices in terms of clarifying monitoring programs (DK 2).

The second indicator in this project concerns monitoring the impacts of mitigation measures specified in the environmental assessment (Larsen et al., 2022). This aims to validate the predicted biodiversity impact, which is related to the impact seen in practice, the outcome of mitigation measures, and the effectiveness of mitigation in preventing impacts (DK 2). The third indicator is related to the informed assessment that specifies how monitoring of biodiversity should be used. This is specifically related to implementing adaptive management, building knowledge for future environmental assessment and planning, and checking compliance with the conditions for approval (Larsen et al., 2022).

Unfortunately, the project is still ongoing, and the results have not been published yet. Therefore, there are no indications of the extent to which the result can be discussed in this case. However, this case study provides information related to different kinds of follow-up; the follow-up on monitoring instruments. Furthermore, the benchmark by the BioValue project contributes to providing insights into the best practices of EA Follow-up, including the identification of indicators that can establish these best practices (DK 2). Therefore, it is included in this case study to present different kinds of follow-up measures. However, in the latter part of the project, the knowledge gathered from this benchmarking exercise will be put together, including with the other part of the project, to improve best practice guidance for future projects, programs, and policies (Larsen et al., 2022).

Success Factors and Challenges

One of the key positive aspects of this project is the involvement of multidisciplinary and diverse partners. This has enabled the gathering of different opinions and the ability to crosscheck cases in different locations (*BioValue - HorizonEU*, n.d.). Furthermore, the BioValue project also considers various themes besides monitoring, including knowledge. This includes the integration of different types of knowledge, such as local knowledge and citizen science databases (DK 2). DK 2 mentioned,

> *"I think it also is relevant for some mitigation in terms of looking at the knowledge that we use in environmental assessment; is it expert, local or multidisciplinary knowledge?... And in Denmark, a lot of local knowledge comes from data collected in citizen science databases."*

Throughout the projects, it has been observed that databases focusing on biodiversity and nature are crucial, although not directly related to the success factors of BioValue's benchmarking project (DK 2). This information could be used as input for the general practices of EA Follow-up for data monitoring. For example, local populations can submit observations of bird habitats into a large database. This plays a significant role in monitoring and collecting data to inform future environmental assessment practices, suggesting that monitoring practices can extend beyond formal EA procedures (DK 2).

One of the challenges related to environmental assessment is to what extent current practices motivate change (DK 2). This is connected to the goal of benchmarking biodiversity value to establish improved best practices and whether it will be used to transform current practices. Although the value of monitoring is clear, there is a challenge of determining financial structures and identifying who will be responsible for financing it (DK 2). Another challenge related to the process of benchmarking the monitoring report is quantifying the significance of biodiversity impact in EA (Larsen et al., 2022). There are different methodologies for assessing the significance of biodiversity impact, such as national biodiversity strategies or the UN SDG framework. To address this, a solution could be to use a target group to compare their impact and determine the significance of the impact by comparing it to the degradation of natural habitats (Larsen et al., 2022).

Physical-geographical Conditions, Institutional Arrangements, and Stakeholders Involvement

The BioValue project is primarily focused on research and is quite academic in nature. However, it has collaborative partners from different universities and municipalities and covers various types of knowledge, including environmental assessment and spatial planning. The project "builds upon knowledge created by several EU projects, including a conceptual framework on transformative change to be adapted for analysing the potential of instruments and their interactions in local case studies" (Aalborg University, n.d.). By drawing upon different kinds of knowledge, the project aims to provide transformative potential for change. Although the case study focuses on the benchmark, it will have a greater impact on the practice of environmental assessment in other countries as well and will be shared with other member countries within the project. In this case study, the physical-geographical condition is not highlighted as the project is knowledge-based and does not involve many physical-geographical elements.

6 Discussion

This chapter discusses the findings from Chapter 4 about practice in the Netherlands, Iceland, and Denmark, along with related case studies on energy infrastructure (Chapter 5). All of these findings are then related back to the literature that was examined in Section 2, particularly in regard to the implementation theory and the adaptive management theory. The discussion follows each sub-section to better understand how it relates to the implementation theory, including the implementation of EA Follow-up principles and the occurrence of implementation gap, as well as the adaptive management theory in terms of the adaptive management of EA Follow-up and the uncertainty that occurs.

6.1 Implementation Theory and EA Follow-up

The follow-up process is closely related to the implementation theory and involves the translation of recommendations and planning from EA into actionable strategies. This helps to transform environmental impact assessment reports into practical and implementable solutions in the field while ensuring compliance with laws and regulations (Wood, 2003). Studies conducted in the Netherlands, Iceland, and Denmark have shown that follow-up is used to understand how compliance with regulations and implementation procedures relates to the overall objective (Wood, 2003). For example, in Iceland, the follow-up process is used to ensure that environmental monitoring procedures are being met by conducting follow-ups in the Power Line 3 case. In the Netherlands, for instance, monitoring is used to understand whether the noise frequency levels from wind farms are in accordance with standards. This highlights how follow-up provides guidance in a more practical and implementable way for implementation strategies.

6.1.1 Implementation of EA Follow-up principles

In six case studies, implementing EA Follow-up involves adhering to some of the 15 principles published in the IAIA by the Arts and Morrison-Saunders (2022) and the related guidance by Morrison-Saunders and Arts et al. (2024). However, there are also aspects that can be addressed more broadly at the country level. The 15 principles have been discussed in Chapter 2 (Literature Review), and this section discusses the relation of those 15 principles to the research findings – see Figure 2.

The case study of plans and projects generally follows Principles 1 (state the objective) and 2 (tailored to context), where the objectives of the overall activity are tailored to specific contexts instead of general follow-up. Although some are being commenced early (Principle 3 – commence early) in the impact assessment process related to planning, but not as early as during the screening or scoping process (see Figure 4). Follow-up is mainly being commenced after the EAs are conducted. Moreover, the implementation might not necessarily be throughout the project or plan life cycle (Principle 4 – carried out throughout the project or plan life-cycle) because all cases were still ongoing at the time of this study, and they are not in the decommissioning stage. Therefore, it is quite difficult to understand whether it will be carried out throughout the project or plan's life cycle.

In addition to Principles 5 (be transparent), 6 (be accessible), and 7 (clear accountability), the projects discussed in the case study prioritise transparency in their follow-up processes (Arts and Morrison-Saunders, 2022). Countries such as Iceland, the Netherlands, and Denmark provide information on the monitoring progress and results on websites. For example, stakeholders are given access to impact assessment reports and invited to attend meetings in the case of Icelandic case studies, which helps provide clear accountability for follow-up procedures. However, it can be difficult to determine who is responsible for the follow-up process. This issue is related to Principles 8 (well-justified performance criteria) and 9 (specify enforcement provisions), as there is limited evidence about the clear performance criteria if EA Follow-ups are being conducted and no specified enforcement provisions in any of the countries mentioned by participants. While impact assessment follow-up is legally binding when required by a permit, the enforcement may not be equal for all types of projects. Despite these challenges, the case study provides clear and predefined performance criteria as specified in the EA Follow-up process.

Moreover, in order to promote continuous learning (Principle 10), adaptive management (Principle 11), and flexibility toward emerging needs (Principle 12), it is important to stay informed and be informed (Principle 13) about other relevant activities related to the EA Follow-up for the projects (Arts and Morrison-Saunders, 2022). Those principles are generally addressed well in the case studies where continuous learning is being underlined. Although, in some cases, it is only for the purpose of monitoring and measurement, and it is not very clear about how the project will be utilised. However, in the Netherlands, Iceland, and Denmark, the stakeholders are aware that continuous learning is an important aspect of follow-up because it can help facilitate adaptive management and flexibility to the emerging needs within the projects, plans, or programs. This has been seen, for example, in the case of Gas Extraction in the Wadden Sea, the Netherlands, or Power Line 3 in Iceland.

