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How are sustainability considerations integrated into the planning, execution, and monitoring of wind park projects: A multiple-case study in Scotland

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ABSTRACT: This paper has investigated the ways in which environmental, social, and economic sustainability factors have been incorporated into the planning, execution phase, and monitoring of several wind park projects in Scotland and the issues and trade-offs encountered. It has utilized a qualitative multiple-case study approach, selecting 4 projects for analysis: Berwick Bank Wind Farm, Neart na Gaoithe Wind Farm, Viking Wind Farm, and Cairn Duhie Wind Farm. The empirical material used was planning and Environmental Impact Assessment documents, and consultation reports. Led by Sustainable project management, the Triple Bottom Line (TBL) and the perspective of project lifecycle, the research employs abductive thematic analysis to investigate sustainability across environmental, social, and economic areas, as well as planning, execution, and control phases. The results show that the project documentation seems to capture primarily the integration of sustainability at the project planning stage. The environmental dimension is most elaborated, while the social dimension is mostly covered with the initiative taken for the stakeholder engagement, and the economic dimension is less clear. Integrating sustainability is obscured during the execution and the monitoring strategies, where an action is mainly reported as being planned. Trade-offs are central to the findings. The analysis identifies conflicts between renewable energy development and environmental protection, national versus local stakeholders, and formal commitments and realities. Overall, the integration of sustainability principles is patchy across dimensions and phases of the lifecycle, and is constrained by regulatory and project-specific factors.

KEYWORDS: Sustainable Project Management, Wind Energy, Scotland, Environmental Impact, Stakeholder Engagement.

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Abbreviations

EIA Environmental Impact Assessment

IEA International Energy Agency

IRENA International Renewable Energy Agency

SPM Sustainable Project Management

TBL Triple Bottom Line

Declaration on the Use of AI and Proofreading Tools

In the course of preparing this thesis, I have received limited language-related support from the following AI-related writing tools: Grammarly. The tools were used to enhance grammar, sentence clarity, academic tone, readability and proofreading. They also helped to revise vague sentences and enhance the flow of some paragraphs. No AI tools were used to replace my own academic work. I developed the research topic, research question, objectives, theoretical framework, case selection, data collection, data analysis, findings, discussion, conclusions, final argumentation, and had them reviewed. This analysis drew on publicly available project documents for the selected wind park projects in Scotland: Environmental Impact Assessments, planning documents, consultation reports, and monitoring documents. I conducted a document-based multiple case study, an abductive thematic analysis, and a cross-case comparison. To proofread the grammar, spelling, punctuation, and readability errors, Grammarly was used. Its suggestions were reviewed by me before being accepted or rejected. I do know that AI-generated content can be wrong or misleading. Therefore, all language suggestions have been critically reviewed and edited by me and I take full responsibility for the accuracy, originality, interpretation, references and final content of this thesis.

1 Introduction

1.1 Background of the Study

The global energy system is undergoing a major transition toward low-carbon and renewable sources. This shift is driven by the need to reduce greenhouse gas emissions and limit climate change. The Paris Agreement sets international targets for reducing emissions and strengthening the use of clean energy (United Nations, 2015). According to the International Energy Agency, renewable energy is currently the fastest-growing source of electricity worldwide, and it is expected to dominate future energy expansion (International Energy Agency [IEA], 2023). This shows that the transition to clean energy is both necessary and already in progress.

Wind power is a leading energy source in the category of renewable energy. It is popular due to its scalability, affordability and lack of direct emissions while in operation. According to IRENA (2023), wind energy is one of the most developed and growing renewable energy technologies worldwide. There are numerous countries that are developing both onshore and offshore wind projects to achieve climate targets. This has led to wind energy being an important part of national energy policies.

In this worldwide context, Scotland comes out front and center as a strong example for a wind energy case study. In addition to its wind resource potential, Scotland is spending large sums of money to develop both onshore and offshore wind farms. The Scottish Government has set very ambitious targets such as becoming a net-zero emitter and achieving high levels of renewable generation of Scottish electricity supply (Scottish Government, 2020). The development of wind energy in the locale is large scale and diverse, as evidenced by Berwick Bank Wind Farm, Neart na Gaoithe Wind Farm, Viking Wind Farm and Cairn Duhie Wind Farm. The range of public documents that have been made available as a result of these projects has made Scotland an excellent empirical environment for this study, with the availability of Environmental Impact Assessments and planning reports.

It's important to note, however, that wind energy projects are not just a technical or engineering endeavor. They pose a host of intricate environmental, social and economic

challenges. Environmental considerations include impacts on biodiversity, ecosystems and landscapes. Social factors involve community support, stakeholder participation, and local effects. Economic considerations are related to investment choices, the cost of production, and the creation of value over time. Often, these various aspects result in situations where the pursuit of one objective may be hindered by another (Wolsink, 2007; Devine-Wright, 2011).

Project management is a critical factor in this situation. The development of wind parks has multiple stages, such as planning, execution, and monitoring. The cooperation of stakeholders, compliance with regulations, and consideration of sustainability have to be coordinated at every stage. Environmental, social and economic outcomes have to be balanced during the project life cycle is the main point of sustainable project management (Silvius & Schipper, 2014).

Through efficient project management, renewable energy projects can be accomplished not only efficiently but also in a responsible manner. That is why analyzing wind park development as a project management activity is a good way to gain knowledge. It allows one to see how sustainability is carried out in practice and how difficulties and concessions are handled. Scotland, with its vibrant wind energy industry and availability of project-level data, serves as a good and realistic example for carrying out such an analysis.

1.2 Research Gap

Existing literature about wind energy and renewable energy has already delved quite deeply into sustainability matters. Studies have looked into environmental effects like biodiversity and emissions, but also the social acceptance and economic elements of wind power development (Wolsink, 2007; Devine-Wright, 2011). On the one hand, this shows that wind energy is a mature research area. On the other hand, most of this research is done at a broad level, such as policy or sectoral level, rather than at the project level.

Therefore, our knowledge of how sustainability aspects are incorporated into the actual planning, execution phase, and monitoring of specific wind park projects is very limited. That is one among the many ways project-level analysis of sustainability is deficient because it is not only the definition of sustainability, but more importantly, the actual execution phase of sustainability that is missing. Besides this, existing papers mostly address only one dimension of sustainability, e.g, environmental impacts or social acceptance, and thereby largely ignore the ways in which environmental, social, and economic considerations affect each other within one project.

As a result, we understand little about the trade-offs and tensions that occur when multiple sustainability goals must be harmonized during the development of a project. Still more, there is very little research that looks at sustainability integration over the entire project lifecycle. Some papers take planning stages, such as environmental assessments or public consultation, as the focus of their studies. But there are very few that examine how sustainability commitments get translated into actions during execution and after that during monitoring. The result of this is a gap in the understanding of how sustainability is kept on track during the lifecycle of a wind park project.

This paper takes a project-level approach and looks at selected wind park projects in Scotland in order to fill in the gaps pointed out above. Scotland is chosen as the empirical focus mainly because it has one of the most advanced wind energy systems in the world, and already has a very comprehensive regulatory framework; it has a considerable number of both onshore and offshore wind installations, and there is a lot of project documentation that is publicly available.

As such, it offers an excellent opportunity to study the integration of sustainability into actual projects. In this way, the paper makes a methodological contribution by studying how environmental, social, and economic aspects of sustainability are integrated into different phases of wind park development at the project level. Additionally, it explores the challenges and compromises that come up in practice, thus connecting the concept of sustainability with project management processes in a tangible empirical context.

1.3 Research Question

This study is guided by the following research question:

How are environmental, social, and economic sustainability considerations integrated into the planning, execution, and monitoring of Scottish wind park projects, and what challenges and trade-offs emerge in this process?

This research question indicates the necessity for studying sustainability as a multi-faceted concept that covers environmental, social, and economic dimensions, along with the recognition of the fact that these different dimensions of sustainability are implemented at various stages of a project's life cycle.

Earlier studies show that the sustainability of projects depends on bringing together the planning, execution, and review stages rather than concentrating on one separate stage only (Silvius & Schipper, 2014). The author also mentions that the question raises the issue of the actual difficulties and compromises that one has to make in the process of achieving different sustainability goals.

Wind energy developments, for instance, involve trade-offs among priorities such as environmental conservation, local people's wishes, and economic viability (Wolsink, 2007; Devine-Wright, 2011). By concentrating on these factors, this study's question aims at a thorough investigation of the ways in which sustainability is practiced in actual wind park projects in Scotland.

1.4 Research Aim and Objectives

The purpose of this research is to analyze how sustainable aspects are integrated in a wind park project, especially environmental, social and economic aspects. It aims to understand how these sustainability features are taken into account in different phases of a project (planning, construction and monitoring). The paper fulfills the need for more knowledge about sustainable project management in the field of renewable energy (Silvius & Schipper, 2014).

The paper looks at some specific wind power schemes in Scotland; including Berwick Bank Wind Farm, Neart na Gaoithe Wind Farm, Viking Wind Farm and Cairn Duhie Wind

Farm. These projects provide a suitable empirical basis mainly because of public documents like EIA documents, planning documents and documentation which focuses on sustainability..

Based on this aim, the study is guided by the following research objectives:

- To examine, in detail, the representation of sustainability issues related to the environment, society and the economy in chosen wind power projects from Scotland.
- To explore the implementation of these sustainability aspects from the planning, implementation and monitoring stages of a wind park development.
- To evaluate the level of integration of sustainability in the chosen projects by analyzing the scope of integration displayed in the Environmental Impact Assessments, planning documents and sustainability-related reports.
- To gain insight into the main challenges, tensions and trade-offs to consider when incorporating sustainability aspects into wind park project development.
- To help develop the theories and practice of sustainable project management in the realm of RE infrastructure.

Besides looking at the practices through the lens of project management, this paper will also engage with the ongoing discussion on sustainable project management generally (see e.g., Silvius & Schipper, 2014) by providing empirical evidence from wind energy projects.

It is hoped that with this deep dive into these projects, the study can also provide a contribution from a practical point of view (in the context of renewable energy infrastructure) on sustainable project management, in addition to the theoretical side.

1.5 Structure of the Thesis

The thesis consists of eight chapters. Each chapter has a specific objective and the chapters build and unravel the subject of sustainability in the context of wind energy projects in Scotland in a logical and progressive fashion.

Chapter 1: Introduction. This chapter starts the research and justifies its necessity. It describes the history of wind energy evolution in Scotland and stresses the relevance of sustainability in wind energy projects. The chapter points out the research gap, formulates the research question, and describes the research objectives. Besides, it specifies the study's scope and limitations and gives the thesis's general outline.

Chapter 2: Literature Review. This chapter establishes the theoretical base of the research. It defines sustainable project management and outlines its distinction from conventional project management. Besides, it explores sustainability in renewable energy and, more specifically, in wind energy projects. The chapter also covers the main sustainability aspects, which are the environment, society, and economics, as well as governance and stakeholder engagement. Furthermore, it discusses the Triple Bottom Line as a framework and the project lifecycle viewpoint. Finally, the chapter recaps the literature and locates the research gap filled by this study.

Chapter 3: Theoretical Framework. This chapter clarifies the theoretical concepts that underpin the analysis. Sustainable project management is the main topic of research for it. Uses the Triple Bottom Line as a framework to structure environmental, social and economic considerations. Besides, it discusses the project lifecycle view, which centers on planning, execution, and monitoring phases. In the end, this chapter offers the analytical framework that integrates all these aspects to direct the data analysis.

Chapter 4: Research Methodology. This chapter discusses the mode of carrying out the research. It explains the use of the qualitative, document-based multiple-case study and gives reasons why it is suitable. This chapter presents the finalized cases: Berwick Bank Wind Farm, Neart na Gaoithe Wind Farm, Viking Wind Farm, and Cairn Duhie Wind Farm, and provides the factors that led to their selection. It also describes the data sources, data collection procedure, and abductive thematic analysis technique. The chapter also presents the coding framework and tackles the quality, reliability, and limitations issues.

Chapter 5: Case Context The Selected Scottish Wind Park Projects. This chapter presents the four Scottish wind park projects to be studied in detail. It offers the background information about the projects such as Berwick Bank, Neart na Gaoithe, Viking, and Cairn Duhie. Moreover, the chapter justifies the inclusion of each project in the study and gives

a comparative summary of the four cases, including their features, development stage, and documentation available.

Chapter 6: Findings. Here we unveil the main outcomes of our study. The chapter highlights the environmental, social, and economic sustainability aspects within the projects selected for our research. It further considers how the project's stages, such as planning, execution phase, and monitoring, have been integrated with sustainability aspects. Included in the chapter are figures for each cross-case comparison and a list of the major challenges, tensions, and trade-offs that have been observed in the projects.

Chapter 7: Discussion and Conclusion. As the last chapter, this chapter outlines the final conclusion derived from the research. This chapter, therefore, covers principal findings related to research questions, literature, and theoretical framework. This chapter, moreover, demonstrates how wind park projects should integrate social, environmental & economic sustainability. Principal challenges, obstacles, and major trade-offs that are very common in the process of environmental sustainability integration are also prominent topics of this chapter. From this chapter, readers will get an overview of theoretical contributions originating from reflecting on sustainable project management and the triple bottom Line framework, and managerial contributions discovered from practical implications. Lastly, this chapter presents the limitations of the study and suggestions that might be considered for future research. To sum up the research, finally, this chapter also presents key insights derived from the research.

2 Literature Review

2.1 Introduction to the Literature Review

This chapter reviews the academic literature relevant to this study. It focuses on four main areas: sustainable project management, sustainability in renewable energy projects, sustainability considerations in wind farm development, and the integration of sustainability across the project lifecycle. The purpose of this chapter is to establish a theoretical and conceptual foundation for the study and to identify key themes and gaps in existing research.

2.2 Sustainable Project Management

SPM is a broadened project management that is integrated with environmental, social, and economic issues into project processes. In the past, traditional project management has been concerned with three factors that are considered of utmost importance to consider when evaluating the success of a project: time, cost, and scope (Atkinson, 1999). This is a good way to get projects completed on time, but it does not comprehensively tackle the social and environmental impacts of projects.