Regarding Principles 14 (consider cumulative effects) and 15 (consider overall effects), which relate to the cumulative and overall effects of a project or plan, the assessment in the big monitoring programs such as the one in the hydropower plant in Iceland (IS 4) and the off-shore windfarm in Denmark provide examples of assessments being conducted to understand the cumulative effects, as well as the findings that follow-up practices aim to understand the impact on all aspects (Arts and Morrison-Saunders, 2022). This example provided information on how the monitoring has been carried out for years and on a larger scale to understand the impact over the years. However, it is possible that the data may be available but has not yet been discovered in this case study and research. In the future, when conducting follow-up practices related to Environmental Assessment (EA), it is important to consider the 15 principles to ensure adherence.

Overall, it can be concluded that in the countries and cases examined, principles 1 and 2 related to the objectives of the projects are addressed. Principles 5, 6, and 7 related to transparency, accessibility, and accountability have been well addressed, and stakeholders are well-involved in the EA Follow-up processes. Principles 10, 11, 12, and 13 are also well addressed with the promotion of continuous learning and adaptive management. However, principles 3, 4, 8, and 9 are only partially addressed. Meanwhile, principles 14 and 15 are minimally addressed in relation to cumulative effects, and the overall effects are limitedly addressed.

6.1.2 Bridging implementation gaps

There is limited evidence that the EA Follow-up is being implemented properly, as shown in the follow-up programs in the original EA report. There is a gap between what EA Follow-up should be conducted, what is advised by the relevant authority, and how it is being done in practice, as found in the interviews (NL 8, NL 9, IS 2, IS 4, DK 3) and confirmed by the FGD. Furthermore, the finding suggests that there is ambiguity regarding whether EA Follow-up is being implemented after receiving advice or opinions. This finding confirms the theory which indicates an implementation gap, which refers to the disparity between the planning process and the effective execution of EA Follow-up in the field (Gilg and Kelly, 1997). Discrepancies between the planned and actual results in the field highlight the need for EA Follow-up.

There are various factors contributing to the implementation gap in EA Follow-up practices, but the most significant one is the differing regulations of each country. The EU EIA directive has made it compulsory to some extent for EA Follow-up to be implemented, which has highlighted the gap. This gap can widen due to resource limitations, opposing policies from stakeholders, and uncertainty in project scope, which are all reflected in the literature (Gilg and Kelly, 1997). For example, the EA Follow-up depends on the project proponent. In Iceland, where the project proponents are large developers, EA Follow-up is likely to be conducted. Similarly, in smaller projects, EA Follow-up are less likely to take place.

Findings from the Netherlands, Iceland, and Denmark, as well as discussions during the FGD, revealed that the implementation of EA Follow-up is hindered by the lack of clarity and consistency regarding who is responsible for carrying out follow-up, and by limited practical guidance at the country level. This can lead to ambiguity in how the policies are implemented across different countries, despite the fact that they all follow the same EU EIA Directive. In order to address the implementation gaps, the case can be addressed based on the four types of implementation theories - top-down, bottom-up, adaptive, and evolutionary (see Figure 15) (Palumbo and Oliverio, 1989). In *top-down implementation*, where the focus is on the central government creating policies that are enforced upon projects or programs, the rules and regulations of the EU EIA directives provide an example of such a scenario, where then it is translated into the guidance at the national level. However, there is a need for an emphasis on when environmental assessments need to be conducted and the consequences for failing to oblige. The second one is related to the *bottom-up implementation*, which is more focused on the role of community-led EA Follow-up. It can be seen in the case of the Wind farm De Drentse Monden and Oostermoer as people promoting the EA Follow-up where the executions depend on public participation in the case of form in which the people demand the monitoring to happen.

The third implementation relates to *adaptive management*, which continually evaluates, monitors, and adjusts to changes in the environment. This approach is similar to the theory of EA Follow-up, where monitoring is conducted, and lessons are learned for continuous improvement (Arts et al., forthcoming). This process addresses implementation gaps by tailoring assessments to suit the specific conditions of the local context and integrating insights gained during project execution and program implementation. The fourth element related to the *evolutionary implementation* is to make changes in the overall system of EA Follow-up to make them more efficient. This involves the ongoing evolution of programs during implementation (Palumbo and Oliverio, 1989). While evolutionary implementation shares some similarities with adaptive management, it primarily focuses broad range of

policy reform, which necessitates complex research and policy development beyond the scope of environmental management. In the context of EA Follow-up in energy infrastructure, while adaptive management focuses on the environmental assessment process itself, evolutionary implementation focuses on the broader evolution of social, political, and infrastructure complexities that impact the energy sector.

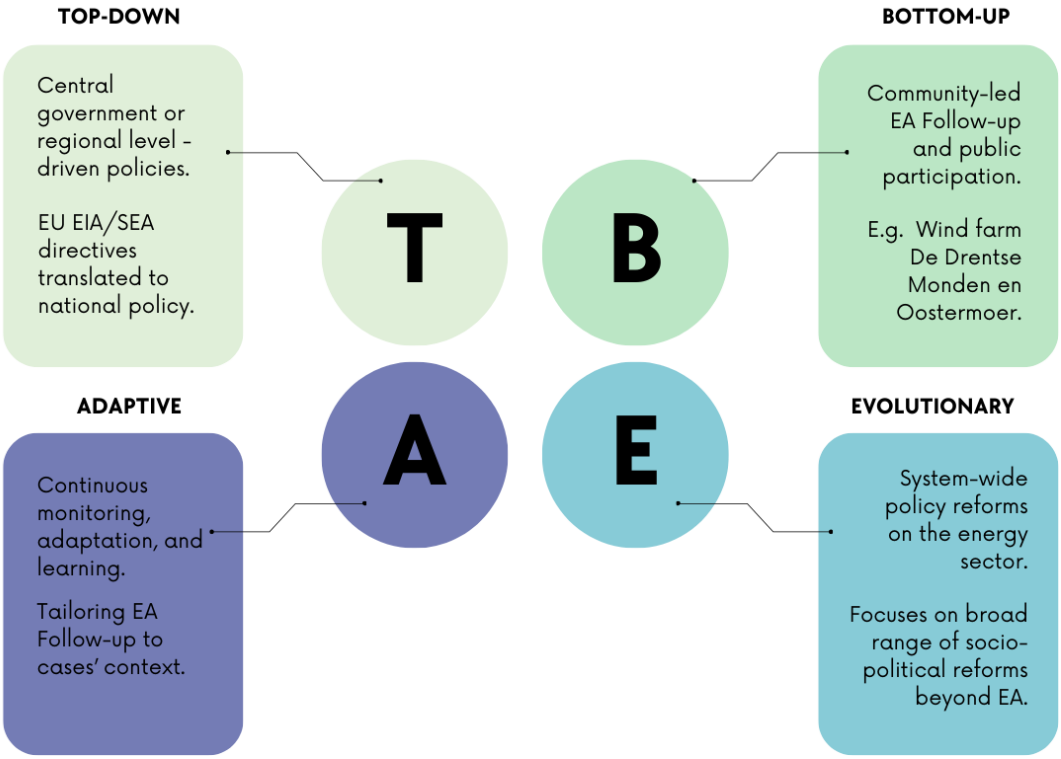

Figure 15. Implementation theory in EA Follow-up. Source: Author depiction adapted from Palumbo and Oliverio (1989)

6.2 Adaptive Management in EA Follow-up

The Adaptive Management theory is an essential aspect of EA Follow-up. Follow-up should not only involve monitoring and compliance but also taking knowledge and lessons learned from project monitoring to understand how the actual impact compares to the previous impact. This helps in making necessary adjustments to be adaptable to different kinds of uncertainty. This section discusses adaptive management in EA Follow-up practices and addresses different uncertainties found within the context of this study.

6.2.1 Adaptive Management in EA Follow-up

The Netherlands, Iceland, and Denmark have observed the importance of adaptive management in EA Follow-up. However, the alignment between the theories and practice varied between the cases. The case of Power Line 3 project in Iceland provides a lesson learned to improve the next construction of another power line and for the future number when conducting the calculation (IS 5, Mannvit, 2023). However, this is not always followed at the country level. This case demonstrates the lesson learned about the EA Follow-up to

ensure adaptive management is not only related to monitoring but also to how the knowledge gained can be used for the betterment of the project. This means taking into account lessons learned and applying them to future projects. Similarly, another example is the gas extraction project in the Netherlands, where monitoring results are continuously used to decide whether the gas extraction project in Ternaard should continue. Both the case studies and the country-level findings highlight the importance of learning from the EA Follow-up outcome, which was also confirmed during the FGD. This provides a good example of how adaptive management is a crucial process that is closely linked to knowledge acquisition and learning. It involves evaluating and monitoring new information and then adjusting strategies and goals based on the results (Lessard, 1998). Adaptive management is particularly important for environmental issues because it takes into account the environmental impact and helps to understand different ecological variables that could influence the projects (Holling and Walters, 1978). This allows necessary adjustments to be made. The practice of EA Follow-up emphasises continuous learning and adjustment for the process.

Environmental assessment involves continuous learning, with Arts et al. (Forthcoming) noting the practice includes single-loop and double-loop learning, which are both seen in the findings of this research. According to the cycle, EA Follow-up involves assessing project design, implementing, conducting monitoring, and adjusting projects as needed, however, few cases actually follow this practice. All case studies conducted monitoring, but the extent to which they used their knowledge varied. The wind farm in Drenthe in Iceland is an example of single-loop learning, as the results focused on project management and compliance. On the other hand, the gas extraction in the Wadden Sea and Power line in Iceland, and the hydropower in Iceland are examples of double loop learning, as results were used to improve beyond the project itself. This type of double-loop learning is important because it helps in "closing the loop" to ensure that the knowledge gathered from the monitoring is being utilised for further improvement of the projects and beyond the project (NL 3, IS 4). It has been stated that the purpose of learning is to enhance EIA practices and prepare for future projects. However, research has revealed that the benefits of learning extend further than just project improvement. It serves as a means to expand knowledge for about the sectors and the general public. The EA Follow-up case in Denmark related to the offshore wind farm has the potential to be a huge example of changes in policy-level practices, as discussed in their objectives. However, further data is needed to make such a claim. This example highlighted the concept of an adaptive management cycle, adapted by Miles (2013) from Nyberg (1999), which is crucial to understanding EA Follow-up.

6.2.2 Uncertainty: Knowing the unknown

The findings of this study in the Netherlands, Iceland, and Denmark show that the EA Follow-up practices in each country address uncertainties and provide a way to manage them. EA Follow-up is a way of embracing uncertainty and turning it into an opportunity for continuous learning and innovation. By monitoring and gaining new knowledge from the process, environmental management can transform negative impacts into innovative solutions (Peterson et al., 2003). Therefore, EA Follow-up is crucial because it can help to understand different types of uncertainties and turn them into known variables (NL 3). The finding in this study confirms the theory related to adaptive management is an approach that provides flexibility in dealing with uncertain planning situations (Allen et al., 2011). Adaptive planning and EA Follow-up are ways of coping with uncertainty because uncertainty can be viewed both as a challenge and an opportunity. The uncertainties that

were identified in this study, such as climate change and stakeholder engagement, can impact the nature of project planning. This unpredictability can be seen as a challenge because it can disturb the planning process and potentially exaggerate impacts (Peterson et al., 2003). Thus, EA Follow-up, if applied according to the examples of the 15 EA Follow-up principles, can help create a positive impact and continuous improvement.

This research addresses that EA Follow-up is particularly crucial when there is uncertainty. EA Follow-up is an important process that helps to tackle uncertainty and ensure that everything is in accordance with predictions. Understanding what is currently unknown provides opportunities for continuous learning and improving current and future projects (NL 6). EA Follow-up is being carried out to better understand what is unknown and provide a continuous learning experience to improve the next phase of the project (NL 3). NL 6 mentioned that permits are mainly related to the known factors, but there are unknown and previously unconsidered factors that may arise during the EIA process, as well as new developments. Therefore, continuous monitoring is crucial (NL 7) to build up knowledge for the future (IS 2). This research discusses the case of the offshore wind farm in Denmark and the importance of EA Follow-up procedures to ensure continued learning and improvement. The implementation of monitoring helps to understand the uncertainties of the project and is part of the theory of adaptive management. Learning is being used to improve the project itself (single-loop learning) or to develop a new plan (double-loop learning) (Arts et al., Forthcoming). Ultimately, this approach helps to guide the use of new technologies and improve overall project outcomes (Peterson et al., 2003).

There are many unknown factors in the planning process that need to be understood in order to determine projects or plans' maximum planning capacity. EA Follow-up can help to gather knowledge to extend the planning capacity, especially in relation to energy infrastructures with new innovations constantly emerging. It is important to understand and acknowledge these limitations to improve the predictive capability in the future. An important aspect of EA Follow-up in planning is to ensure that the predictions and environmental assessments for the future improve over time. To achieve this, it is necessary to recognise the threshold of what can be anticipated and controlled, as well as the extent to which planning can take place based on the current knowledge. This is where EA Follow-up plays a crucial role, as it allows proponents to adopt adaptive management within the planning process and make necessary adjustments based on new information, which confirms the study from Miles (2013) related to the adaptive management cycle. Recognising the maximum planning capacity and implementing EA Follow-up processes can help us understand projects and plans' limitations, while also leaving room for improvement and learning (Williams, 2011; Williams and Brown, 2014). The concept of adaptive management is closely linked to the idea of maximum planning capacity, and EA Follow-up can assist in extending this capacity to address unforeseen environmental challenges in the future.

6.2.3 Continuous learning by closing the loop

This study presents several findings regarding the different scenarios in which monitoring takes place. The theory suggests the process of the project life cycle starts with SEA or EIA, and then is followed by the consent decision, project implementation with EA Follow-up (Arts and Morrison-Saunders, 2004; Morrison-Saunders and Arts, 2004). In practice, some cases follow this *standard scenario*, while other cases also follow a *distinctive scenario*

where the EA Follow-up occurs outside of the EIA plans but has an influence on the EIA process. This is due to the vast amount of monitoring of environmental impacts that occur outside of the EIA plan, such as nationwide programs for air and water pollution or monitoring for specific energy targets like renewable energy projects.

This research revealed that the standard scenario can be seen in the Wind Farm De Drentse Monden and Oostermoer in the Netherlands, Power line 3 – 220 kV high voltage line in Iceland, and the Horns Rev and Nysted offshore wind farms in Denmark. On the other hand, there are also cases with a distinctive scenario; for example, in the Netherlands, the continuous Follow-up practices related to gas extractions have impacted the current and future environmental impact assessment practices of new projects. In Iceland, after completing an environmental impact assessment (EIA) for a project, a comprehensive monitoring program is implemented to oversee the sustainability of the project area. This monitoring program extends beyond the scope of the EIA and involves collaboration with other companies in the area. On the other hand, in Denmark, the BioValue case study examines the effectiveness of environmental assessment instruments, specifically the follow-up and monitoring practices.

It is crucial to examine all necessary aspects when carrying out monitoring activities. In this research, participants have argued that EA Follow-up might not be needed if similar monitoring activities have been conducted recently in proximity to the project (NL 3). However, it is essential to recognise that there could be various factors leading to the underreporting of environmental impacts, which may not directly relate to the frequency or existence of monitoring efforts. Thus, having a pre-existing monitoring program is not a valid reason to forgo additional monitoring. Instead, such a program should facilitate more efficient monitoring and learning from the project. Ensuring the project complies with EIA regulations. Despite potential overlaps with existing monitoring efforts, it is important to conduct follow-ups on these projects to fully comprehend the outcomes and lessons learned.