Sustainable project management extends the vision to add sustainability to decision-making and project implementation. Sustainable project management as managing the project with a focus on economic performance, environmental protection, and social responsibility in the planning, executing, and closing phases (Silvius & Schipper, 2014). Sustainability is not looked at as a result but as a component of project processes.

This is different from the traditional project management strategy that emphasizes efficiency rather than value. It calls upon project managers to take into account the broader effects of their projects. The integration is especially relevant in complex infrastructure and energy projects which may lead to substantial environmental and social impacts (Martens & Carvalho, 2017).

2.3 Sustainability in Renewable Energy Projects

People think of renewable energy projects as sustainable, as they help to reduce greenhouse gas emissions. But studies reveal that sustainability for renewables is not as straightforward as it might seem. These projects offer environmental advantages, but they can also generate environmental and social tensions.

For instance, renewable energy such as wind can affect ecosystems, landscapes and communities (Drewitt & Langston, 2006). Social acceptance is key, and local opposition can be raised on issues of visual impact, noise or perceived unfairness in decision making (Devine-Wright, 2011). Other factors like economic acceptance (investment costs and benefits distribution) affect project outcomes (Söderholm et al., 2011).

The results indicate that renewable energy projects are not necessarily a boon to everyone, and there are trade-offs to consider. A project may help meet climate objectives but could also cause environmental or social issues in the area. Sustainability in renewable energy projects, then, should be seen as a multiple goal balancing rather than as a secure outcome.

2.4 Sustainability Principles in Wind Farm Development

2.4.1 Environmental Sustainability Considerations

Environmental sustainability in wind park development focuses on minimizing negative impacts on natural systems. Key concerns include biodiversity protection, habitat conservation, and impacts on bird and marine life (Drewitt & Langston, 2006). In some cases, wind projects may affect peatland ecosystems or marine habitats, which require careful management. Environmental Impact Assessments and mitigation measures are commonly used to address these risks, along with ongoing monitoring.

2.4.2 Social Sustainability Considerations

Social sustainability is connected with the influence of wind farm projects on local communities and stakeholders. These can encompass stakeholder engagement,

community consultation and public acceptance. Social acceptance is critical to the success of a project, and if it is not present, the project can stall or even meet with opposition (Wolsink, 2007). Social sustainability also involves delivering local benefits and fairness and fostering inclusion.

2.4.3 Economic Sustainability Considerations

Economic sustainability is concerned with whether wind farm projects are economically sustainable and whether they contribute positively to the economy. These projects need a lot of investment and they should be economically viable in the longer term. They can also help with local economic development in terms of job creation and infrastructure development (Söderholm et al., 2011). Furthermore, the wind energy can help meet energy security goals by decreasing reliance on fossil fuels.

2.4.4 Governance and Stakeholder Considerations

Governance is an important element for effective management of sustainability. That means transparency, accountability and adherence to regulations. Policy frameworks and regulatory processes influence wind project planning and implementation. Stakeholder participation and balancing competing interests are aided by strong governance (Lock & Seele, 2017). Governance can then be interpreted as ‘enablement' to achieve sustainability in practice.

2.5 Triple Bottom Line

A very popular concept of sustainability is the Triple Bottom Line developed by John Elkington (Elkington, 1997). It structures sustainability in three areas: the environmental, social, and economic. The framework is helpful as it offers a clear structure for analysing sustainability. It assists researchers to assess if projects take into account these three dimensions. This should not, however, stand in the place of specific sustainability principles. Rather, it serves as a structure that helps them to order and understand them.

In this study, the Triple Bottom Line is used as a structuring framework to analyse sustainability considerations in wind park projects. It enables a systematic analysis of the extent of sustainability dimensions addressed.

2.6 Project Lifecycle Perspective

This study analyses sustainability at three key stages in the project lifecycle: planning, execution, and monitoring. The lifecycle perspective is relevant as sustainability integration can be different at different stages of a project. Sustainability is considered in the planning process by project design, environmental assessments and consultation with stakeholders. During the execution phase, sustainability is applied when building and with mitigation measures.

The monitoring phase consists of reporting and follow-up activities, and is used to evaluate sustainability (Silvius & Schipper, 2014). But concentrating on just one aspect would give only half the picture of sustainability. It has been shown that the implementation and monitoring of sustainability commitments are often less strong than the planning stages. Hence, a study of all phases is required to grasp the implementation of sustainability in practice.

2.7 Sustainable Project Management in Wind Farm Context

Smart development for a wind farm is an appropriate example for sustainable project management. These projects are complex to involve environmental regulations, policy goals, economic pressures, and local communities. This means they need to be balanced with respect to various dimensions of sustainability.

National energy policies affect wind projects and there are also challenges at the local level. This puts pressure on balancing global climate goals with local interests. Project managers are tasked with dealing with these complexities and making sure commitments to sustainability are met. This reinforces the need for project-level analysis

of sustainability. Real wind farm projects provide opportunities for real-world learning about sustainability governance, beyond the policy level.

2.8 Summary of Literature and Research Gap

The literature indicates that sustainable project management is an extension of traditional project management that incorporates environmental, social and economic dimensions. It also includes an awareness of the fact that renewable energy schemes, such as wind schemes, come with complex sustainability issues and compromises.

Most of the literature available, however, deals with just one aspect of sustainability at a time, not both in tandem. Furthermore, there is a limited focus on research on the application of sustainability throughout the project life cycle. There are also no studies on the link between sustainability and project management practices in particular contexts, for example, in the context of wind park projects in Scotland.

The aim of this study is to fill these gaps by examining the level of sustainability considered at the planning, execution and monitoring stages of selected wind farm projects in Scotland. It also connects the concepts of sustainability to project management principles and practices for a fuller understanding of sustainable project delivery. From this literature, the analytical framework that will be used in this study is defined in the next chapter.

3 Theoretical Framework

3.1 Introduction to the Theoretical Framework

This chapter outlines the theoretical basis for analysing the empirical material in this study. This chapter aims to clarify the concepts and frameworks that are applied to analyse the integration of sustainability in wind park projects. These frameworks help in the analysis of the selected cases and interpretation of the findings.

Four models are used in the study. First, sustainable project management is mainly used to frame the understanding of sustainable integration in project processes. This view is an extension of PM, which integrates environmental, social, and economic aspects in the planning, implementation, and tracking of projects (Silvius & Schipper, 2014).

Second, the Triple Bottom Line is an approach to organizing sustainability into three areas: environmental, social, and economic. This framework helps to structure an analysis of the different sustainability aspects covered in wind park projects (Elkington, 1997).

Third, the project lifecycle perspective is used to consider at which stages of project development sustainability is considered, and how. These phases involve planning, execution, and monitoring. It's a point to consider because the issues of sustainability can be different for each phase of a project.

Finally, the study also takes a governance and stakeholder view that focuses on regulatory frameworks, stakeholders, and decision processes. Wind park projects have a number of stakeholders, such as the government, the developer, and the local community, who interact with each other and affect the implementation of sustainability (Lock & Seele, 2017).

The following are theoretical perspectives that are relevant since they offer different perspectives. There is an overall lens in sustainable project management, a framework of dimensions in the Triple Bottom Line, a temporal dimension from the lifecycle perspective, and a stakeholder and institutional dimension from the governance perspective. They can be used in combination to analyse sustainability in wind park development.

3.2 Sustainable Project Management as the Main Lens

Sustainable project management is the main frame of reference for this research. It helps to determine the degree to which environmental, social, and economic factors are taken into account and combined in wind park projects at different stages.

In this study, sustainable project management is not considered as a general concept but as a method for analyzing and understanding the sustainability footprint of project processes. It offers a system for highlighting the sustainability aspects in planning, execution, and control activities.

Wind park projects have a number of interconnected aspects like environmental systems, economic investments, regulatory requirements, and local communities, which is why the perspective of sustainable project management is very important for them. Using this approach, the paper explores how sustainability is implemented and how different sustainability dimensions are considered in project decision-making. An examination of the integration processes and the identification of the emerging trade-off leads to answering the research question.

3.3 Triple Bottom Line as an Analytical Structure

This paper uses the Triple Bottom Line (TBL) setup as a tool to separate and examine environmental, social, and economic impacts given sustainability perspectives. It presents three broad categories, environmental, social, and economic, which can be used to uncover sustainability aspects methodically within selected cases of wind parks. Here, the triple bottom line is not considered merely as a narrative system but as an instrument for coding and comparative analysis. It helps to locate and classify manifestations of sustainability in the project reports, and concurrently, it supports the comparative analysis of cases by the provision of uniform analytical categories.

For the researcher, this way is most of all beneficial because it enables one to evaluate, on the one hand, if the three sustainability aspects have received a balanced consideration, and on the other, if certain elements have been emphasized. Still, TBL is insufficient for the portrayal of the entire complexity of sustainability in the real world, in particular when depicting the ongoing interactions of governance structures with broader system changes (Geels, 2002). Yet, because the primary focus of the analysis is at the project level, the use of TBL is regarded as suitable for the study.

3.4 Project Lifecycle Perspective

In this study, a project lifecycle view is adopted as a vehicle to assess how much and in what manner sustainability is embedded at different stages of a wind park construction project. To carry out the investigation, the development of wind parks was divided into three main phases: planning, execution, and monitoring.

Through this project lifecycle perspective, instead of generally characterizing the phases, it is used as an instrumental framework to conduct an analysis of the sustainability integration variation across the different stages. The perspective enables the research to uncover whether the issues of sustainability are deeply ingrained in the project throughout the phases or whether they are mainly a concern of particular phases only.

The reason for doing this is that, first of all, sustainability is not necessarily going to be equally apparent or manifested at all stages. Also, by breaking down the analysis into lifecycle phases, the paper is in a position to track the changes of sustainability over time and, correspondingly, to discover possible discrepancies between initial planning promises and subsequent execution phase or monitoring.

3.5 Governance and Stakeholder Perspective

Governance and stakeholder perspectives are the two main axes along which the analysis in this thesis is conducted. The key point of the thesis is stakeholder participation, regulatory instruments, and institutional arrangements and their impact on integrating sustainability in different phases of the project lifecycle.

The role of governance is limited in this research. It is viewed mainly as a contextual element that can coexist and interact with other issues such as the environment, society, and economy. Analysing governance exposes the decision-making process, the instruments through which sustainability commitments are incorporated, and the modes of reconciling the interests of different stakeholders.

In fact, adopting such a stance is not only compatible with the example of wind power projects in which diverse actors come into play and where outcomes are not only subjected to legal provisions but also to stakeholders' expectations. That's why, looking at governance as a concurrent feature gives rise to a research scenario where sustainability is both subject of discussion and practice.

3.6 Analytical Framework of the Study

This section unites the theoretical perspectives above and demonstrate how they have been used in the analysis.

Three key elements are used in this study to analyze the empirical data by means of:

- **Sustainability dimensions**: environmental, social, economic
- **Project lifecycle phases**: planning, execution, monitoring
- **Cross-cutting issues**: governance, stakeholder engagement, challenges, and trade-offs

These elements form the basis for coding and interpreting the data. The framework ensures that the analysis is systematic and consistent across all selected wind park projects.

Table 1: Analytical Framework Table

Sustainability Dimension	**Planning Phase**	**Execution Phase**	**Monitoring Phase**
Environmental	Environmental Impact Assessments, biodiversity studies, and site selection	Mitigation measures, habitat protection, emissions control	Environmental monitoring, compliance reporting
Social	Stakeholder consultation, public participation, community engagement	Local employment practices, communication, and conflict management	Community feedback, ongoing engagement, and the impact evaluation
Economic	Cost planning, investment decisions, and feasibility analysis	Cost control, resource management, and economic efficiency	Performance evaluation, long-term value assessment
Governance & Stakeholders	Regulatory approval, policy alignment, and transparency	Compliance with regulations, stakeholder coordination	Reporting, accountability, regulatory follow-up

Table 2: Application of the Analytical Framework in Data Analysis

Analytical Element	How it is used in the analysis
Environmental Dimension	This is often done to mark and tag environmental sustainability features like the protection of biodiversity, management of habitats, and ecological effects in the documents related to projects.
Social Dimension	Used to find and track public participation, consultation methods, community worries, and social consequences.
Economic Dimension	Used to figure out the viability of a project, the economic benefits, the cost considerations, and the long-term value aspects
Planning Phase	Used to analyse the way sustainability is reflected in pre-construction documents such as Environmental Impact Assessments, site selection, and project design
Execution Phase	Used to look at ways in which sustainability is implemented through mitigation measures
Monitoring Phase	Used to figure out the viability of a project, the economic benefits, the cost considerations, and the long-term value aspects

Governance & Stakeholders	Used to analyse the way sustainability is reflected in pre-construction documents such as Environmental Impact Assessments, site selection, and project design
Challenges & Trade-offs	Used to look at ways in which sustainability is implemented through mitigation measures

The analysis shows consistent patterns across projects after using the setup. Each part of the structure becomes a code for sorting through project documents. This way, comparisons work smoothly and researchers spot similarities, variations, and trade-offs in how sustainability is applied.

It tracks how sustainability appears in environmental, social, and economic areas across planning, building, and ongoing checks. Governance and stakeholder involvement act as a constant factor affecting every stage. Using the method helps reveal trends, strong points, and missing parts in real wind park cases. The clear setup keeps results fair and makes side-by-side reviews reliable..

3.7 Summary of the Theoretical Framework

This chapter outlines the theoretical foundation of this research. Sustainable project management is the main idea of the analysis to explain in what ways sustainability is incorporated in project processes. The setup of the Triple Bottom Line serves as the main skeleton for dissecting environmental, social, and economic aspects.

Looking at the project lifecycle helps to map the different phases of planning, execution, and monitoring. The governance and stakeholder aspect infuses the analysis with the greater context by pointing to the roles of institutions and actors.

These perspectives together create a full-fledged system for the analysis of sustainability in wind park projects. This structure will be the basis of the research way and the data-driven study in the next chapter.

4 Research Methodology

4.1 Introduction to the Methodology

This chapter details the overall research design and the procedure through which the entire study was conducted. It gives a thorough explanation of the methodological approach used to address the research question and fulfill the study goals. It lays out the key methodological choices made and the justifications for opting for these methods when examining the incorporation of sustainability in wind park projects.

The study is based on a qualitative research approach since it fits well with the exploration of complex phenomena such as the integration of sustainability in project execution phase in the real world. The research takes the form of a document-based multiple-case study, with a focus on several wind park projects in Scotland.