Regardless of the standard or distinctive scenario, effective EA follow-up involves not only implementing a monitoring program but also utilising it for continuous learning. This was emphasised during the FGD, where participants agreed on the significance of using monitoring for learning purposes. Various monitoring programs are available that can provide valuable insights into different aspects of a project, especially in situations where financial constraints make EA Follow-up difficult. The data from these monitoring programs can be used to gain valuable insights, and it is not necessary for the proponent to provide the data directly (NL 1). The key is to leverage this data to improve the project and identify areas that require adjustments. This is in line with the principles of adaptive management, which emphasise the need for EA Follow-up to facilitate learning and continuous improvement by closing the loop of the EA Follow-up process (Holling and Walters, 1978; Miles, 2013).

7 Conclusion

This chapter discusses the conclusion of the findings in order to answer the research questions and the sub-research questions. The main research question is related to *"**How is Environmental Assessment Follow-up for energy infrastructure conducted in the Netherlands, Iceland, and Denmark, and what lessons can be learned to contribute to careful implementation and adaptive management of energy infrastructure projects in these countries?"*** To obtain the main findings, the research is guided by four sub-questions, which are outlined in the main findings. Additionally, this chapter discusses recommendations for practitioners and future research. Moreover, the study's limitations and reflections on the research process are also outlined.

7.1 Main findings

This study is guided by the following sub-research questions and the goals to be achieved:

How does adaptive planning and implementation theory shape the understanding and practice of EA Follow-up, especially in relation to energy infrastructure?

The concept of adaptive planning and implementation theory has provided a general understanding from academic perspectives on the comprehension and execution of EA Follow-up practices. The implementation theory has helped better understand how environmental assessment plans translate into practices while offering practical recommendations for more effective strategies and tangible monitoring measures. By utilising monitoring and data analysis, EA Follow-up enables necessary adjustments and the gathering of knowledge to improve the project.

The EA Follow-up process is guided by the principles set forth by the International Association for Impact Assessment (IAIA). This process aligns with the adaptive planning and implementation theory, as it emphasises transparency, continuous learning, and stakeholder engagement. Nevertheless, the application of EA Follow-up principles may vary depending on the country or project.

The EA Follow-up highlights the underlying principles of the adaptive management theory but focuses on environmental management. This approach helps manage uncertainty and understand unknowns in project planning and implementation. It also promotes innovation and improvement for the project and provides a continuous learning opportunity for evaluations and adaptation of project management.

What is the current practice of EA Follow-up in the Netherlands, Denmark and Iceland, especially for energy infrastructure development?

The practice of EA Follow-up is related to the European Union EIA directive, which involves mainly two types of assessments - strategic environmental assessment and environmental impact assessment. In the Netherlands, Iceland, and Denmark, compliance toward the EU directive is mainly conducted. Even for Iceland, which is not a member of the EU, the practice still follows because it is part of the EEA membership. However, in all of those countries, the term "follow-up" is not that well known, and it mostly refers to

monitoring. The general practices are mostly related to monitoring, which is usually especially done to adhere to compliance. The study related to monitoring for knowledge gathering is available but limited, and that primarily depends on the size of the project proponent and the possible significant effect of the projects because it relates to availability of resources.

How is EA Follow-up implemented in the Netherlands, Iceland, and Denmark, and what are the success factors and challenges for the practices of EA Follow-up in energy infrastructure projects?

The success of EA Follow-up practices depends on several factors. However, the primary one is related to the promotion of ***continuous learning*** by conducting extensive analysis to evaluate the effectiveness of projects, plans and programs before and after the construction process. This helps improve future predictions and identify lessons learned for creating an efficient monitoring system. Thus, the leads of the EA Follow-up need to consider implementing comprehensive EA Follow-up that not only monitors but also involves learning from the results to gain new insights for future projects. In this way, it will help in addressing uncertainties and unknowns in the Environmental Impact Assessment process and learning from the follow-up experience to improve decision-making. Furthermore, defining ***clear roles, defined timelines, and specific enforcements*** for EA Follow-up and ensuring that the process according to the EIA planning is adhered to is another important success factor. This can be achieved by ensuring that EA Follow-up is related to permit acquisitions to ensure regulatory compliance and incentivise proper monitoring follow-up. Furthermore, understanding that EA Follow-up provides ***added value*** to the project and helps to communicate the environmental impacts to the public and ***maintain transparency*** to create more effective and transparent EA Follow-up practices.

The process of EA Follow-up encounters several barriers and challenges that can hinder its effective implementation. One of the primary challenges is the ***limitation of resources,*** which includes both financial constraints and a shortage of human resources necessary for carrying out follow-up activities. Additionally, there is often ***insufficient regulatory pressure*** to enforce EA Follow-up in various projects, plans, and programs, coupled with minimal consequences for those who fail to comply. This lack of stringent enforcement can lead to reluctance among project or plan proponents to engage in EA Follow-up, driven by fears that the findings might require revisions to their projects or plans. Furthermore, regulations that employ the phrase "where applicable" tend to be ambiguous, thus, resulting in inconsistent EA Follow-up practices. Moreover, the ***presence of pre-existing monitoring*** efforts, such as national air quality or noise monitoring, may lead some to view these as sufficient for their projects, thus deeming additional follow-up measures unnecessary.

How do physical-geographical conditions (such as 'islandness'), institutional arrangements, and stakeholder involvements in each country influence their EA Follow-up practices related to energy infrastructures?

The physical-geographical conditions have some influence on the practice of EA Follow-up, especially when it comes to the islandness concept and the transboundary impacts. Countries like the Netherlands, which are very connected, and Denmark, which borders other countries, have a greater impact on their neighbouring countries, even in the offshore wind farm projects. On the other hand, Iceland, which is geographically more isolated, is less of a concern related to the transboundary impacts.

The Netherlands, Iceland and Denmark implement their EA regulations based on the European Union EIA/SEA Directives. The application of these regulations depends on the project scope and the project proponent. The directive mentions that monitoring is required when applicable, which mainly translates to when there are significant impacts or uncertainty (known-unknown). The regulations state that monitoring is required when applicable, but there is ambiguity about the consequences if the EA Follow-up is not implemented, except in cases where it is related to the permit. In such cases, permit revocation is a possibility, although it is a rare occurrence, and there are no specific examples of it mentioned in the findings.

The practice of EA Follow-up involves significant involvement from stakeholders. The Dutch commissioners of EIA, the Planning Agency in Iceland, and the Environmental Protection Agency in Denmark are the primary contact points for EIA projects. These institutions offer advice and opinions related to the environmental impact assessment. However, the responsibility for follow-up activities rests mainly with the project proponent, and such activities could be project proponent bullet, government-led, or community-led.

Main Research Questions

In conclusion, in the Netherlands, Iceland, and Denmark, EA Follow-up aligns with the EU EIA Directives and is integrated into national policies. However, it is not typically executed in practice except for projects with significant impacts or major uncertainty or for knowledge acquisition, with some exceptions seen in case studies. The lesson to be learned from investigating the process of EA Follow-up in three countries is that the process should consider the complete practice of the EA Follow-up. This should be generally applied as a valuable step to "close the loop" in evaluation and learning for environmentally effective energy policymaking. A more generally applied EA Follow-up promotes continuous learning, a better understanding of different types and sizes of uncertainty, and bridging the gaps in implementation within the process.

7.2 Recommendations for practitioners

Based on the findings and elaborated during the FGD, there are some recommendations for EA practitioners to promote the practice of EA Follow-up. It is necessary to ensure that clear regulations are in place to identify who is responsible for leading and monitoring the implementation of EA, and what the consequences are for non-compliance. Additionally, it is also important to ensure that monitoring is not only used for adhering to permits, but also for gathering new knowledge. If necessary, permits should be made temporarily to promote follow-up every 5 or 10 years to provide checks and balances if the EA Follow-up is carried out according to the plan. Since the current findings suggest that EA principles are not fully utilised in the process, it is crucial to promote the 15 Principles of the EA Follow-up and ensure their follow-up implementation via the suggested principles. This is particularly related to the principles that address cumulative effects and overall effects of the plans and projects. Furthermore, it is important to raise awareness about the advantages of EA Follow-up for knowledge acquisition and added value for projects, plans, and programs.

Conducting a full environmental assessment follow-up is not always necessary, meaning first-hand monitoring and data collection by the proponents. The monitoring can be carried out using data from different sources, such as nationwide monitoring programs, or

previously conducted monitoring can also be used. This way, the practice of the EA Follow-up can be connected by utilising the available resources. The key to the EA Follow-up process is continuous learning and considering all information for future projects or to improve the current project.

It is critical to establish a well-defined and practical follow-up program, which should include detailed information about responsibilities and budget allocation. This can be achieved by designating a knowledge broker to act as the primary point of contact for EA follow-up inquiries. Instead of creating a new agency, the existing agency can be strengthened to include a specific function dedicated to addressing EA follow-up matters. Furthermore, clearly setting the scope of monitoring (at project, regional, and national levels) and increased public involvement are also significant aspects to consider. To enhance implementation in practice, it is important to provide concrete, more detailed guidance on application EA Follow-up as well as conduct EA Follow-up specific, prioritised pilot projects or plans to enhance learning.

In order for the guidance to be followed through, it is key to provide capacity building for adaptive management and ongoing support for project proponents. This can be accomplished by organising workshops at regional or national levels for environmental impact assessment practitioners, as well as delivering practical training for project proponents on how to conduct EA Follow-up. Additionally, it is important to promote various tools and modules for integrating adaptive project management based on assessment outcomes. This will allow project proponents to not only obtain data from the follow-up, but also utilise it to improve their projects or plans.

Furthermore, having a solid plan to improve the website and follow-up procedures is a crucial step in the near future. One way to do this is by creating various fact sheets about the EA follow-up. This can be done by experts in environmental assessment follow-up or the knowledge broker proposed above. It is also crucial to have an updated procedure for conducting follow-ups; a clear, user-friendly website can significantly improve access to information.

Another suggestion is to involve an independent reviewer in EA Follow-up to ensure that the proponents deliver on their promises related to the environmental assessment. This independent reviewer can be initiated at the national or regional level, depending on the size of the projects. The reviewer's role can also be related to permitting to ensure that there is a legal basis for the reviews and consequences for non-compliance.

7.3 Recommendations for future research

One of the recommendations for future research to improve the practice of EA Follow-up is to promote cross-country learning within the European Union to have a more standard EA Follow-up under the EU EIA/SEA Directive. This is also an approach to improve stakeholder communications and ensure that the voices of various stakeholders, starting from the institution’s research group and the public, are heard and considered.

Further research suggestions include conducting a comparative analysis of environmental assessment follow-up not only within different EU countries but also between the EU and non-EU countries. This could include comparisons between the EU and the South Asian

Association for Regional Cooperation countries or the EU and the Association of Southeast Asian Nations. Another approach for further study could involve comparing EU countries with non-EU countries or comparing developed countries with developing countries to assess the extent to which EA Follow-up practices are being adhered to. This type of research could provide valuable insights into the regional level of implementation EA Follow-up.

This study also addressed the interaction between 'islandness' and mainland. Thus, further research could enhance our understanding of how environmental assessments are conducted in countries with the mainland and islands, such as the Netherlands and Denmark, particularly the nexus between the mainland and the islands.

7.4 Strengths and limitations of the study

The study combined both macro and micro-level EA follow-up practices in three different countries. The comparative analysis of the three countries also provides unique insights into the EA follow-up practices with regional variations. Furthermore, the study addressed the physical-geographical conditions, particularly the aspect of islandness, which has not been widely addressed in EA follow-up studies. Additionally, the study combined various data collection methods, including interviews with experts, document analysis, and focus group discussion, which helped to triangulate the findings and ensure the validity of the results.

In this research, there are informants from three different countries, despite in differing numbers for each: 10 from the Netherlands, 5 from Iceland, and 6 from Denmark. The initial aim was to have a similar number of representatives from each country, which proved to be challenging. Furthermore, the process of finding suitable cases for the study was particularly difficult, primarily because the selection relied heavily on participant suggestions, indicating that a higher number of participants might have yielded a broader range of suggestions.

Additionally, identifying exact comparative elements of EA Follow-up cases was complicated due to the distinct energy production and infrastructure present in each country. It is important to note that this study was limited to using only publicly available data, as this was the information participants were willing to share and what could be readily found. Therefore, there might be other relevant cases or hidden information that were not included. The information gathered and presented here serves as examples specific to the scope of this study and should not be generalised to represent all information related to the countries in question.

7.5 Reflection

The overall process of this study was conducted about three months after the proposal was written. With such time constraints, the process was both fulfilling and challenging. It was fulfilling to research the topic that I am deeply connected to; environmental issues and the energy sector. The research process was combined with an internship at the Rijkswaterstaat, Ministry of Infrastructure and Water Management, the Netherlands, which provided valuable experience in understanding the context of the research put into practice. The challenges mainly revolved around finding participants and suitable cases for the study. However, despite these challenges, I was able to meet and engage with experts in the field,

which provided valuable insights not only for the thesis but also for future career prospects. The interviews typically started with an informal discussion and introduction before progressing to the actual interview. Furthermore, I reflect that conducting this research was not a straightforward and linear process. I had to go back and forth with data collection and writing process. Now, looking back on the past three months, this research was a valuable learning journey.

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Appendix A – Interview Guide for General Interview

Guideline for General Interview

This document serves as guidelines for initial interviews related to Environmental Assessment follow-up.

Purpose of interview : To understand the general ideas of Environmental Assessment follow-up before conducting the in-depth interviews. This is to help answer the first question of the research about the definition and approach

Target participants : People who have some experience with Environmental Assessment follow-up and/or have some experience with impact assessment in general.

Estimated time : 30 – 40 minutes for general interview and 60 – 90 minutes for in depth interviews.

Notes : The questions in bold are the main questions that need to be asked during the general interview, while the non-bold are additional questions which go deeper into the in-depth interview. The non-bold questions are asked during the General Interview only if making an appointment with the same person can be considered difficult.

Introduction

My name is Yulita, and I am a Research Master's student enrolled in a double degree program for Islands and Sustainability at the University of Groningen and the University of Iceland. I am currently working on my MSc-thesis that aims to conduct a comparative analysis of Environmental Assessment follow-up in the Netherlands, Iceland, and Denmark. The objective is to understand how these practices differ across different countries with different contexts in order to draw lessons for enhancing EA Follow-up in practice. In this research, I focus on (renewable) energy infrastructure (e.g. windfarms, power lines, geothermal energy) which is in all countries an important sector. I combine this Master-thesis study with an internship at Rijkswaterstaat, Ministry of Infrastructure and Water Management, the Netherlands.

The interview will be anonymous as mentioned in the Research Project Information Sheet and there is no right or wrong answer. The interview aims to explore the experiences related to EA Follow-up. Before we start, do you have any questions about the study?

May I record this conversation?

General questions to ask for rapport-building

*The following consists of questions that are asked for rapport building as well as the first contact with the potential informants. This is not necessarily asked during the general interview but can be asked during the **(unrecorded)** informal discussion.*

1. **Could you describe your current role and the primary responsibilities you hold within your organisation?**
2. **Are there any specific EA projects or initiatives you are currently working on, especially for the energy sector or (renewable) energy infrastructure? Could you share some details about your involvement and contributions?**
   Notes: Especially for energy sector and (renewable) energy infra, such as; windmills parks (at sea or land), geothermal energy etc., electricity/powerlines, pipelines for heat etc., energy stage etc.
3. **Have you been involved in any interesting EA projects or research recently that you are particularly proud of or excited about related to EA (SEA for plans, programmes and/or EIA for projects), especially for the energy sector or (renewable) energy infrastructure?**

General questions – EIA experience in general and state of art about follow-up

4. **Could you share experiences in your country with Environmental Assessment in general?**
   (Probes: explanation about the EA process in general from notification to follow up).
5. **What is your general understanding of follow-up regarding EA (SEA Follow-up for plans, programmes and/or EIA Follow-up for projects)?**
   Notes: EA Follow-up means activities conducted after the completion of an impact assessment (post-decision) to monitor, evaluate, and manage the outcomes of the assessment in relation to the impacts of a project or programme. This aims to ensure that the predictions made during the impact assessment phase (pre-decision) are compared against actual outcomes and then followed up with adaptive management and mitigation of unforeseen negative impacts.
   a. How does follow-up in environmental assessment (EA) usually work?
   b. What term is usually used to describe EA Follow-up, such as monitoring and evaluation, monitoring and auditing, etc?