This approach makes it possible to thoroughly engage with the topic of how sustainability considerations are both reflected and acted upon in the project environment. The chapter gives details on the project selection, which comprises four wind park projects, namely Berwick Bank Wind Farm, Neart na Gaoithe Wind Farm, Viking Wind Farm, and Cairn Duhie Wind Farm. These cases offer suitable empirical content mainly through publicly accessible project documents.

Furthermore, the chapter presents the data sources, which are secondary documents - Environmental Impact Assessments, planning reports, consultation documents, and other materials related to sustainability - and also explains the way the data collection was done and the criteria for deciding which documents were relevant and should be used. Abductive thematic analysis is a method of data analysis.

Such a method makes it possible for this study to merge theoretical knowledge with the empirical evidence at the same time. This chapter details how thematic development was conducted and theme coding was oriented towards sustainability dimensions and project lifecycle phases. At the same time, it highlights elements related to research quality, reliability, and limitations.

In general, this chapter lays out a step-by-step description of the study execution phase and planning, making certain that the research workflow is comprehensible, orderly, and consistent with the study aims.

4.2 Research Approach

This research uses a qualitative method. Qualitative methods are fitting when a research is, like this one, unfolding the how sustainability is incorporated into wind park projects by studying textual and descriptive data only. It is concentrating on finding out the meanings, patterns, or symbols that appear in documents related to the project instead of measuring the things quantitatively.

What is intended by this research is not to get a statistical summary, but, on the other hand, to dive into understanding in what ways environmental, social, and economic sustainability issues are tackled by practitioners. Besides that, qualitative research can be a great match for investing the nature of change and for probing scenarios with complex causality, where many different factors lead to outcomes, and where the context is important (Creswell & Poth, 2018).

In fact, wind park development is a situation where sustainability is not one single variable that can be measured, but rather a concept with several dimensions that needs to be interpreted. The research is documentary, based on Environmental Impact Assessments, planning documents, and sustainability reports of selected wind park projects in Scotland. Such documents offer a lot of information about project decisions, commitments, and practices.

Qualitative methods allow the researcher to analyze this material in a systematic way and recognize the patterns in terms of the integration of sustainability issues. Besides that, this research, among other things, is interested in how sustainability is 'done' in projects through the different phases of the project lifecycle. Sustainability is being 'done', meaning here being described, implemented, and monitored initiatives rather than being quantified. Qualitative research is best for this kind of textual-based

interpretive analysis as it firstly allows to identify themes and secondly to see the relationships that are formed in data.

Hence, the qualitative research method suits this research well as it facilitates an in-depth and context-dependent study of the incorporation of sustainability in wind park developments. It aligns with the aim of the research to discover the way sustainability factors are depicted and implemented in actual project settings.

4.3 Research Design

This research adopts several case study designs based on the analysis of documents. It is a suitable design since the investigation focuses on determining the real-life integration of sustainability into wind park projects. A case study is a research method that allows a detailed and thorough investigation of a phenomenon in the context of its real-life setting, so that the context is not lost (Yin, 2018).

In this research, each wind farm is a case to study the sustainability execution phase. Case study research is a powerful tool for analyzing wind farms since these projects have many aspects that interplay among themselves, such as the environment, stakeholders, laws, and the economy. It is not easy to isolate these aspects from their context, which is why case study research is the best way to understand the execution phase of sustainability.

Furthermore, the study applies multiple case studies rather than a single one. This facilitates comparison across projects and identification of patterns, similarities, and differences regarding sustainability delivery. There are multiple cases as a way of making findings more credible by using the cross-case investigation(Yin, 2018).

In this investigation, the different wind projects are compared as a source of a deeper understanding of the sustainability under different circumstances. The cases chosen are Berwick Bank Wind Farm, Neart na Gaoithe Wind Farm, Viking Wind Farm, and Cairn Duhie Wind Farm. The selection of these cases was due to the fact that they represent different styles of wind projects, and there is substantial documentation available for

them that is substantial. This choice facilitates a comparative and richly contextual analysis.

Environmental Impact Assessments, planning reports, and consultation papers are appropriate sources to back up this research paper. Such records contain extensive information about project identification, commitment to sustainability, and project implementation strategies. In addition, these are reliable and publicly available data that support the openness and repeatability of the study. To sum up, engaging with numerous case studies and document analysis constitutes a research paper foundation of quite some strength.

They provide a very detailed and comparative exploration of the incorporation of sustainability in wind park projects and Because of this are very much aligned with the research question and objectives..

4.4 Justification for Document Analysis

Environmental Impact Assessments (EIAs) explore in great detail the potential harm to ecosystems and present measures to mitigate these effects. This research mainly uses document analysis as wind farm projects generate numerous written records throughout their lifecycle.

Planning statements, consultation reports, and environmental management plans are the key documents produced Mostly when projects are approved through formal regulatory channels as is the case in Scotland. These documents record how environmental risks are assessed and how community views are solicited and incorporated in decisions. Since legal provisions require openness, every report contains indisputable proof of the policy's commitment to sustainability goals.

Mitigation measures are described in the official jargon. Demonstrating concrete commitments by revealing actual activities and not just intentions in the areas like habitat loss or noise pollution. Stakeholder consultation reports document genuine discussions with locals about concerns that have an impact on everyday life. Monitoring

mechanisms describe how activities are tracked once construction has started and also during execution phase.

At least theoretically, such formal documentation can help scholars identify real actions rather than merely reporting at meetings. This information gives insight into how deeply sustainability ideas have been integrated beyond just talking or calling. Projects not only talk about environmental care they provide the supporting actions and these are recorded in publications.

One of the reasons document analysis is an excellent method for this research is that it helps to keep the comparison of different cases of sustainability at the same level. All the projects that were selected for this study, which were subject to similar regulatory requirements, have their documentation as a common element for analyzing sustainability integration.

Document analysis is a research technique that enables, in a very systematic way, discovery of patterns, themes, and meanings in textual materials (Bowen, 2009). Still, it should also be mentioned that there are certain pitfalls when one chooses to conduct document-based research. In fact, whilst documents can tell us a great deal about formal commitments and reported practices, they may not depict the full range of internal decision-making processes or the informal negotiations between the stakeholders.

After all, they reflect what is officially reported, not necessarily what happens behind the scenes. So, it's quite normal that some aspects of project dynamics, like power relations or conflicts, might not be entirely visible in the available data. Despite these limitations, document analysis is still very much suitable for the present study since it mainly focuses on how sustainability is being officially represented and integrated in the project processes. Also, using different types of documents for each case not only deepens the analysis but also leads to a more comprehensive understanding of the incorporation of sustainability in wind park projects.

4.5 Case Selection

This study uses a multiple-case study strategy with four wind park projects as cases: Berwick Bank Wind Farm, Neart na Gaoithe Wind Farm, Viking Wind Farm, and Cairn Duhie Wind Farm. These cases were selected to provide a tight but diverse empirical basis for the investigation of sustainability integration in the development of wind parks. The rationale behind the selection of these projects is their importance for the development of wind energy in Scotland. Scotland is a very mature and highly regulated setting for wind power having experienced large-scale deployment of both onshore and offshore projects. The cases picked here can be seen as characteristic of major developments in this setting and also illustrate how sustainability is carried out in reality. The main requirement for case selection is the existence of publicly available documentation.

The projects chosen all have tons of documents such as Environmental Impact Assessments, planning applications, consultation reports, and monitoring plans. Such paperwork is necessary for a document-based analysis and Also it helps to confirm that there is enough data for each case.

Also, the study includes wind projects both onshore and offshore. The Viking Wind Farm is an example of an onshore project whereas Berwick Bank, Neart na Gaoithe, and Cairn Duhie are all offshore wind farms. Such distinction is important because onshore and offshore projects might differ in their environmental impacts, their regulatory requirements, and their stakeholder engagement methods. Including both types allow for a more in-depth study.

Besides, the selected cases also vary in project type and context. They differ not only based on the size and development stage of the project but also by the geographical locations. For example, whereas some projects are operational or under construction, others are at the planning or proposal stages.

Such diversity enables the research to address sustainability integration under various conditions and stages of development. In general, these four cases are appropriate for the research as they offer relevant, diverse, and well-documented examples of wind park

projects in Scotland. The mix of comparability and difference facilitates a comprehensive analysis and also allows for a meaningful comparison across cases.

4.6 Data Sources

In this paper, secondary, document-based data were used. Four wind park projects were selected for this study: The analysis behind the study of these projects was limited to the publicly available documents, which were directly related to the projects.

The main categories of documents used in this study are as follows:

- **Environmental Impact Assessments (EIAs):**

These papers present thorough assessments of the potential environmental impacts that each project might have. They cover evaluating biodiversity ecosystems' visual aspects, and the measures planned to offset negative impacts. Environmental Impact Assessments (EIAs) are a significant reference for environmental sustainability aspects.

- **Planning statements and planning applications:**

Such documents describe the project in a broad sense, telling its objective and showing its compliance with the rules. Through them, one can see how the concept of sustainability is being used and communicated at the early stage of a project.

- **Design and access statements:**

These records explain design decisions, the choice of location, and the inclusion of accessibility features. They point out how a project might be scheduled in line with environmental and social considerations.

- **Consultation reports:**

These records give an outline of all stakeholder engagement interactions, particularly public consultations and the collection of feedback from the community and organizations. They play a key role in the analysis of social sustainability and the involvement of stakeholders.

- **Mitigation and monitoring plans:**

These records give an account of the methods used to handle environmental and social impacts during the execution phase of a project, as well as post-completion. They

mention specific actions and control plans, which relate to a review of sustainability during the execution phase and monitoring phases.

- **Sustainability-related reports (where available):**

Sustainability-related documents, for example, sustainability statements or corporate disclosures, are attached if necessary. These records shed light on the communication and execution phase of sustainability.

The use of these document types allows for a comprehensive analysis of sustainability integration across different phases of wind park development.

4.7 Data Collection Process

The basis of the articles was largely public documents that were discovered, gathered, and arranged in a purposefully ordered way about the wind projects of the four that were selected: Berwick Bank Wind Farm, Neart na Gaoithe Wind Farm, Viking Wind Farm, and Cairn Duhie Wind Farm. The principal document sources were official project websites, public planning portals, and developer websites. Official project websites provide direct access to the key documents, like Environmental Impact Assessments and project reports.

Planning portals that are public, mostly those managed by Scottish authorities, make planning applications, consultation materials, and regulatory decisions available to the public. Developer websites were visited to gather project-related reports and documents on sustainability execution. Document selection was conducted according to strictly defined criteria to ensure relevance and consistency. First of all, only those documents were selected which referred directly to the projects chosen. Secondly, documents containing data about the various sustainability aspects, like environmental, social, or economic, were considered. Thirdly, top priority was given to those formal types of document that have the status of being authoritative, like Environmental Impact Assessments, planning statements, consultation reports, and monitoring plans.

The regulative attainments-topics regulations discuss the major documents focused Mostly. These usually have reliable and well-structured information. The criteria for exclusion of documents included, for example, general promotional materials, news pieces, and those not having any substantial content on sustainability. This was done to make sure that the total data consisted of works mainly directly supporting the research objectives and research question.

After gathering and selecting, we organized the papers in an absolute method as project and paper type. Such a structuring greatly facilitated the study process as it allowed one to compare one case or document category with others. It also ensured that each piece of information was identified, accessible, and used openly throughout the coding and analytical phases.

In essence, the data gathering way was targeted at ensuring the selected documents were of a high level of relevance, credibility, and aligned with the research focus. This detailed approach is a strong point of the transparency and also allows the research to be duplicated by others.

The review is essentially centered on a set of necessary documents emanating from the recognized projects. Usually, these include Environmental Impact Assessment (EIA) reports, planning documents, consultation reports, and plans for mitigation, monitoring, and restoration. For example, the evaluation report of the Berwick Bank Wind Farm is mainly based on the Environmental Impact Assessment Report and related consultation documents (SSE Renewables, 2022) .

Environment Impact Assessment (EIA) documentation and planning proposals for Neart na Gaoithe have been the basis for the case study of the wind project (EDF Renewables UK, 2020). The Viking Wind Farm story is built upon Environmental Impact Assessment documents and a habitat management plan (SSE Renewables, 2019). For the Cairn Duhie Wind Farm, the research is mainly based on the planning and environmental documentation A lot limited in quantity and publicly accessible (Cairn Duhie Community Wind Farm, 2017). These documents provide the primary empirical basis for this paper and are, That means, the reference point in all the cases to ensure the comparability of the results.

4.8 Data Analysis Method

In this study, abductive thematic analysis is applied to understand how sustainability is being incorporated into the chosen wind park projects. It's a fitting choice as it permits the analysis to mesh pre-existing theoretical understanding with the fresh insights drawn from the data.

The position of abductive analysis is between the deductive and inductive methods. It is not a fully deductive method where the themes are strictly preset on the basis of a theory, and it is not a fully inductive method where the themes are only generated from the data. Rather, it is a mixture of theory-informed and data-emergent coding (Timmermans & Tavory, 2012).

This is the reason why it fits well for the research that intends to both utilize and improve the concepts of theory. Here, the preliminary themes are taken from the theoretical framework of Chapter 3. The three sustainability dimensions (environmental, social, and economic) are based on the Triple Bottom Line, and the different phases of the project lifecycle (planning, execution, and monitoring) are used as the framework for categorizing the data. Besides these, governance and stakeholder issues have been identified as cross-cutting themes. These pre-set categories provide an already well-structured analysis setup. Even so, the research remains open to the discovery of new themes in the documents. For example, issues related to challenges, tensions, and trade-offs, which may occasionally defy the simple categorization under the pre-set categories and might be revealed through a thorough examination of the data.

This kind of flexibility opens up the possibility of the research identifying unexpected patterns and leads to a deeper understanding of the concept of sustainability. The very essence of the coding procedure is to find out in which ways sustainability elements are reflected and concretized in the selected texts. When coding the data, principal analytical categories, for instance, sustainability dimensions, lifecycle stages, etc. as well as cross-cutting issues, like governance and trade-offs, are employed.