Experience with EA Follow-up

6. **Have you previously been involved in any plan or project with Environmental Assessment follow-up?**
   If yes, could you provide detailed insights into your involvement?
   If not directly involved, have you engaged in activities or know about plans/programmes/projects closely related to Environmental Assessment Follow-up processes?
   a. Could you describe the project(s) you were involved in?
   b. How was the follow-up process for the environmental assessment performed?
   (Probes: information about methodologies and approaches employed).
   c. What are the objectives of the project to implement EA Follow-up?
   d. What are the methods used to implement the EA Follow-up?

e. After the monitoring, what is the next step? To what extent the results from the monitoring is being used?
f. Who were the key stakeholders involved in the impact assessment follow-up process, and what roles did they play?

(Probes: government, consultants, academics, and what are their roles)

7. What are the approaches or practices of Environmental Assessment follow-up in the Netherlands / Denmark / Iceland?
8. How do institutional arrangements (such as formal and informal rules, policies, norms, laws, and government structures) in your country influence their EA Follow-up practices, especially related to energy infrastructures?
    a. Are there particular laws or regulations related to EA (EIA/SEA) follow-up? If yes, what are those?
    b. To what extent are the laws and policies being implemented?
    c. What are the consequences if they are not being implemented?
9. How do physical conditions (such as 'islandness', geographical conditions, infrastructures landscape, and connectivity) in your country influence their EA Follow-up practices, especially related to energy infrastructures?
    a. To what extent did a transboundary impact happen between the mainland and the islands?
10. **In your opinion, what are the success factors/advantages/levers of, and conditions for, EA Follow-up, especially in energy infrastructure projects?**
11. **In your opinion, what are the challenges or barriers for your country to implement (or not to implement) EA Follow-up?**
12. **Do you know of any (other) specific plans, projects, or case studies, including reports, studies, guidelines, and guidance documents about EA Follow-up in the Netherlands / Denmark / Iceland, that could provide valuable insights?**

Question for further discussion and interview

13. As I am interested in understanding more about Environmental Assessment follow-up, especially in the Netherlands, Iceland, and Denmark, would you be willing to participate in an in-depth interview later on?
    a. If yes, when would you prefer to have the interview?
14. Are there experts or colleagues you could recommend for more detailed discussions on this topic?
15. Do you know/have other information about EA Follow-up in your country (e.g., organisations, websites, reports, other publications), especially related to energy sectors?

Closing

Thank you very much for your time. After the interview, I will write the transcript and provide you with a copy if you would like. Do you have any additional questions for me?

Appendix B – Interview Guides for Case Study

Guideline for Case Study Interview

This document serves as guidelines for initial interviews related to Environmental Assessment follow-up.

Purpose of interview : To understand the general ideas of Environmental Assessment follow-up before conducting the in-depth interviews. This is to help answer the first question of the research about the definition and approach

Target participants : People who have some experience with Environmental Assessment follow-up and/or have some experience with impact assessment in general.

Estimated time : 30 – 40 minutes for general interview and 60 – 90 minutes for in depth interviews.

Notes : The questions in bold are the main questions that need to be asked during the general interview, while the non-bold are additional questions which go deeper into the in-depth interview. The non-bold questions are asked during the General Interview only if making an appointment with the same person can be considered difficult.

Introduction

My name is Yulita, and I am a Research Master's student enrolled in a double degree program for Islands and Sustainability at the University of Groningen and the University of Iceland. I am currently working on my MSc-thesis that aims to conduct a comparative analysis of Environmental Assessment follow-up in the Netherlands, Iceland, and Denmark. The objective is to understand how these practices differ across different countries with different contexts in order to draw lessons for enhancing EA follow-up in practice. In this research, I focus on (renewable) energy infrastructure (e.g. windfarms, power lines, geothermal energy) which is in all countries an important sector. I combine this Master-thesis study with an internship at Rijkswaterstaat, Ministry of Infrastructure and Water Management, the Netherlands.

The interview will be anonymous as mentioned in the Research Project Information Sheet and there is no right or wrong answer. The interview aims to explore the experiences related to EA follow-up. Before we start, do you have any questions about the study?

May I record this conversation?

1. **Could you provide an overview of this case study and tell me about your experience/engagement related to this case?**
   a. How was the EA follow-up process / what steps were taken on the EA follow-up? *(Probes: information about methodologies and approaches employed).*

Was it planned from the beginning of the EIA process? Was it more reactive toward the situation or a preventive approach?

b. What are the objectives of the project to implement EA follow-up?
c. Who were the key stakeholders involved in the impact assessment follow-up process, and what roles did they play?
   (Probes: Proponent-led follow-up, IA regulator-led follow-up, Community-led follow-up, Indigenous-led follow-up, Independent-led follow-up)
   i. To what extent people/public are involved in the follow-up process?
d. What are the methods used to implement the EA follow-up?
e. What are the results of the monitoring/follow-up activities?
f. To what extent the results are in accordance with the predicted impact of the EIA?
g. How were the results from the follow-up/monitoring utilised or implemented for the management of the project or future projects?

2. How do institutional arrangements (such as formal and informal rules, policies, norms, laws, and government structures) in your country influence their EA follow-up practices in this case study?
   a. What are the permits connected to this project that have influenced conducting the follow-up?
   b. What is the validity of the permits? Are the permits 'temporary permits' to ensure continuous follow-up?

3. How do physical conditions (such as 'islandness', geographical conditions, infrastructures landscape, connectivity) in within the area of this projects influence their EA follow-up practices in this case study?
   a. To what extent did the transboundary impact happen in this project?

4. In your opinion, what are the success factors/advantages/levers of, and conditions for, EA Follow-Up, especially in energy infrastructure projects?

5. In your opinion, what are the challenges or barriers within the context of the project during the implementation EA Follow-up?

6. What are your recommendations for better EA Follow-up practice?

7. Do you know of any (other) specific plans, projects or case studies, including reports, studies, guidelines, or guidance documents about EA follow-up in the Netherlands / Denmark / Iceland that could provide valuable insights related to EA Follow-up?
8. Are there experts or colleagues you could recommend for more detailed discussions on this case study?

Closing

Thank you very much for your time. After the interview, I will write the transcript and provide you with a copy if you would like. Do you have any additional questions for me?

Appendix C – Research Information Sheet

Research Project Information Sheet

Environmental Assessment Follow-up in Energy Infrastructures:
A Comparative Study of the Environmental Assessment Follow-up
in the Netherlands, Iceland, and Denmark.

Thank you for your interest in taking part in this research study. This information sheet aims to explain what the research involves and how it will be carried out. Please take the time to read the following information carefully. If any part of it is unclear, please do not hesitate to contact the researcher using the contact details provided at the end of this document.

What this study is about?
The research is a comparative analysis of Environmental Assessment follow-up in the Netherlands, Iceland, and Denmark. At this, the study focuses on Environmental Assessment for the development of (renewable) energy infrastructure. Environmental Assessment (EA) includes both Strategic Environmental Assessment (SEA) for plans or programmes, and project-related Environmental Impact Assessment (EIA).
The objective is to understand how these practices differ across different countries with different contexts in order to draw lessons for enhancing EA Follow-up in practice. For the purpose of our study, we would like to gather information from participants who have experience in Environmental Assessment, specifically in follow-up in the Netherlands, Iceland, and Denmark – and, if possible, with a focus on the energy sector.
This research is being conducted as part of a Research Master's thesis program at the University of Groningen and the University of Iceland, in combination with an internship at Rijkswaterstaat, Ministry of Infrastructure and Water Management, the Netherlands – an agency leading in Dutch infrastructure planning and closely involved in the development of renewable energy infrastructure, conducting many SEA and EIA studies.