This line of work is, in fact, a structured one that naturally balances the comparability of cases and their unfolding new features. Besides, abductive thematic analysis as a means is well in line with the research goals of the study because it combines theory-driven and data-driven modes of interpretation. Also, the approach to using tested models while taking live project data's complexity into account is very effective. So, the research results portray sustainability efforts in a detailed and nuanced manner when talking about wind park development.

Abduction here is a method which allows the article to avoid the usual theory-testing (deductive) or strictly theory-building (inductive) methods. It creates a paradoxical 'two-way street, ' on one hand, it refers to the sustainability setups and But it refers to the very specific features of the empirical wind farm documents. While the Triple Bottom Line is still recognized as the major pillar, abductive reasoning However allows the researcher to reveal the sustainability conflicts in a surprising manner, e.g. local community trade-off issues which are usually difficult to be revealed by a strict deductive system.

4.9 Coding Framework

This section presents the initial coding framework used to analyse the empirical data. The coding structure is developed based on the theoretical framework outlined in Chapter 3 and is designed to guide the systematic analysis of sustainability integration in the selected wind park projects.

The coding framework consists of several **first-level codes** that reflect the main analytical categories of the study:

- **Environmental sustainability**
- **Social sustainability**
- **Economic sustainability**
- **Planning phase**

- **Execution phase**
- **Monitoring phase**
- **Governance and stakeholder issues**
- **Challenges and trade-offs**

The codes are not just used for sorting the data but also to indicate the different ways in which sustainability factors are taken into account in various project aspects and stages. The three pillars of sustainability- environmental, social and economic- are derived from the Triple Bottom Line concept, and the life cycle stages- planning, implementation and monitoring- reflect the time aspect of project development.

Governance and stakeholder-related issues are seen as cross-cutting elements affecting all dimensions and phases. Challenges and trade-offs are incorporated to reflect tensions and conflicts that may emerge during the project execution phase. During the analysis, the segments of the documents that are pertinent are marked with these categories. For instance, mentions of biodiversity conservation or emissions reduction are marked as environmental sustainability, whereas stakeholder consultation is marked as social sustainability and governance. Content related to Environmental Impact Assessments, for example, is generally linked to the planning phase, while monitoring reports are associated with the monitoring phase.

Instead of viewing a coding scheme as a fixed technical tool, it was thought of as a constantly changing tool and therefore actively used. Coding had been done in cycles by stepping abductively; by that, when new signs were found about nature conservation or sea area damages, the first categories were changed and enlarged so as to describe the data in the most detailed way possible. That circle of folding back on itself will result in a product that is at the same time logically justified and very closely adapted to the peculiarities of the Scottish wind energy industry.

The coding setup is like a structured plan, which gives a starting point, But the analysis is still flexible. As the coding process goes on, new sub-themes might be identified when data patterns are discovered. For instance, in the environmental sustainability theme, sub-themes like nature conservation or effects on marine life could be the ones getting

developed. This way, it makes the analysis capable of not only relying on preset categories but also discovering new insights from the data. Overall, this coding system ensures that the analysis remains thorough, aligned with the research objectives, and is replicable while maintaining methodological rigor. It details exactly what the study will be coding for and the various ways the data will be interpreted in different instances.

4.10 Cross-Case Comparison

After the coding process is completed for all cases, the results are carefully compared between the four chosen wind park projects - Berwick Bank Wind Farm, Neart na Gaoithe Wind Farm, Viking Wind Farm, and Cairn Duhie Wind Farm. This comparison among cases is a very significant stage in the study as it allows the research to move beyond individual cases and identify the general trends of sustainability integration.

The method of comparison is through a comparative analysis of each case with the major categories - environmental, social, and economic sustainability, and project phases - planning, execution, and monitoring. Using the same coding method for all the cases ensures a comprehensive and equitable comparison.

The primary goal of the analysis is to find the similarities and differences between the cases. Similarities might indicate common practice or a shared approach to sustainability integration among the wind park projects. But, differences may be due to the project context scale location, or development stage.

Besides, the comparison points out the more and less successful methods of sustainability integration. Some projects may demonstrate a more comprehensive and consistent approach to all aspects and phases, while other projects might focus more on certain aspects and be less integrated in others. The purpose of this is to assess to what extent sustainability is "embedded" in the project processes..

Contrary to that, the cross-case analysis also aims at identifying the same tensions and trade-offs that keep being mentioned. For instance, this might be the failure to link environmental protection to project development, the hardships of stakeholder engagement, or the difference between sustainability plans and the reality of the

execution phase. Recognizing such recurring patterns will provide an even clearer picture of the genuine issues in making wind park projects sustainable.

So, the cross-case comparison assists a research in comprehending the concept of sustainability integration at a much deeper level. It is helpful in identifying the major trends while at the same time it recognizes that each case has individual characteristics, That means it not only increases the level of analysis but also the reliability of the results.

4.11 Quality, Reliability, and Validation

This research paper uses multiple approaches to decide on the quality, dependability, and validity of the research outcomes. In qualitative research, these standards are sometimes named trustworthiness, which comprises being credible, consistent, and transparent throughout the research process (Lincoln & Guba, 1985). An overview of the specific documents used in the analysis across the four cases is presented in Table 3.

A major method implemented in this research is the triangulation of different types of documents. The research uses several kinds of data, such as Environmental Impact Assessments, planning documents, consultation reports, and monitoring plans. Through the comparison of data across these various kinds of documents, the study limits the chance of trusting one point of view and, at the same time, improves the reliability of the findings (Bowen, 2009).

A further significant method is cross-case comparison. Performing the analysis and comparison of four different wind park schemes: Berwick Bank Wind Farm, Neart na Gaoithe Wind Farm, Viking Wind Farm, and Cairn Duhie Wind Farm, the research is capable of recognizing common patterns together with the differences.

The research also connects itself with theory and policy setups. Its insights are re-analyzed through the lens of the theoretical structure discussed in Chapter 3 sustainable project management and the Triple Bottom Line. At times, project documents are scrutinized about their conformity to laws and regulations for deeper analysis. Such double conformity probably boosts the research's analytical validity. Another essential element in coding is concor.

This research work uses an organised coding scheme that is derived from already known categories, such as sustainability aspects and lifecycle stages. Consequently, all the data across different cases is analysed in a well-organised manner. On the other hand, the abductive method provides room for the discovery of new, unanticipated elements without jeopardising consistency. Eventually, the results are explained through the combination of theoretical knowledge and official project documents.

In this manner, firm grounding in reality is maintained by the analysis, whilst peer recognition of the article is ensured through elements of academic literature. This paper's methodological rigor owes a great deal to the four pillars of qualitative trustworthiness. To achieve credibility, documents are triangulated; to maintain dependability, a systematic and consistent coding framework is utilised. Besides, owing to a very comprehensive explanation of the data-gathering process, confirmability is made possible, which then leads to auditability, whereas the employment of several case studies - including both onshore and offshore projects - facilitates generalisability to other renewable energy contexts (Lincoln & Guba, 1985).

Table 3: Overview of Documents Used in the Study

Project	**Document Name**	**Type**	**Year**	**Source**	**Reason for Inclusion**
Berwick Bank Wind Farm	Environmental Impact Assessment Report	EIA	2022	SSE Renewables	Leading assessment document for environmental, social, and economic dimensions
Berwick Bank	Consultation Report	Consultation	2022	Project website	Engagement of the stakeholders and

Wind Farm					obtaining public input
Neart na Gaoithe Wind Farm	Environmental Impact Assessment Report	EIA	2020	EDF Renewables UK	Principal environmental and spatial planning studies
Neart na Gaoithe Wind Farm	Planning Documents	Planning	2020	Planning portal	Concept, design and compliance with regulation
Viking Wind Farm	Environmental Impact Assessment Report	EIA	2019	SSE Renewables	Ecological and environmental survey/assessment
Viking Wind Farm	Habitat Management Plan	Monitoring	2019	Project documents	Execution phase and supervision of environmental protective measures
Cairn Duhie Wind Farm	Planning Application Documents	Planning	2023	Planning portal	Accessible data regarding sustainability and design
Cairn Duhie Wind Farm	Environmental Reports	Environmental	2023	Public sources	Extra environmental details

The whole research looks at a number of important papers of the four chosen wind park projects. Depending on the public availability, the number of papers significantly changes from one project to another. For Berwick Bank, Neart na Gaoithe, and Viking Wind Farm, a variety of very detailed papers like Environmental Impact Assessments, consultation reports, and planning documents were not only available but also analyzed. As a result, the Cairn Duhie Wind Farm situation relies on a smaller quantity of publicly available documents. In the end, around 2-4 main documents were studied per project, which allowed for an in-depth understanding and making comparisons among the projects. The chosen documents were the ones that most directly relate to sustainability, are official, and best represent the stages of planning, execution phase, and monitoring. The final chapter includes a comprehensive discussion of the study limitations as well as an alignment of the findings and the overall research contribution.

4.12 Summary of the Methodology

This chapter has mapped out the methodological framework for this paper. It is a qualitative multiple-case study research design using document analysis at its core, which makes it possible to dive into the actual project settings and see how sustainability integration is conducted in them. The empirical analysis is of the four wind park projects in Scotland: Berwick Bank Wind Farm, Neart na Gaoithe Wind Farm, Viking Wind Farm, and Cairn Duhie Wind Farm. The investigation is carried out through secondary data, such as Environmental Impact Assessments, planning papers, consultation materials, and monitoring schedules.

Such documents offer a thorough and project-specific glimpse of sustainability concerns. The data are examined through abductive thematic analysis, which merges the theory-based coding with the themes derived from the data. The analysis is framed within the sustainability dimensions, the phases of the project lifecycle, and the cross-cutting issues like governance and trade-offs.

Besides this, cross-case comparison is also carried out to detect the similarities and recurring patterns in the chosen projects. Such a method increases the certainty of the

results as well as the depth of comprehension of sustainability integration. In general, the method gives a step-by-step and fair approach to dissect how sustainability is portrayed and realized in wind park projects. Next, the chapter focuses on the case background by describing the chosen projects thoroughly, thus forming the basis for the analysis.

5 Case Context

5.1 Introduction to the Case Chapter

This chapter sets out the empirical cases selected for this study and supplies the contextual background for the analysis. To cover the variation of the project type (onshore vs offshore), scale, and development stage, different cases were selected. In this way, a rigorous research of how sustainability is incorporated in diverse wind energy environments can be conducted. The aim of this chapter is to present the wind power projects that the research initiative has focused on and to give an overview of their main features before the presentation of the results. By giving a detailed account of the history of each project, the chapter creates a good comprehension of the context in which the integration of sustainability aspects takes place.

In this research, four wind park projects in Scotland, namely: Berwick Bank Wind Farm, Neart na Gaoithe Wind Farm, Viking Wind Farm, and Cairn Duhie Wind Farm, are chosen as the study cases. These cases showcase both onshore and offshore wind developments and illustrate different project sizes, locations, and phases of development.

Providing context is critical as wind park projects are shaped by a mix of factors such as the natural environment, the regulatory climate, the roles of the different stakeholders, and the intrinsic features of each project. These contextual elements need to be understood to make sense of how sustainability is tackled in each case. Lack of this background would not only hinder the thorough analysis of the similarities and differences found in the results, but it would also limit the interpretation of the findings. This chapter, therefore, functions as a basis for the following analysis by describing each case separately and then providing a comparative summary.

5.2 Scottish Wind Energy Context

Wind power matters a lot in the energy portfolio of Scotland, and it is the main reason motivating the transitional change of the country towards a low-carbon economy. Besides harnessing the power of onshore winds, Scotland boasting fruitful wind

conditions, has massively ventured into the generation of offshore wind energy. The deployment of wind energy is deeply interwoven with the country's climate objectives, both national and regional ones, which include emission reduction and increasing the share of renewables in the electricity sector (Scottish Government, 2020).

Both types of wind energy - onshore and offshore - continue to have their places in the energy landscape of Scotland. While onshore wind has been dominating the landscape of renewable sources over the years with large-scale examples like Viking Wind Farm, offshore wind has seen spectacular growth lately due to the advent of new technologies and supportive government measures (Scottish Renewables, 2023). Wind farm projects like Berwick Bank and Neart na Gaoithe represent the importance of offshore wind as a major contributor to future energy needs, while Viking and Cairn Duhie show the continuing role of onshore wind development. The policy climate in Scotland mirrors strong governance mechanisms and clear sustainability goals.

Initiatives in wind energy must be subjected to comprehensive planning and environmental evaluation stages which apart from Environmental Impact Assessments, also mandate local community consultations. All of these aim to ensure that any project approval is a result of a detailed examination of environmental preservation, social factors, and economic consequences.

Sustainability is another very important requirement in the design of a project. Apart from other things, the developers have to present ways in which their project will be environmentally friendly, will encourage the locals, and will contribute to the economy, for example, by increasing the number of jobs created (Golder Associates S.r.l, 2019). The measures taken can be preserving the variety of life in an area, creating programs for the welfare of the community, as well as monitoring the environmental effects over time without stopping. Generally, wind park projects in Scotland function under a very strict and sustainability-focused system.

This environment determines how projects are designed, carried out, and checked. Being aware of this wider context is very necessary when studying how sustainability factors are put into practice through the selected cases. In general, this chapter has presented the actual setting for this research by outlining the principal characteristics of

the selected wind park projects. The variations between the units present a strong foundation for the succeeding part of the study that will explore the extent to which the concept of sustainability is ingrained in wind energy development.

5.3 Berwick Bank Wind Farm

Berwick Bank Wind Farm is a sizable offshore wind energy facility in the North Sea, near the Scottish East Coast. SSE Renewables is developing the project, which is among the major offshore wind initiatives in the region. It is aimed at providing a considerable portion of renewable electricity generation and enhancing the achievement of the national climate and energy objectives. Since it is located offshore, Berwick Bank finds itself in a marine environment, which inevitably brings in quite a few environmental and regulatory factors (SSE Renewables, 2019).

For instance, direct and indirect effects on marine life, seabirds, fisheries, and coastal scenery are some of these factors. It is well-known that offshore wind projects call for substantial planning and environmental assessment efforts due to their sheer size and complexity. A variety of publicly available documents back the project. These comprise Environmental Impact Assessments, planning applications, consultation reports, and technical studies.

Such documents give an exhaustive insight into the environment-related operations of the project, the stakeholder engagement process, the remedial actions taken, and the monitoring measures. They constitute a whole set of data sources for the analysis of the extent to which sustainability aspects are considered in the planning and execution phases of the project delivery.

The sheer size and complexity of this project set it apart as an excellent case for studying the extent to which sustainability is taken into account environmentally, socially, and economically. What's more, the large amount of documentation readily available makes it possible to conduct a thorough investigation into the sustainability targets and project planning phases (Golder Associates S.r.l, 2019).

Moreover, investigating the project is a good move as it reveals how sustainability can be part of offshore wind projects, which generally have higher environmental and stakeholder issues compared to onshore projects. It also gives the chance to see how things differ with other projects in this research, especially when looking at the ways sustainability is incorporated into different activities and situations. In fact, this topic tackles a lot of the problems involved in factoring in the sustainability elements in massive offshore projects. This chapter primarily provides the empirical context of the research through an outline of the main characteristics of the selected wind farm projects. The contrasts between the cases form a valuable starting point for further exploring how wind power is brought about with the aim of sustainability.

5.4 Neart na Gaoithe Wind Farm

Neart na Gaoithe Wind Farm is a deepwater wind energy project in the North Sea, roughly 45 km/south-east of Fife. The project, owned by EDF Renewables UK, is a significant part of Scotland's plan to increase its wind energy production capabilities.

Neart na Gaoithe is a massive offshore project and marks a major milestone in the Scottish renewable energy sector as it contributes significantly to the expansion of offshore wind generation (ESB, 2025). The project has gone through a rather long development cycle, including getting planning approval, facing regulatory review, and construction phases, which shows how complex offshore wind development is.

There are quite a few project documents available to the public. They include Environmental Impact Assessments, planning and consent documents, consultation reports, and technical studies. These documents provide a detailed picture of the environmental impacts, the engagement with stakeholders, and the proposed measures to mitigate the negative effects, all of which are crucial to the assessment of the project's sustainability-related elements.

The project is a good match for this research since it offers an example of how sustainability issues can be integrated into the offshore wind project development, even under a regulated environment. Besides the comprehensive assessments of

environmental and social impacts, the documentation also includes mitigation and monitoring plans. Therefore, it becomes an excellent case study resource for exploring the formal representation of sustainability in project documentation.

Neart na Gaoithe is an apt example, not just because it is one of the projects that will be practically implemented, but also because it deals with offshore wind projects in Scotland (EDF, 2019). This case is very helpful in explaining the topic and provides a thoroughly documented example that goes along with the rest of the cases in this research, hence multi-case analysis is justified. This case is very much in line with the topic of the thesis, as it is a representative of sustained development issues in the context of major offshore resources exploitation. Chapter 2 presents an overview of different wind park projects through a brief description of each project selected. The heterogeneity of the cases provides a solid groundwork for subsequent research on which aspects of wind energy development are compatible with sustainability.

5.5 Viking Wind Farm

The Viking Wind Farm is a huge onshore wind energy project in the Shetland Islands, Scotland. The project, which is being carried out by SSE Renewables in partnership with local stakeholders, is one of the most important onshore wind projects in the area .

Among other things, its location in Shetland makes it very interesting because energy infrastructure is one of the key elements in regional development. While on the one hand, the Viking Wind Farm aims at increasing renewable energy capacity, on the other hand, it is also in line with the local economy. Being quite large and located in a very remote and environmentally sensitive area, it makes the Viking Wind Farm is an example of onshore wind development in a beautiful, quiet region. Besides the nature and social aspects that the project brings with it, the local stakeholders and communities are very much involved in the project. They rely on working together with the developer to make the project a success.

This project is thoroughly documented with various publicly accessible documents like Environmental Impact Assessments, planning applications, consultation reports, and

habitat management plans. They have detailed information on environmental mitigation measures, stakeholder engagement processes, and strategies of the project execution phase.

Viking Wind Farm is a good illustration in this study since it can provide an onshore point of reference to the offshore wind farm projects which were a part of this research. Essentially, it offers a chance to discuss how the different aspects of sustainability change in onshore versus offshore settings with a particular emphasis on environmental impacts and community participation. Also, the availability of detailed documentation allows for an in-depth analysis of how sustainability has been integrated into the project. This instance is an excellent fit for the study's subject as it underscores the challenges of incorporating sustainability features in large onshore developments. Very broadly, this part has set the stage for research by presenting the main features of the selected wind park projects. The differences between the cases form a robust basis for further analysis of the various methods of embedding sustainability in wind power generation.

5.6 Cairn Duhie Wind Farm

The Cairn Duhie Wind Farm is a wind energy project located in Scotland. It is one of the latest additions to the Scottish wind sector, contributing to the ongoing rise of renewable energy capacity in the area (Mark, 2023). Its location and scale place it among the numerous wind energy projects that are instrumental in helping the country achieve its climate and energy targets.

As a relatively new project, Cairn Duhie is an important example for understanding how sustainability is represented in newer wind farm developments. It reflects the most recent standards set by regulators, planning authorities, and sustainability committees, which differ from those of older projects. That's why, it serves very well as a reference for examining how sustainability is incorporated in new project proposals and related paperwork.

The presence of various publicly accessible documents, such as planning applications, Environmental Impact Assessments, consultation materials, and technical reports, has

sustained the project. These give a thorough account of the project layout, environmental concerns, stakeholder consultations, and suggested mitigation practices. Cairn Duhie is a part of this examination as it brings diversity in case selection, considering the time of the project and development phase. It offers a newer viewpoint which goes well with the other cases, and at the same time, the comparison across projects that may have been developed under changing regulatory as well as sustainability expectations is made possible. In addition, the availability of some relevant public documents supports its inclusion as a document based analysis case.

This case is very important for the research as it highlights the difficulties of including sustainability elements in newer onshore wind developments. Overall, by outlining the key characteristics of the selected wind park projects, this chapter has laid the foundation for the empirical part of the study. The variety among the cases provides a strong foundation for the subsequent stage of the research on the integration of sustainability aspects in wind energy production.

5.7 Comparative Overview of the Four Cases

The following part introduces the four chosen wind park projects in a comparative manner. Different sizes, locations, and phases of development offer a great starting point to see how sustainability is interpreted and implemented in different regions. The aim is to outline the main features of each case in a systematic way and to draw attention to their similarities and differences at a simple level.

Table 4: Comparative Table of Cases

Project	Type	Onshore / Offshore	Developer	Broad Sustainability Relevance
Berwick Bank Wind Farm	Wind Farm	Offshore	SSE Renewables	Large-scale offshore impacts, marine ecosystems, stakeholder engagement.
Neart na Gaoithe Wind Farm	Wind Farm	Offshore	EDF Renewables UK	Offshore development, environmental mitigation, stakeholder consultation.
Viking Wind Farm	Wind Farm	Onshore	SSE Renewables	Peatland management, local community impact, and biodiversity.
Cairn Duhie Wind Farm	Wind Farm	Onshore	Not publicly confirmed	Recent project context, evolving sustainability expectations.

Comparative Overview

The choice of these four cases consists both of offshore and onshore wind projects. So there are some differences in environmental factors, regulatory requirements, and methods of dealing with stakeholders. For instance, offshore cases like Berwick Bank and Neart na Gaoithe are huge developments and their activities have to be aligned with the conservation of marine environments.

Whereas, the onshore projects like Viking and Cairn Duhie by nature have a more immediate impact on the surroundings and local community. Most of the projects are

supported by formal documents, especially Environmental Impact Assessments and planning-related documents, although the amount of available documentation varies across cases. This provides a reliable and uniform database for the research. However, the projects also vary by size, phase of development, and emphasis on sustainability, thereby allowing for a significant comparison in the next chapter on findings.

In general, this comparison indicates that although the cases have several features in common as wind energy projects in Scotland, they also differ enough to permit a detailed examination of sustainability integration. Indeed, a diverse range of cases is a crucial element for a comparative study of how sustainability is being implemented in both onshore and offshore wind developments.

6 Findings

6.1 Introduction to the Findings

The empirical results of the document-based analysis of the four selected wind park projects: Berwick Bank Wind Farm, Neart na Gaoithe Wind Farm, Viking Wind Farm, and Cairn Duhie Wind Farm are presented in this chapter. The results are derived from the systematic analyses of publicly available project documents, including Environmental Impact Assessments, planning materials, and consultation reports (SSE Renewables, 2022; EDF Renewables UK, 2020; SSE Renewables, 2019). It must be mentioned that the extent of available documentation is different in every case. For example, the case of Cairn Duhie Wind Farm is based on quite limited publicly available data, and therefore, the detailed level of the findings is affected.

This chapter aims to show how the issue of sustainability has been taken into account and manifested in the development of these projects. The focus is on spotting the patterns and themes related to the integration of sustainability, which are visible through the official project documents. These documents offer structured and project-specific information on environmental, social, and economic aspects of wind park development (Bowen, 2009). The chapter simply reports the findings before connecting with the theory, which is done in the discussion chapter.

The arrangement of the findings follows three main ways. To start with, the analysis of the first part is done based on the sustainability aspects of the environment, society, and economy. Next, the result is studied by phases of the project lifecycle, i.e., planning, execution, and monitoring. Lastly, the chapter summarises the problems and the resources that have to be given up on the two sides of the same coin globally identified across the cases, i.e., tensions that arise when one tries to meet different sustainability objectives (Timmermans & Tavory, 2012).

The chapter has been organized such that these findings represent and show how sustainability is integrated in wind park projects. This layout facilitates case comparison and sets the basis for interpretation, which is given in the next discussion chapter.

6.2 Environmental Sustainability Considerations

Analysis of project documents for the four chosen wind park projects - Berwick Bank Wind Farm, Neart na Gaoithe Wind Farm, Viking Wind Farm, and Cairn Duhie Wind Farm - has revealed that environmental sustainability is a fundamental aspect in project planning and development.

A prominent environmental issue that features in all the cases of biodiversity protection. Project reports recognize the presence of species and ecosystems that could be affected and describe ways to lessen the harm. For instance, in offshore projects like Berwick Bank and Neart na Gaoithe, there is a great concern for the marine environment, including seabirds and marine habitats (SSE Renewables, 2022; EDF Renewables UK, 2020).

These reports normally have ecological studies and mitigation plans that are intended to reduce impacts during construction and operation, which relate to the execution and monitoring phases of the project lifecycle. The onshore Viking Wind Farm, on the other hand, focuses more on the conservation of natural habitats and the protection of flora and fauna in the project area (SSE Renewables, 2019). The documents contain plans for habitat management, which serve the function of protecting and restoring the areas affected. Likewise, offshore projects also use similar ways of outlining mitigation measures with a view to reducing the impacts on marine habitats and ecological systems (SSE Renewables, 2022).

Environmental monitoring is definitely the main focus across all the cases. It is a standard part of plan documentation that a system should be in place to monitor the environmental impact of the project and to check if the mitigation measures are effective for the whole duration of the project. It is not very unusual to end such plans outside the construction phase and thus indicate the intention to long-term environmental management and regulatory compliance (EDF Renewables UK, 2020).

Also, project documents tackle emissions and ecological management on a larger scale. Generally, the selling points of wind energy projects include their share in reducing emissions by providing renewable electricity. However, it is acknowledged in the

documents that the construction and installation activities have environmental impacts on a local level, and these impacts are to be mitigated through strategies and environmental management plans (SSE Renewables, 2022).

As a whole, the outcome of the study supports that at least in the documentation preparations, considerations for environmentally sustainable development are very much taken into account and formally planned for at least in the preliminary phase. But, it should be kept in mind that the review is limited to official project documentation, which mainly depicts expected activities and commitments. One cannot tell from the existing sources the degree to which such measures are truly being executed.

6.3 Social Sustainability Considerations

The examined project documentation of the four wind park projects of Berwick Bank Wind Farm, Neart na Gaoithe Wind Farm, Viking Wind Farm, and Cairn Duhie Wind Farm reveals that social sustainability is mostly achieved by formal stakeholder engagement processes, public consultation, and community impact considerations. Such elements can be found in consultation reports, planning submissions, and Environmental Impact Assessments (SSE Renewables, 2022; EDF Renewables UK, 2020; SSE Renewables, 2019).

The common theme in the cases is stakeholder engagement as a major part of social sustainability. Formal and often repeated ways of reaching out, including public meetings, consultation events, and a request for written feedback, are standard to the project documents in all cases. For the offshore projects of Berwick Bank and Neart na Gaoithe, stakeholder engagement also involves marine users such as fisheries and maritime stakeholders, as the projects are situated offshore (EDF Renewables UK, 2020; SSE Renewables, 2022).

Public consultation is another highly related issue. The cases mandate that formal consultation processes are conducted as part of planning and approval. Such procedures are intended to gather responses, identify concerns, and assist in project development.

The articles reveal that consultation is an essential element of the regulatory system, a sign of transparency and adherence (SSE Renewables, 2019).

Community acceptance is another angle explored in the documents. Developers point in their papers potential local people's issues: for example the changes in people's views, environmental degradation, alterations of the land uses, and so on. The Viking Wind Farm, located in Shetland, emphasizes very much the local aspect. So, the major purpose o the documentation is to illustrate how important community engagement and stakeholder involvement are (SSE Renewables, 2019).

Also, off-shore projects mention possible threats, but in the overwhelming majority of cases, they draw attention to the issues of fishing and other marine activities, as well as those of coastal communities. Apart from that, the articles refer to people's concerns and possible effects. There might be environmental changes, construction disturbance, and a sense that local livelihoods are somehow impacted. Usually, this understanding is acquired through consultation reports that describe mitigation measures and communication strategies (EDF Renewables UK, 2020).

Another dimension of social sustainability is the sharing of benefits and justice. Some project papers talk about community advantages like local investment, creation of jobs, or making local development initiatives financially possible. Nevertheless, the extent of the information and the importance given to these aspects differ from one case to another. For instance, in some projects, the distribution of benefits is specified very clearly, whereas in others it is only mentioned in a very general way (SSE Renewables, 2022).

The main result is that social sustainability is an integral part of project work - especially through stakeholder engagement and consultation. On the other hand, environmental considerations are again reflected by official documentation, which outlines planned approaches and reported practices. The extent to which these processes lead to actual community acceptance or perceived fairness cannot be fully confirmed from the available sources.