What does participation involve?
The participants are invited to take part in this study and will be involved in the data collection process through interviews and/or focus group discussion. Participation is entirely voluntary, and the initial interview will last for approximately 30-40 minutes, while the in-depth interview will take approximately 1 - 1.5 hour. The focus group discussion is expected to take between 1.5 - 2 hours. The researcher is flexible and willing to work around the participants' schedules.

Do you have to participate?
Participation in this study is voluntary and participants may choose not to answer specific questions without consequences or providing a reason. Participants will receive a copy of their interview transcript and may request alterations by the agreed date – i.e. before the formal MSc-thesis defence/submission.

Are there any benefits to participating?

The final MSc-thesis with the study results will be send to you as a pdf-file. Nevertheless, the participation will provide valuable contributions towards the knowledge advancement related to Environmental Assessment follow-up. Moreover, if participants are involved in the focus group discussion, they may gain valuable insights into the practices and experiences of environmental assessment follow-up brought forward by the other participants.

How will the information provided be recorded, stored and protected?
The interview will be recorded with prior consent from the participants. After the completion of the data collection process, all collected data will be kept confidential and stored securely in the secured drive of the University of Groningen. Access to this data will be granted only to the researcher and her supervisors. The participation in this study is anonymous and no material that could identify the participants will be used in any reports generated from this study without their prior consent.

Participants have the opportunity to review the transcript prior to the publication of the results. Thus, participants can have control over the aspects of their participation that are made public. Additionally, participants have the choice to refine or retract their involvement in the study within the specific timeframe mentioned above.

What will happen to the results of the study?
The data collected will be used for a master's thesis submitted to the University of Groningen and the University of Iceland. The findings of the research will be presented through the Graduate Research Presentation at one of the universities, as well as during the final presentation of the research internship at Rijkswaterstaat. Furthermore, being part of a Research Master, the research aims to be submitted for publication in the form of an article in a reputable academic journal.

Informed consent form
As part of the study requirements, participants will be requested to sign a consent form and will be provided with a copy for their records.

Contact for further information
If you have any further questions or require clarification regarding this research, please do not hesitate to contact the researcher.
Researcher : Yulita Muspitasari
Study program : Research Master's in Islands and Sustainability (Double Degree Program)
Universities : University of Groningen and University of Iceland
E-mail addresses : y.muspitasari@student.rug.nl

This research has been developed under the guidance of the following experts.
Primary Advisor : Prof. dr. Jos Arts (email: jos.arts@rug.nl)
Internship Supervisor : Maartje van Ravesteijn, M.Sc. (email: maartje.van.ravesteijn@rws.nl)
Faculty coordinator : Prof. dr. Benjamin David Hennig (email: ben@hi.is)

Appendix D – Consent Form

Agreement to Participate

Title study: **Environmental Assessment Follow-up in Energy Infrastructures: A Comparative Study of the Environmental Assessment Follow-up Practices in the Netherlands, Iceland, and Denmark.**

Name participant: _____

Purpose of study

The research is a comparative analysis of Environmental Assessment follow-up in the Netherlands, Iceland, and Denmark. The objective is to understand how these practices differ across different countries with different contexts in order to draw lessons for enhancing EA Follow-up in practice.

Assessment

- I have read and I understand the information sheet of this present research project.
- I have had the opportunity to discuss this study. I am satisfied with the answers I have been given.
- I understand that taking part in this study is voluntary and that I have the right to withdraw from the study until the agreed date, and to decline to answer any individual questions in the study.
- I understand that my participation in this study is confidential. Without my prior consent, no material, which could identify me will be used in any reports generated from this study.
- I understand that this data may also be used in articles, book chapters, published and unpublished work and presentations.
- I understand that all information I provide will be kept confidentially on the drive of the University of Groningen and/or the drive of Rijkswaterstaat, and only accessible to the researcher and supervisors.

Please check the following which are applicable:	**Yes**	**No**
• I provide consent for my interview to be recorded.	☐	☐
• My function title can be mentioned for this research.	☐	☐
If yes, please write which function title shall be mentioned: _____		
• I wish to receive a copy of the transcript.	☐	☐
• I wish to receive a copy of the scientific output of the project.	☐	☐

"I agree to participate in this individual interview and acknowledge receipt of a copy of this consent form and the research project information sheet."

Signature of participant:_____ Date: _____

“I agree to abide by the conditions set out in the information sheet and I ensure no harm will be done to any participant during this research.”

Signature of researcher:_____ ___ Date: _____

Appendix E – Coding Scheme

Coding Scheme for Document Review and Interview

Deductive coding

Codes	Scope	Trigger words
Adaptive planning	How adaptive planning or adaptive management is being applied in the EA Follow-up. It relates to the extent to which good monitoring and evaluation practices are learned from previous experience and then applied to improve the project.	Flexible, adaptive, adapt, adaptation, management, adjust, arrangement
Advice for monitoring	The advices or recommendations related to monitoring, evaluation, or EA Follow-up for a project's environmental assessment.	Advice, recommendation, best practice
Case study	A specific case study or example of how monitoring and evaluation or environmental assessment follow-up can be applied within the energy infrastructure.	Application, example, lesson, case.
Challenges	These are the barriers and difficulties encountered during the implementation of EA Follow-up.	Barrier, challenge, difficult
Definition of EA Follow-up	A detailed explanation of what environmental assessment follow-up is, its meaning, and the state of the art in EA Follow-up.	EA Follow-up, definition, meaning, define, term
Evaluation	An evaluation of the results and efficiency of the environmental impact assessment.	Evaluation, assessment, evaluate, examine.
Implementation	The implementation of environmental assessment follow-up in real life compared to the planning, taking into account not only regulations but also their execution.	Applied, implement, used, organized.
Implementation gap	An identification of the gaps between the planning process and the actual implementation within the EA Follow-up. This also includes EA Follow-up that has been conducted, and what the gaps are between the implementation and the regulations or policies.	Gap, implementation, discrepancy.
Lesson learned	This is related to the previous experience that are used to improve future practices of EA Follow-up.	Lesson, learned, insight, takeaway

Methods	The methodology and indicators used in EA Follow-up.	Method, outcome, measurement, indicator
Monitoring	The procedure for monitoring the environmental impact.	Monitoring, metrics, observation
Practice of EA Follow-up	The current procedures for conducting environmental assessments and follow-up activities within the targeted country.	Practice, methodology, approach, procedure, regulation, policy
Stakeholder	This is a person, group, organization, entity, proponent, or institution involved in EA Follow-up processes.	Stakeholder, involvement, engagement, participant, public, government, company, contractor, consultant, agency.
Success factors	Factors and aspects that contribute to successful environmental assessment follow-up.	Success, advantages, contribute, good.

Notes: The trigger words are mainly used as starting points but should also be complemented by reading the article thoroughly, as not all the trigger words are representative of the research findings.

Inductive Coding

Codes	Scope
Cumulative effect	Discussion about the long-term impacts of the projects, plans, and programs on the environment.
EIA in emergency	Environmental assessment for projects related to emergency situations such as disasters.
History of EIA	Information related to the historical background of the EIA process, including its introduction in the country for the first time, the conditions at that time, and how public response to it.
Transboundary impacts	The impact of projects, plans, and programs on the environment beyond the countries' borders.
Uncertainty	The situation where the impacts of projects, plans, and programs on the environment are unknown.