6.4 Economic Sustainability Considerations

The review of the project documents of the four wind park projects that we selected, Berwick Bank, Neart na Gaoithe, Viking, and Cairn Duhie reveals that economic sustainability is mostly discussed in terms of the project's economic viability, its ability to contribute to the energy system, and the potential local and national economic benefits. These areas of concern are especially reflected in the planning documents, Environmental Impact Assessments, and other supporting reports (SSE Renewables, 2022; EDF Renewables UK, 2020; SSE Renewables, 2019).

The main topic running through all the cases is the viability of the project. Usually, the project documents provide a development rationale, lay down energy output expectations, and discuss the contribution to renewable energy targets. Economic viability is framed in terms of the production of electricity over the long term and the importance of wind energy in the support of national energy strategies. Such points of view are brought out strongly in large-scale offshore projects like Berwick Bank and Neart na Gaoithe, which are the big players in terms of investment and infrastructure development (SSE Renewables, 2022; EDF Renewables UK, 2020).

Apart from these, the economic impact of the projects is another major feature of the wind farm documents. For instance, they convey the positive economic impacts of the wind farm projects by stimulating economic activities, such as supply chain activity and investments in infrastructure and employment during the periods of construction and operation, which relate to the execution and monitoring stage of the project lifecycle. For the Viking Wind Farm, the emphasis on the local economy is made even stronger given its siting on Shetland, where energy projects are tied to the economic development of the region (SSE Renewables, 2019).

Energy security is a theme in the supporting evidence as well as in the concept itself. Wind energy work is, for example, seen as a way of strengthening the energy security of the system and enhancing diversification by raising the level of domestic energy production from renewables. (SSE Renewables 2022)

This is a factor that is especially important in Scotland because renewable energy is one of the main priorities of the country's energy policy. Along with direct economic benefits like jobs, investment in local communities, and money set aside for initiatives, there is mention in the text of indirect benefits. Nevertheless, there are quite significant variations in comprehensiveness. While some documents merely express economic benefits in abstract terms, others go into very specific aspects, such as direct supply chain or enhanced opportunities for community benefit (EDF Renewables UK, 2020).

For example, EDF Renewables UK's long-term shared value is examined in various ways, such as the sustained operation of energy systems, the provision of energy, and the achievement of climate and economic targets, among others. The development of wind parks is marked as a long-term infrastructure investment that fulfils both environmental goals and economic goals via the production of renewable energy.

The emergence of economic sustainability features is reflected in a consistently high level of project-related material that is focused on the economic aspects of feasibility, and also the other contributions that the economy can make at large. Like the other aspects of sustainability that were studied, this one also looks at high-level project documents, which are primarily indicative of the expected benefits and the planned results. Consequently, the actual economic benefits and the extent to which they may be realized cannot be determined at this time based on the sources that have been made available.

6.5 Sustainability Across the Planning Phase

Analysis of planning-stage documents from the four chosen wind park projects, i.e. Berwick Bank Wind Farm, Neart na Gaoithe Wind Farm, Viking Wind Farm, and Cairn Duhie Wind Farm, indicates that planning for sustainability is extensively carried out during the planning phase. This phase, which usually involves formal assessments, making decisions on site selection, stakeholder engagement initiatives and the creation of mitigation measures, is mostly documented in Environmental Impact Assessments

and planning applications (SSE Renewables, 2022; EDF Renewables UK, 2020; SSE Renewables, 2019).

Site selection is a key aspect of sustainability planning. Documents of the projects show that site selection is based Mainly on environmental, technical, and social factors. When it comes to offshore projects like Berwick Bank and Neart na Gaoithe, site selection is about assessing marine conditions, ecological sensitivity, and proximity to existing infrastructure. If it is an onshore project such as the Viking Wind Farm, then other factors like land use, landscape impact, and environmental sensitivity including peatland areas will have to be considered (SSE Renewables, 2019). The principal purpose here is to strike the right balance between the energy generation potential On one side, while environmental and social constraints on the other are taken into account.

Environmental Impact Assessments (EIAs) form the backbone of environmental impact assessment. They introduce a systematic approach to identifying environmental and social impacts, including biodiversity, landscape, and the welfare of people living in those areas. EIAs make a difference in risk identification and are a tool for deciding on the project design. Apart from the planning process being a legal requirement, they also be a basis for regulatory decision-making (EDF Renewables UK, 2020).

Meanwhile, stakeholder consultation is a very significant element of the planning phase. Documentation indicates that gathering of feedback from local communities, stakeholders, and regulatory bodies through consultation processes is a common practice. Through these consultations, the primary goal is to surface concerns and give stakeholders an opportunity to share their views which that can then be reflected in the project planning.

Whether onshore or offshore, consultation is a recognized part of project development and regulatory compliance (SSE Renewables, 2019). Besides that, the planning phase entails design-stage mitigation measures.

These measures stem from impact assessments and stakeholder consultation findings. For instance, remodeling a project to lessen environmental footprints, staying away from environmentally sensitive areas, and handling stakeholders' issues can be done. These kinds of mitigation procedures are reflected in planning applications and supporting

documents and are geared towards reducing negative effects even before the actual running of the project.

Most importantly, the results show that sustainability is deeply rooted in the planning phase, not only by formal processes but also through documentation. Identification and subsequent addressing of environmental, social, and economic issues happen very systematically at this stage. Nevertheless, these are only illustrations of what has been planned and what is proposed. Journals/plans of the planning stage alone cannot ascertain the degree to which these promises are carried through to the later stages of the project.

6.6 Sustainability Across the Execution Phase

The scrutiny of project documentation reveals that sustainability in the execution phase can be traced to management plans, construction-stage mitigation measures, and formal execution phase commitments. These are the main components featured in Environmental Impact Assessments, construction environmental management plans, and similar project documents of the four chosen wind park projects: Berwick Bank Wind Farm, Neart na Gaoithe Wind Farm, Viking Wind Farm, and Cairn Duhie Wind Farm (SSE Renewables, 2022; EDF Renewables UK, 2020; SSE Renewables, 2019).

A dominant aspect of this phase is the application of management plans. Project documents refer to organized plans aimed at leading construction operations and making sure environmental and regulatory standards are met.

An additional important factor is construction-stage mitigation. The documents point out that mitigation measures at construction include limitations on working hours, reducing noise, and disturbing the environment only to a certain extent. While at offshore projects, mitigation measures are mainly environmental, e.g., protecting marine ecosystems, land being the main focus in onshore projects (EDF Renewables UK, 2020; SSE Renewables, 2019). Protection of habitats during work is also emphasized in the literature. For example, Viking Wind Farm places great importance on safeguarding vulnerable areas, such as peatlands, during its construction phase (SSE Renewables,

2019). Similarly, offshore projects feature steps for protecting marine habitats and species during installation (SSE Renewables, 2022).

Besides, the paper corrects project execution phase commitments that were made at the planning stage and converted into mitigation strategies more suitable for the execution of the project. Some of the basic elements are sticking to the environmental standards, fulfilling the regulatory requirements, and using the agreed mitigation measures. The commitment part of the consents or project management frameworks is the most common place where these are formalized.

The results as a whole indicate that sustainability during the execution phase is shown through the use of management systems on a turn-key basis and the clearly demarcated mitigation measures. The records highlight the fact that the planned sustainability commitments are to be implemented during the construction work. However, just like other phases of the project, the documentation comprises formal project documentation only, which describes the practices planned. Actually implementing the measures, and to what extent they result in a positive outcome, is something that cannot be fully ascertained from the present sources.

6.7 Sustainability Across the Monitoring Phase

Analysis of project documents shows that sustainability in the monitoring phase is mainly expressed through adherence to compliance requirements, ecological monitoring programs, and long-term commitments after construction. These aspects are documented in Environmental Impact Assessments, consent conditions, and monitoring plans of the three most extensively documented projects: Berwick Bank Wind Farm, Neart na Gaoithe Wind Farm, and Viking Wind Farm (SSE Renewables, 2022; EDF Renewables UK, 2020; SSE Renewables, 2019). Compared to these, the available information for Cairn Duhie Wind Farm is much less, and therefore its monitoring practices are not as well represented in the analysis.

A very definite cross-case pattern can be found in the portrayal of monitoring in the various projects. In fact, in the three highly-documented cases, namely Berwick Bank,

Neart na Gaoithe, and Viking Wind Farm, monitoring is seen as a formal activity carried out through well-organized ecological programs, compliance reports, and long-term commitments.

These examples demonstrate a formalized approach in which monitoring forms a part of the series of regulatory requirements and the post-construction obligations.

Generally speaking, location-related factors cause divergence in monitoring issues. For example, offshore projects like Berwick Bank and Neart na Gaoithe focus heavily on monitoring marine ecology, Mainly seabirds and marine habitats, while But, the onshore Viking Wind Farm mainly concerns itself with terrestrial ecosystems, including the condition of peatlands and habitat restoration. Meanwhile, the Cairn Duhie Wind Farm case shows that monitoring is hardly featured in their practice Mainly it is also the result of very limited publicly accessible documentation rather than a complete lack of monitoring. This diversity illustrates that not only the type of project but also the availability of data can influence the level of sustainability monitoring that is reflected in the respective project documentation.

Meeting the environmental regulations laid down by the regulators is one of the most important aspects of this step. Monitoring is the means by which project activities are linked to the consent conditions and regulatory requirements. Developers are required to demonstrate through their reports that they are controlling the environmental impacts following the approved plans and also that they are implementing mitigation measures as specified (EDF Renewables UK, 2020). It is a reflection of the formal approach to sustainability, where monitoring is a means of accountability.

Ecological monitoring is also a big part of it. As the project documentation, these programs are not only the plan and the design, but they also keep track of the operations of wind parks and how they impact species and habitats. For offshore projects, monitoring is done on marine ecosystems, mainly including seabirds and other marine species. In the onshore Viking Wind Farm case, monitoring is related mostly to terrestrial ecosystems and includes habitat condition and restoration outcomes (SSE Renewables, 2019). The goal of these monitoring programs is to determine whether the impacts that

were forecasted are the ones that have In fact occurred. The documents also refer to long-term commitments post-construction.

Besides that, mechanisms and processes for tracking and reporting are described. Normally, the results of the monitoring phase are documented and reported to the authorities as part of compliance requirements. These procedures present a systematic opportunity to record environmental performance and make project operations transparent.

In general, the research shows that sustainability during the monitoring stage of work is depicted by official compliance, measurement, and reporting systems.

Monitoring is a crucial medium connecting sustainability planning with the real-world execution phase of sustainability follow-ups. Nevertheless, like other phases, the research is performed on project papers that are usually plans for monitoring activities. To what degree these procedures are actually implemented, and their enforcement cannot be concluded from the existing sources.

Table 5: **Cross-Case Evidence of Monitoring Practices**

Project	**Monitoring Focus**	**Evidence in Documents**	**Strength of Representation**
Berwick Bank	Marine ecosystems, seabirds	Detailed monitoring plans with compliance reporting (SSE Renewables, 2022).	Strong
Neart na Gaoithe	Marine habitats, regulatory compliance	Monitoring linked to consent conditions (EDF Renewables UK, 2020).	Strong
Viking	Peatland, terrestrial habitats	Habitat monitoring and restoration plans (SSE Renewables, 2019).	Strong

Cairn Duhie	Limited visible monitoring	Very few documents available.	Weak

6.8 Cross-Case Comparison

The cross-case analysis reveals both regular patterns and significant differences in the ways sustainability is depicted in the four selected wind park projects: Berwick Bank Wind Farm, Neart na Gaoithe Wind Farm, Viking Wind Farm, and Cairn Duhie Wind Farm. This comparison relies on the study of project documents, with a heavier focus on the three cases that are more extensively documented (SSE Renewables, 2022; EDF Renewables UK, 2020; SSE Renewables, 2019).

One obvious recurring pattern in all cases is a very strong dependence on official documentation to portray sustainability. Environmental Impact Assessments, planning reports, and consultation documents routinely showcase well-ordered methods for addressing environmental, social, and economic issues. In fact, the projects always use formal activities to depict sustainability, e.g., impact assessment, stakeholder consultation, mitigation planning, and monitoring commitments. Besides, the projects differ in their foci. For example, offshore wind farms, e.g.

Berwick Bank and Neart na Gaoithe are primarily concerned with the environmental impacts on the marine environment, such as seabirds and marine ecosystems. Besides, they feature a large-scale infrastructure development and the related regulatory requirements. On the other hand, the onshore Viking Wind Farm is very concerned with terrestrial environmental aspects, especially peatland management, besides local community impacts in Shetland (SSE Renewables, 2019). Such distinctions are made since land and sea projects differ considerably in their environmental and social aspects.

The comparison also brings out changes in how far sustainability was integrated. Only in the three cases, which were documented in greater detail, did sustainability aspects consistently show up in planning, execution, and monitoring phases of the projects. These projects thoroughly presented the details of the mitigation measures, the stakeholder engagement processes, and the monitoring strategies. On the other hand,

the Cairn Duhie example reflects a much less extensive portrayal mainly because of a smaller number of uncovered documents.

Consequently, in this case, sustainability integration throughout the phases is not very evident. Furthermore, an important difference is that the project characteristics are onshore versus offshore. It is a tendency that offshore projects concentrate on wider ecological systems and the country's energy output, whereas onshore projects have a strong link with the local environment, such as involving local communities and land-based environmental management. These distinctions shape the manner in which sustainability issues are being presented and solved in project documentation.

To sum up, the cross-case comparison exhibits that even though a uniform pattern is maintained in the formal representation of sustainability, the particular emphasis and extent of integration depend on the type of project, the context, and the availability of data. This thus underlines the common sets of rules that direct wind park development and the very local nature of sustainability integration.

6.9 Challenges, Tensions, and Trade-offs

The study of project papers uncovers a number of continuous difficulties and trade-offs for incorporating sustainability in a wind park development. These issues come from the fact that three aspects of sustainability: environmental protection, social considerations, and economic objectives have to be balanced simultaneously in very complex project environments. It appears that the results mostly refer to the three better-documented cases: Berwick Bank Wind Farm, Neart na Gaoithe Wind Farm, and Viking Wind Farm, while the case of Cairn Duhie Wind Farm is less evidenced due to the limited availability of documents (SSE Renewables, 2022; EDF Renewables UK, 2020; SSE Renewables, 2019).