Appendix F – Participants of Interviews

Interviewees	Roles	Countries	Dates	Notes
NL 1	Advisor EIA	The Netherlands	22 – 02 – 2024	General interview
NL 2	EA Consultant	The Netherlands	04 – 03 – 2024	General interview
			01 – 05 – 2024	Case study interview
NL 3	Technical Secretary	The Netherlands	26 – 03 – 2024	General interview
NL 4	Senior policy advisor on EIA	The Netherlands	02 – 04 – 2024	General interview
NL 5	Senior advisor spatial procedures	The Netherlands	09 – 04 – 2024	Case study interview
NL 6	Project manager monitoring and assessment	The Netherlands	11 – 04 – 2024	General interview
NL 7	Project manager monitoring and evaluation	The Netherlands	11 – 04 – 2024	General interview
NL 8	Policy officer	The Netherlands	22 – 04 - 2024	General interview
NL 9	Policy officer	The Netherlands	22 – 04 – 2024	General interview
NL 10	Advisor energy monitoring	The Netherlands	30 – 04 – 2024	Case study interview
IS 1	Head of Environmental Consent	Iceland	21 – 02 – 2024	General interview
IS 2	Lecturer	Iceland	13 – 03 – 2024	General interview
IS 3	Manager of Environment and Sustainability	Iceland	22 – 03 – 2024	General interview
IS 4	--	Iceland	11 – 04 – 2024	General interview
			15 – 04 – 2024	Case study interview
IS 5	Environmental Specialist	Iceland	02 – 05 – 2024	Case study interview
DK 1	Associate professor	Denmark	23 – 02 – 2024	General interview

DK 2	PhD student	Denmark	16 – 02 – 2024	Case study interview
DK 3	Advisor	Denmark	29 – 04 – 2024	General interview
DK 4	Consultant	Denmark	29 – 04 – 2024	General interview
DK 5	Expertise director	Denmark	10 – 05 – 2024	General interview
DK 6	Bioscience expert	Denmark	14 – 05 – 2024	Case study interview
DK 7	Senior Specialist, PhD	Denmark	19 – 06 – 2024	General interview

Appendix G – List of Documents

Author(s) - Date	Title	References
Aalborg University's Research Portal (n.d.)	BioValue	https://vbn.aau.dk/
Aðalsteinsson H and Landsvirkjun (2017)	Kárahnjúkavirkjun: Framkvæmd skilyrða fyrir virkjunarleyfi	https://www.sjalfbaerni.is/
Advice -Commissioner.nl (n.d.)	3205. Monitoring aardgaswinning onder de Waddenzee vanaf de locaties Moddergat, Lauwersoog en Vierhuizen	https://commissiemer.nl/adviezen/3205
Advice -Commissioner.nl (n.d.)	3152. Gaswinning bij Ternaard	https://commissiemer.nl/adviezen/3152
Antea (2024)	Onderzoek monitoring en evaluatie mer	https://open.rijkswaterstaat.nl
BioValue - HorizonEU (n.d.)	BioValue	https://biovalue-horizon.eu/
Commissie voor de milieueffectrapportage	2553. Windpark De Drentse Monden en Oostermoer	https://www.commissiemer.nl/adviezen/2553
Dijkstra ir. M (Mike) (2023)	Windpark De Drentse Monden en Oostermoer Akoestisch onderzoek	https://www.borger-odoorn.nl/
European Parliament and Council (2011)	Directive 2011/92/EU	https://eur-lex.europa.eu
European Parliament and Council (2014)	Directive 2014/52/EU	https://eur-lex.europa.eu/
Kjær J et al. (2006)	Danish Offshore Wind: Key Environmental Issues	https://tethys.pnnl.gov

Klimaat M van EZ en (2024)	Voorlopig geen toestemming voor gaswinning Ternaard	https://www.rijksoverheid.nl/
Larsen JK et al. (2013)	Danish Offshore Wind: Key Environmental Issues – a Follow-Up	https://ens.dk
Larsen SV et al. (2022)	Benchmark for integration of biodiversity	Project Report – Written Correspondence
Mannvit (2023)	Umhverfisúttekt fyrir Kröflulínu 3 (KR3)	https://minarsidur.mulathing.is/
Miljøministeriet (2023)	Vejledning til lov om miljøvurdering af planer og programmer og af konkrete projekter (VVM)	https://mim.dk/
Nehls G (2017)	Figure 1. Producing and planned gas fields in the Dutch Wadden Sea	https://www.researchgate.net/
Oortwijn J et al. (2023)	Maken windturbines in Veenkoloniën nou wel of geen bromtonen? Wij zochten het uit	https://www.rtvdrenthe.nl/
Rijkswaterstaat (n.d.)	Plannen en programma's en de milieueffectrapportage	https://iplo.nl/
Rijkswaterstaat (n.d.)	Projecten en de milieueffectrapportage	https://iplo.nl/
Sjálfbærniverkefni Alcoa Fjarðaáls ogLandsvirkjunar (n.d.)	Forsagan	https://www.sjalfbaerni.is/
Skipulagsstofnun (n.d.)	Kröflulína 3, 220 kV	https://www.skipulag.is/
Staatstoezicht op de Mijnen (2021)	De effectiviteit van hand-aan-de-kraan bij het beoordelen van mogelijke gevolgen van mijnbouw rond de Waddenzee	https://www.sodm.nl/
wetten.overheid.nl (n.d.)	Omgevingswet	https://wetten.overheid.nl/
Windpark De Drentse Monden en Oostermoer (n.d.)	Over de windturbines van DMO	https://wordpress.drentsemondenoostermoer.nl/

Appendix H – Concept Notes of FGD

Concept Notes
Focus Group Discussion

1. Introduction

This concept note aims to provide an outline and planning for the Focus Group Discussion (FGD) as part of the data collection for the MSc Thesis titled "**Environmental Assessment (EA) Follow-up in Energy Infrastructures: A Comparative Study of Practice in the Netherlands, Iceland, and Denmark"**.

The main objective of the FGD is to briefly present the study's findings and triangulate them with representatives from the Netherlands, Iceland, and Denmark. Another objective is to gather suggestions related to recommendations for practitioners of EA Follow-up.

2. Methodology

a. Selection of Participants:

- Participants are selected based on their expertise in Environmental Assessment (especially related to EA Follow-up, monitoring, evaluation, and energy issues) and availability. This will include individuals with diverse expertise and backgrounds, such as those from government, academia, and experts in the fields of EA follow-up, EIA, and energy sectors.

b. Practicalities

- **Date and Time:** Monday, June 17 at 3PM – 4.30PM (CEST)
- **Duration:** The session will last approximately 1 hour and 30 mins.
- **Location:** Online Meeting in Google Meet Meeting / Teams.

c. Program

- ***Introduction:*** Welcome and introduction of the FGD and participants (10 mins) - Jos
- ***Presentation:*** Presentation of the research and the findings (10 mins) - Yulita
- ***Discussion:*** Guided discussion about four main issues (60 mins) – Facilitated by Jos
- ***Conclusion:*** Final discussion and remarks (everyone), and follow-up – Yulita (10 mins)
- *Extra time (if necessary)*

d. Ethical Consideration

- Consent from the participants is requested at the beginning of the focus group discussion, and the moderator requests permission to record the FGD at the beginning of the session.

3. Discussion Questions

- **Country-Level Practice:**
  - Why is the practice of EA Follow-up limited?
  - How can we promote EA Follow-up practices?
- **Success Factors and Challenges:**
  - What strategies have you found most effective in promoting EA Follow-up practices?
  - How can we overcome the challenges?
- **Institutional Arrangements and Stakeholder Involvement:**
  - How can institutional arrangements enhance the effectiveness of EA Follow-up practices?
  - How can we improve stakeholder involvement in EA Follow-up practices?
- **Practices to Theories:**
  - How can EA Follow-up help the implementation of projects/plans?
  - How can EA Follow-up support adaptive management?

Appendix J – Participants of FGD

Participants	Expertise	Countries
FGD 1	Environmental Assessment, Monitoring & Evaluation	The Netherlands
FGD 2	Environmental Assessment, Monitoring & Evaluation	The Netherlands
FGD 3	Environmental Assessment, The Dutch Context	The Netherlands
FGD 4	Environmental Assessment, International Context	The Netherlands
FGD 5	Environmental Assessment, Energy Sector	The Netherlands
FGD 6	Environmental Assessment Procedure, Energy Sector	Denmark

Notes: The expertise is being mentioned as broadly as possible to ensure the anonymity of participants.