A major dilemma, often in the spotlight, is the one between renewable energy and environmental conservation. Although wind energy initiatives mainly aim at decreasing the emission of greenhouse gases and, at the same time, adhere to the set environmental targets, the documents point out that such activities can lead to the disruption of the ecosystem. More specifically, potential negative implications on the

marine environment are the main concern raised by offshore wind projects, such as the disturbance to seabirds, marine habitats, etc., whereas onshore wind projects mainly focus on the impact of terrestrial ecosystems like peatlands (SSE Renewables, 2019; EDF Renewables UK, 2020). This poses a dilemma whereby projects that are directed at enhancing environmental sustainability are simultaneously exposed to risks of local environmental deterioration.

A further significant dilemma is about reconciling the expectations of the stakeholders with the underpinning goals of the projects. The project-related documents reveal, on one side that developers intend to have deep and meaningful interactions with the stakeholders through consultation(s). On the other hand, it is not possible to satisfy all stakeholders' needs and expectations through the project design. Hence, local concerns about environmental issues and usage of land might be regarded as a trade-off against the general energy development objectives (SSE Renewables, 2022).

These results also show that the making of formal commitments to sustainability is often far from reflecting what is actually happening on the ground. Project proposals, for example, feature detailed mitigation methods, monitoring schemes, and sustainability promises. Contrastingly, they are predominantly future-oriented and illustrate measures to be taken. The extent to which these promises have been fulfilled is not always ascertainable by documents only.

So, a discrepancy is established between how sustainability is represented in official writings and its real implementation phase. A further major trade-off is the effect on the local area versus the country's energy goals. Wind park projects mostly are depicted as contributing to national or regional energy objectives, for instance, renewable energy targets and energy security. Yet, these projects at the same time may cause local manifestations, e.g. environmental alterations or community worries. This reflects the broader contradiction of large-scale energy transitions and the accommodation of site-specific impacts, in particular with Shetland, where the local environment is of great significance (SSE Renewables, 2019).

As far as sustainability is concerned, research finds that the integration of this with wind park projects is far from only about altering environmental footprints but about

interacting with a complicated set of environmental, social, and economic topics that frequently call for trade-offs. Taken together, these issues highlight the complex nature of attempting to bring about sustainability in the real world where different environmental, social, and economic factors not only have to be taken into account, but there is also a need to operate within the limitations imposed by laws and projects.

6.10 Summary of Findings

This chapter is elaborating on the findings from the research done through the document analysis of the selected wind park projects. The chapter is mostly oriented towards the three key cases with most documentation: Berwick Bank Wind Farm, Neart na Gaoithe Wind Farm, and Viking Wind Farm. But, Cairn Dhuie Wind Farm, which has the smallest amount of evidence, is also referred to. In short, the findings indicate that the cases, environmental sustainability concerns, appear as the most extensively covered topics. Yes, major environmental issues like the protection of species, management of habitats, and ecological monitoring are very often and very thoroughly accompanied in project documents, Mostly through Environmental Impact Assessments. Social sustainability topics like stakeholder engagement and consultation also appear quite frequently.

But, in most cases, these are limited to discussing formal procedures rather than actual results. Economic sustainability is briefly discussed related to project feasibility, energy supply, and the overall contribution to the economy. But, these issues tend to be considered in a more general way compared to the environmental ones.

Considering a project lifecycle, sustainability is probably at its highest level during the planning phase. This is the phase where sustainability profoundly influences the project plans due to well-documented impact assessments, site selection, and mitigation strategies.

On top of that, sustainability is also linked to the execution and monitoring phases through management plans and compliance mechanisms, etc. Still, these last stages are mostly presented as future endeavours, and their actual execution phase cannot be fully ascertained from the documents available.

The report shows some major challenges and trade-offs that come from the ongoing situation in the field. For example, the paper identifies tensions between the expansion of renewable energy and protection of nature, how lobbies may disagree with the objectives of a project, and the tensions between local communities and the nationwide goals for electricity supply. Besides that, one of the issues that was pointed out the most in the work is the gap between the official sustainability pledges and their actual implementation.

In general, the results demonstrate that sustainability is structurally embedded in the authors' reporting and in the decision-making process.

However, in reality, sustainability means dealing with a complex combination of different and sometimes opposing demands. First of all, it must be said that the results elaborated in this chapter rely on documented commitments and planned actions as stated in official project papers. These papers mainly show the ways in which sustainability is intended, communicated, and formalized through project activities. On the other hand, they are not a direct indication of actual application or effects in the field. Hence, except when specifically mentioned, the figures here can be viewed as depictions of intended sustainability incorporation rather than proof of actual performance. Such a differentiation is key to grasping the extent and shortcomings of the results. The following chapter uses these results as a stepping stone by explaining them in terms of a theoretical framework and a literature review.

7 Discussion and Conclusion

7.1 Introduction to the Chapter

This chapter serves to present the discussion and interpretation of the key results of this research. It seeks to find an answer to the research question by revealing in what way considerations of sustainability are taken into account in the planning, execution, and evaluation of the selected wind projects in Scotland: Berwick Bank Wind Farm, Neart na Gaoithe Wind Farm, Viking Wind Farm, and Cairn Duhie Wind Farm. Instead of repeating, this chapter interprets and integrates the findings. It describes the implications of the findings on the theoretical concepts addressed (e.g., sustainable project management, the Triple Bottom Line, and the project lifecycle approach). An earlier study indicates that the project management approach to sustainability adds the dimensions of environment, society, and economy to classic project management (Silvius & Schipper, 2014).

By applying this approach, the chapter attempts to interpret how sustainability is managed throughout the stages of wind park development. Furthermore, the Triple Bottom Line (TBL) approach is discussed as a framework for structuring the analysis of the different sustainability dimensions. The TBL framework provides a structure for the sustainability analysis in the form of categorization into environmental, social, and economic factors, which facilitates a structured interpretation of these three dimensions throughout project contexts (Elkington, 1997). As a second dimension of structuring, the project lifecycle phase is applied to this analysis for this purpose.

Here, it is assumed that the relevance of different priority areas in sustainability varies significantly over the planning, execution, and controlling phases of project execution, which has been identified as an important dimension in project-based sustainability research (Martens & Carvalho, 2017). Additionally, governance and stakeholder issues are three cross-cutting issues that impact the penetration of sustainability the chapter will take a look at. Literature prior to this time suggests that stakeholder participation, transparency, and compliance to regulative requirements are necessary to make a successful project sustainable (Aaltonen & Kujala, 21).

Beneath the theoretical discussion, the chapter also highlights the theoretical and practical implications of the study. In doing so, it elaborates on the contribution of the findings to the knowledge on sustainable project management of a wind park development.

The chapter also briefly discusses the shortcomings of the study, including the restrictions imposed due to the use of document-based data and the lack of homogeneity of the case studies in terms of the availability of data.

7.2 Summary of Main Findings

Summary of main findings: This part of the document gives you the gist of the major discoveries a brief highlighting the main findings from the analysis. What we have identified are patterns sustainability dimensions, life cycle phases, and emerging problems. In fact, in all the cases the environmental sustainability dimension appears to be the most dominant and most developed. The project documentation includes detailed reporting on potential environmental impacts, including responses to biodiversity, conservation of habitats, and ecological monitoring initiatives.

This prominent focus is due to the importance of Environmental Impact Assessment when planning wind parks and its compliance with the regulatory framework (SSE Renewables, 2022; EDF Renewables UK, 2020). In comparison, social sustainability factors are mainly quantified through the more formal channels of the consultation process, like stakeholder consultations.

It appears that social factors are talked about in terms of systems like consultation and communication, which enable them rather than the results and effects themselves. Although we can find well-documented stakeholder engagement processes, only part of the results, like social acceptance or fairness of a project, are partially outlined in the academic literature (SSE Renewables, 2019). Considerations of economic sustainability are evident but not as developed as, or as descriptive as, environmental considerations. The project documents make reference to economic viability, the project's goal of providing a contribution to renewable energy sources, and wider economic benefits

through employment and infrastructure development. However, these are also often illustrated more generally and are not always analyzed in detail.

Looking across the lifecycle of the project, sustainability seems to be best integrated at the planning stage. Various impact assessments and site selection processes, as well as the creation of mitigation measures, are apparent in this phase. During execution and monitoring phases, these sustainability aspects are manifested in management plans, compliance issues, and monitoring frameworks, yet these phases are best characterized as what are intended to happen with less clarity about their actual execution. The results also reveal some major challenges and trade-offs. Perhaps the most important is the conflict between the environment and renewable energy development.

Although projects aim at meeting the climate targets, they also produce other impacts at the local. Other problems are between stakeholder expectations and project objectives, as well as between local impacts and national energy targets. Finally, the most common issue is between commitment and actions.

Exemplified by that indicative set of observations, it can be seen that if not yet explicitly or explicitly expressed in the technical content of project documentation, project sustainability considerations are well embedded in planning activities and systems, albeit with the simultaneous management of competing priorities. These emerging indicative patterns are used in the next section to critically discuss the empirical findings in light of the relevant theories of sustainable project management.

7.3 Discussion of Sustainability Integration

This section reflects the depth of integration of sustainability by analysing the equilibrium across sustainability dimensions and the coherence of integration across the project life cycle in the selected wind park projects. These points are discussed on the basis of sustainable project management, which advocates the integration of environmental and social considerations in the core project management processes instead of limiting them to requirements (Silvius & Schipper, 2014).

Environmental Dimension

The strongest dimension of sustainability, to be interpreted as best integrated, is environmental. The environmental dimension is deeply built into all aspects of project documentation in an Environmental Impact Assessment, including measures for environmental mitigation and monitoring, which suggests a moderate level of formal integration in this field. This is attributable to the supervisory status of environmental issues and the development of formal procedures.

It is, however, a compliance-driven integration focused on an environmental sustainability transformation. Environmental sustainability is explicitly documented and comprehensively designed, but it is rather perceived from the angle of 'requirements' regulatory standards than a system of values for a holistic sustainability transformation..

Social Dimension

The social element illustrates a varied picture of integration. Social sustainability is built into the process of consultation and participation, where it is apparent that engagement with stakeholders is part of the project planning process and is presented as an integral component of project planning. Nevertheless, the social sustainability is perceived to be embedded in the process rather than the outcome.

The engagement processes are well documented, but it is hard to see how they evolve toward the relevant outcomes, like the sustained community support and perceived fairness. Consequently, the social sustainability is embedded in the process in terms of formal process, but the outcome is less observed in the documentation (Aaltonen & Kujala, 2016).

Economic Dimension

The economic aspect has been referred to, but it is not as developed as the environmental or social aspects. Economic aspects are generally discussed in terms of the viability of the project, contribution to renewable energy production, and economic benefit generally. Indicates that economic sustainability has been implicitly incorporated rather than explicitly analysed.

While it is usually put forward as the basis for the project justification of the project, it has not been considered in a detailed manner. Thus, the economic dimension seems to be less systematically incorporated in project documents, showing an imbalance among the three density dimensions.

Integration Across the Project Lifecycle

In terms of the project lifecycle, the sustainability execution phase is more obvious in the planning phase, which requires detailed assessments, consultations, and mitigation planning. This phase provides a more structured process for conveying the sustainability aspects of the project.

On the other hand, sustainability in the execution phase and monitoring phases is less visible. Despite that, the project documents specify management plans, compliance requirements, or monitoring activities; they are written as expected procedures.

The Project execution phase and execution are not totally included. This may imply that the integration of sustainability is not uniform across the life cycle. It is practically established in the planning phase and less transparent in the later phases. This may concur with the literature, which has found that 'sustainability is front-end loaded in project planning rather than integrated throughout the life cycle' (Martens & Carvalho, 2017).

Overall Interpretation

In sum, the results show that sustainability is partly integrated into the wind park development. It is obviously part of the formal project processes, primarily in project documentation and early planning steps. It is, however, neither balanced (dimensions) nor equally consistent (life cycle phase). The strength of the presence of sustainability seems to be high, although its observable execution phase seems to be low.

Covering levels of environmental, social, and economic sustainability, the importance of environmental sustainability seems to be prominent, the social only procedure-oriented, and the economic dimension is underdeveloped. Besides, the heavy use of official

documents makes sustainability commitments visible, but makes their field application more abstract.

This indicates that sustainability in these projects is somewhere between strategic integration and regulatory compliance.

7.4 Discussion of Challenges, Tensions, and Trade-Offs

The results indicate that sustainability integration for the development of a wind park does not follow a smooth line, but it is rather a process that encompasses a series of in-built poles between targets. These poles are a characteristic feature of big projects, encompassing simultaneously environmental, social, and economic interests. In terms of a sustainable project management perspective, these trade-offs point out the difficulty of operationalizing sustainability principles into concrete project choices (Silvius & Schipper, 2014).

Renewable Energy Development vs Environmental Protection

Perhaps the greatest tension concerns renewable energy development as opposed to environmental protection. Wind farm projects are supposed to 'actively contribute to climate objectives by displacing fossil fuel-generated electricity, reducing greenhouse gas emissions. However, the evidence shows that the projects could result in localized environmental impacts, e.g.

on marine or terrestrial habitats. This tension is relevant to project management because maximising some effects at a local or a project level may not match maximising other effects at the global or strategic level. Choosing the best solutions, therefore, involves trade-offs and compromises, which project managers have to make at every step (project site selection, mitigation design, etc). In a way, this illustrates the ultimate dilemma: not all sustainability targets are consistent across dimensions.

National Climate Goals vs Local Community Concerns

A second major tension is between state energy targets and the interests of the local community. However, the construction of wind parks can be seen as part of a wider

national or regional energy strategy, which contrasts with the potentially direct socio-economic consequences to local communities of environmental effects and land use issues. This puts a strain on project management in terms of legitimacy and acceptance. Though a project might be in line with overall policy objectives, it still demands buy-in locally to carry it out. Stakeholder assimilation procedures are designed to remedy this; however, the evidence indicates that the processes do not necessarily remove conflict. This draws attention to the need to regulate social expectations (Aaltonen & Kujala, 2016).

Project Efficiency vs Deeper Stakeholder Engagement

Additionally, the findings also indicate a compromise between project efficiency and more meaningful involvement of stakeholders. An excessive consultation process can enhance openness and inclusiveness, but potentially lengthen project duration and escalate costs.

This in turn poses a project management dilemma of balancing efficiency against inclusiveness. Stakeholder participation, which is a virtue of social sustainability, could become an issue with project timing and decision-making. So, the integration of sustainability must be a matter of stakeholder engagement For one thing and handling the practicalities of participation on the other.

Formal Sustainability Commitments vs Practical Execution phase

Another issue we commonly face is the gap between what is officially promised and what really happens during the implementation phase. While project documents contain numerous details about the ways to reduce risks and the methods for monitoring unfortunately these plans mostly seem to be the hoped-for rather than the proven outcomes. This contradiction here is quite thought-provoking in that it exposes a fault of the extended documentation.

As a project management issue, sustainability should not be considered to be embedded if the only evidence can be found in plans and reports. It needs to be implemented on an ongoing basis, in a measurable way, and by means of standards of practice.

Economic Viability vs Broader Sustainability Expectations

There is also a tension here between the economic gains of wind parks and the environmental and social sustainability requirements of the project. A wind park project needs to be economically feasible in order to be developed, which can have implications for the size of a project, for example.

This, in turn, provides a dilemma to project managers as they are required to ensure projects remain economically viable while tackling the bigger picture sustainability issues. It also begins to shed some light on why certain sustainability issues, mainly economic issues, are handled at a more macro level in project documentation due to their close interaction with project viability.

Overall Interpretation

These tensions indicate that integration of sustainability into the wind park development process is inherently difficult and dependent on context, as there is no one singular goal of sustainability, but a bundle of trade-offs that need to be managed across the entire project life. This helps to understand why the integrations appear strong at a formal level. In terms of project management, then sustainability implies ongoing trade-offs and negotiations as opposed to fixed responses. It may also point to the need for dynamic methods of management capable of dealing with changing environmental, social, and economic circumstances.

7.5 Answer to the Research Question

This was an exploratory study that attempted to find out how environmental, social, and economic sustainability issues are embedded into the planning, execution, and evaluation of renewable energy projects in Scotland, and what kind of dilemmas are taking place. Some obvious pattern of infrequent and uneven integration arises from the analysis. Secondly, sustainability is otherwise formally incorporated into and "embedded" within the project processes and presentation, especially in project documentation, such as the environmental impact assessment, planning reports, and

consultation documents (SSE Renewables, 2022; EDF Renewables UK, 2020; SSE Renewables, 2019).

Environmental assessment is most explicit at the planning stage, where all three sustainability dimensions (environmental, social, and economic) are mapped out and dealt with as part of the planning process: there is a thorough analysis of biodiversity, habitat protection, and ecological factors; social strategies relate mainly to local stakeholder consultations; and economic sustainability examines project viability and impact contribution. Secondly, the integration of the concept of sustainability within planning and reporting is less apparent in the execution and monitoring phases.

The project reporting, for example, highlights the management plans and sequences, the mitigation measures, and monitoring frameworks, which are only expressed as dynamic activities rather than actual performances. This indicates that the sustainability aspect is very much built into the planning and reporting process, but has less visibility during the execution phase and monitoring proceedings. Third, the findings reveal that sustainability is unbalanced among all three dimensions.

The environmental dimension is discussed in the most detail, especially in relation to biodiversity, habitat protection, and ecological impacts. The social dimension is addressed mainly through stakeholder consultation and community engagement processes, while the economic dimension is less explicit. This shows that sustainability integration is dimensionally imbalanced. The economic dimension topic is less explicit. Lastly, there is the uncovering of different significant challenges and trade-offs. We see first that there are conflicts between renewable energy development and environmental protection, national energy policies and local interests, project efficiency and stakeholder involvement, formal commitments to sustainability, and tangible actions.

These trade-offs simply show how moving towards sustainability is not a linear process but an ongoing balancing act. In summary, the analysis shows that while sustainability in Scotland's wind park project planning and documentation shows evidence of a systematic approach, there is unsatisfactory performance in the interaction of the different lifecycle phases and the dimensions of sustainability under discussion, influenced by various 'real-world' restrictions.

In other words, sustainability rests on the borderlines of the strategy and the requirements of regulation, seldom been embedded into wider project management activities and controls.

7.6 Theoretical Contributions

The theoretical contributions of this paper to academics are based on utilizing proven theories of sustainability (sustainable project management, TBL, and project lifecycle view of sustainability) to find out how these theories work in practice for wind park projects in Scotland. Although the theoretical background of TBL, sustainable project management, and the project lifecycle view of sustainability is already introduced to academics, this study can make a contribution by actually being used in practice (Elkington, 1997). Firstly, the research is a contribution by implementing the management theory of sustainable project management in the case of wind park development.

The research has shown that ongoing sustainable project management is an enhancement of conventional project management towards using more integrated and broader project management. Through the execution phase of sustainable project management in wind park development, this is especially often evident between the formal planning and execution phases. The level of integration is, for example, far more comprehensive in planning than during the execution phase and control.

This refined the theory of sustainable project management by acknowledging the fact that integration of sustainability with the management of wind park development is not sufficiently consistent throughout the entire project. Secondly, the study's contribution is also in showing the application of the TBL to a project-level analysis. The results indicate that TBL provides an effective framework to group sustainability aspects into 3 proposed layers, namely environmental, social, and economic (Elkington,1997). Yet, the study also reveals that in reality, these 3 layers are not treated in equal detail, especially the environmental layer. This adds weight to the argument that TBL is, to some extent, an effective framework to structure existing sustainability layers, but cannot be used to reflect the uneven effort of each layer.

Thirdly, the paper offers a life-course approach to studying the adoption of sustainability. Focusing on planning, execution phase, and follow-up, it demonstrates that sustainability is perceived most conspicuously during planning and less conspicuously during subsequent phases. It focuses on "the way in which sustainability is integrated into the life course," adding to the existing knowledge, suggesting that sustainability becomes unhidden not at one time stage only but during the project life course and that this requires further theoretical attention to extend, while its earlier focus on the planning phase is maintained(Martens & Carvalho, 2017).

Fourth, while underlining stakeholder significance as a factor affecting sustainability, the paper corroborates and extends the existing literature by revealing the governance and stakeholder considerations as cross-cutting factors of sustainability integration. Good practices of stakeholder engagement, meeting regulations, and having transparency indeed shape the sustainability presentation and management at each phase. The evidence from PP also confirms the existing findings, stressing the relevance of stakeholder concerns to project contexts (Aaltonen & Kujala, 2016).

Lastly, the study adds to the body of knowledge that positions sustainability in relation to other factors such as strategic goals and regulations. As sustainability has been integrated into the project system, this research concludes that the inclusion of sustainability can be said to be situated between strategic direction and compliance, and that the development of sustainability in project contexts does not always imply sustainability as a deep transformation, but rather a strategic positioning or an expression of regulatory obligations. It complements the theoretical debate on the sustainable project management framework.

In sum, this paper also contributes to theory by developing an empirically grounded conceptual framework of how sustainability is formalized, organized, and impeded in real project environments. It demonstrates that sustainability integration differs across dimensions and development stages, and that the execution phase is significantly influenced by regulation and governance factors.

7.7 Managerial Contributions

From a practical standpoint, this study offers some lessons for project managers, developers, and policy-makers working in wind park projects, especially in a setting similar to that of Scotland, where issues of sustainability, expectations of stakeholders, and legislative constraints are greater. As indicated by the findings, sustainability integration in the projects studied is existent but not consistent, and this has implications for practical project management. Firstly, the project manager should make sure that sustainability is embedded in a comprehensive manner throughout the project life-cycle instead of being dominated by the planning stage.

From the project management process perspective, all the sustainability issues should be thoroughly covered in planning, execution, and monitoring phases, which requires the stage links to be further enhanced. Practically speaking, the execution phase of sustainability should be realized in a comprehensive way, including planning, execution, and monitoring. Second, interaction with stakeholders should be regarded as an important strategic project management process, rather than an obligation of engagement through formal consultations.

Literature on consultation may be abundant, but its success largely depends on the willingness to utilize the process. Project managers should adopt a proactive approach by establishing one-on-one relationships with stakeholders and adopting forward-looking improvement measures based on public feedback (Aaltonen & Kujala, 2016). Third, more transparency and documentation during the execution and monitoring phase should be emphasized.

The findings show that the execution and monitoring phase from the project managers' perspective is mostly characterized by what project managers would like to happen rather than what has actually happened in terms of recorded data. Accordingly, project managers can enhance their reporting with concrete proof of the actual execution phase of monitored sustainability indicators.

Fourthly, project managers need to understand that sustainability does not mean perfect balancing of the project, but rather efficient management of those tradeoffs. Tradeoffs

identified in this study include environmental preservation, economic persistence, and societal expectation.

An insight from the study is that project managers can excel in balancing multiple tradeoffs by being aware of them and making appropriate choices, which guarantees overall project sustainability at a given point in time. Fifthly, the results indicate the need for enhanced coordination among EA, SSM issues, and commercialization. Sustainability issues should not be treated separately. For example, project managers should take an integrated approach.

Execution phase of EA should be integrated with the SSM strategy and the commercialization of the project. This will be achieved through coordination among functions and individuals in the project. Finally, project managers should recognize that sustainability is defined by both strategic direction and regulation. While fulfilling regulatory requirements is a must, a compliance-oriented approach will hinder project professionals from reaching the full potential of sustainability. Managers should seek to identify how to optimize project sustainability strategies amid compliance-oriented constraints (Silvius & Schipper, 2014).

Overall, this study points toward a need for greater execution phase focus in wind park projects as a method for improved sustainability integration, and shows that there are benefits of a more execution phase-oriented approach over a documentation-oriented approach. Building greater levels of lifecycle integration, increasing stakeholder involvement, promoting increased transparency, and proactively managing trade-offs can all be achieved by implementing the recommendations presented herein.

7.8 Limitations of the Study

There are a number of limitations that can be identified within this study that need to be considered when interpreting the findings. Understanding these limitations, therefore, helps to establish the boundaries of the data and identify the evidence for and against their significance.

Firstly, the study is based on four Scottish wind park projects: Berwick Bank Wind Farm, Neart na Gaoithe Wind Farm, Viking Wind Farm, and Cairn Duhie Wind Farm. As a

multiple-case design, it enables comparison by not being representative; having only four cases, it is not representative of all wind energy projects or geographically.

Secondly, data used for research is only available publicly. Examples are the Environmental Impact Assessment, Planning documents, and consultation packs. These are documents that are produced mainly for communication or regulation purposes.

They therefore tend to be a more formal and structured presentation of sustainability.

Third, it also lacks primary data collection techniques, including interview and survey methods. As such, the voices of the project managers, stakeholder organizations, and community members are not necessarily heard.

Fourth, there are a number of issues that may not be entirely represented in the official documents. For instance, there may be internal debate, negotiations, and concessions on projects that would appear in reports. And fifth, formal commitments are not always effectively carried out.

The project documents specify actions to be taken, mitigation measures, sustainability objectives, etc. But it is impossible to check through the documents whether these formal commitments have been fully carried out, especially during the execution phase and monitoring stages.

Finally, the research is limited by differences in the availability and depth of documentation for cases. Some projects, such as Berwick Bank, Neart na Gaoithe, and Viking Wind Farm, provide extensive documentation, whereas Cairn Duhie Wind Farm has more limited publicly available material.

7.9 Suggestions for Future Research

According to this study, several aspects that could trickle down to deeper research have been highlighted as the integration of sustainability into the development of wind parks. Besides, the research conducted in the future may consider gathering original information, for instance, holding conversations with the managers of the project, the regulatory authorities, and the members of the local community.

This would provide an easier understanding of how sustainability is implemented and experienced in practice, in addition to the document-based approach utilized by this research. Second, more wind park projects could be studied to broaden the scope of analysis.

Increasing the sample size of projects involved might facilitate comparative analysis and might make it easier to determine if the trends identified in this study are a reflection of the issues in a broader context. Third, future work will compare offshore and onshore projects more systematically.

As part of this research, the differences between offshore and onshore projects identified could be a foundation for a comparison, but a specialized comparative design could be set up.

Fourth, studying projects in different institutional and regulatory settings, for instance, between Scotland and other countries, would shed light on the role of national institutions and regulations and how they shape projects.

Fifth, future research may want to study post-construction monitoring and sustainability measures over time in more depth. This study used the proposed monitoring frameworks outlined in project documents, but future work may want to study the actual monitoring observations and the realization of sustainability commitments. Finally, other theoretical perspectives might be introduced into future research.

For instance, just transition or additional governance and transition theories might shed light on questions of fairness and equity with respect to renewable energy development.

In summary, these directions imply that this study serves as an initial step in understanding sustainability integration in wind park projects, yet there is plenty of room for additional research on how projects are implemented, other actors/sites/circumstances, and other various reasons to approach the issues.

7.10 Final Concluding Section

This research project investigated the extent to which environmental, social, and economic sustainability issues are incorporated in the planning, execution, and monitoring phases of four selected wind park projects (Berwick Bank Wind Farm, Neart

na Gaoithe Wind Farm, Viking Wind Farm, and Cairn Duhie Wind Farm) in Scotland. The results indicate that Sustainability is well embedded in project documents and processes, mainly at the planning phase, but with inconsistencies between the three pillars of sustainability and throughout the project's life span. The most elaborated dimension of the study was environmental, whereas the social and economic dimensions showed more variability.

Furthermore, sustainability appeared more as a planning feature than as a feature of the execution phase and monitoring processes, which had less transparency and fewer feedback cycles. Through this analysis, the author also proves that trade-offs and tensions constitute an intrinsic part of the wind park development: between renewable energy scope and environmental preservation; between national energy and local challenges; between formal commitments and execution phase.

This concludes that wind park project sustainability should not be perceived as a one-dimensional or ideal concept but rather as an ongoing process of trying to reconcile conflicting interests. Sustainable project management has been proven to be crucial in providing a critical perspective into the processes of these balancing acts.

It moves away from a narrow technical performance focus to consider the wider environmental, social, and economic results of project execution. In general, the study suggests that to make renewable energy infrastructure truly sustainable, one must go beyond formal requirements and apply integrated, lifecycle-based, and context-sensitive project management practices that can acknowledge and consciously respond to the complexities of sustainable practice.

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