Collaborative and Anticipatory Governance in Coastal Natural Climate Buffer Projects

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A comparative research on stakeholder collaboration

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This research was shaped by my deep curiosity about how sustainable developments are translated into real-world societal applications. My fascination with nature began when I was only a little kid, during regular Sunday trips to the Schoorlse Duinen and the beaches of Hargen and Camperduin with my mother and later including my sister. Over time, these landscapes became the site of the Hondsbossche Dunes project, which further sparked my interest in how biodiverse environments could be integrated with coastal safety goals. This inspiration is reflected throughout the research presented here.

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I wish you all enjoyable reading.

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Summary

This thesis explores how the system context and stakeholder drivers shape collaborative and anticipatory governance, and how these in turn function as barriers or enablers to the outcomes of Dutch coastal Natural Climate Buffer (NCB) projects. Considering accelerating climate change, biodiversity loss, and increasing societal demands, NCBs are seen as promising nature-based solutions that can enhance coastal safety and ecological resilience. However, implementing such projects is complex, requiring long-term collaboration across diverse actors with varying interests and future expectations.

A comparative case study was conducted on three Dutch projects: the Sand Motor, the Hondsbossche Dunes, and the Marconi Salt Marshes. Data were collected through document analysis and semi-structured interviews with key stakeholders. The research applied the Collaborative Governance Framework (Emerson et al., 2011) and the Anticipatory Governance Framework (Muiderman et al., 2020) to evaluate how stakeholder dynamics unfolded across different project phases.

The findings demonstrate that institutional complexity, ecological urgency, and evolving legal frameworks strongly influence collaborative outcomes. Drivers such as interdependence and shared urgency can catalyze collaboration but are not sufficient without enduring governance structures. Early-stage co-creation, trust-building, and shared problem framing supported strong stakeholder motivation in the Sand Motor and Marconi cases. In contrast, delayed engagement and fragmented leadership weakened collaboration in the Hondsbossche Dunes. Anticipatory governance tools such as scenario modelling, monitoring, and role-play were used to manage uncertainty, but their impact was limited when they were not institutionalized or inclusively applied. Projects were more resilient when foresight was embedded in shared learning and co-created long-term visions.

The study highlights the importance of maintaining collaboration and anticipation beyond implementation. While limited to three cases, the results provide practical and theoretical insights for improving long-term stakeholder engagement and adaptive governance in coastal nature-based climate adaptation projects.

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Chapter 1: Introduction to the Research

1.1. Problem statement

Since human-nature reached the Anthropocene, we are left alone with some pressing questions about mitigating and adapting to climate change, protecting biodiversity and ensuring human well-being (Seddon et al., 2020). Despite the agreements in the United Nations Sustainable Development Goals (SDGs), many goals are unlikely to be met by 2030. In particular, the failure to adapt to climate change (SDG 13) or protect biodiversity (SDGs 14 and 15) is made worse by the fact that these concerns are being addressed independently although they share many of the same drivers. According to Seddon et al. (2020), nature-based solutions (NbS) emerge as a unified approach that could reduce trade-offs and improve synergies among the SDGs. These approaches work with and enhance natural processes to address societal challenges, offering more sustainable and adaptable alternatives to traditional engineered solutions (Chausson et al., 2020).

Coastal areas face increasing risks due to climate change, including sea-level rise, intensified storms, and biodiversity loss (Horstman et al., 2009; Gorman et al., 2022). In the Netherlands, traditional approaches such as dike heightening provide safety but often lack sustainability and adaptability. For example, repeated dike reinforcements require continuous financial and material input (Keesstra et al., 2017). In contrast, NbS like the Sand Motor leverage natural processes to maintain coastal safety with reduced long-term maintenance (Veraart et al., 2019). Given that climate change introduces deep uncertainty about future sea levels, storm intensities, and ecosystem shifts, it is crucial that such nature-based approaches are designed to remain effective and adaptable over multiple decades. However, their implementation and long-term governance remain complex due to multiple stakeholders, conflicting interests, and deep uncertainties about future climate conditions. Integrating collaborative and anticipatory governance is therefore essential to ensure these projects remain effective and resilient over time.

Natural Climate Buffers (NCBs) are a specific form of NbS, providing space for natural processes to grow and evolve (Zingstra & Vertegaal, 2021). They are increasingly recognized as tools for climate adaptation and ecosystem resilience (Keesstra et al., 2017). Still, these projects not only face challenges in design and implementation but also in ensuring their effectiveness under long-term and uncertain future conditions, such as sea-level rise and changing sediment dynamics. Their successful planning and management in the Netherlands were hindered by the large variety of stakeholders, as mentioned in research done by Veraart et al. (2019). For instance, in the Noordwaard polder project, part of the Room for the River program, negotiations between farmers and environmental organizations advocating for nature restoration led to lengthy decision-making processes. Farmers were concerned about losing productive land, requiring compensation schemes and intensive

dialogue to reconcile these conflicting interests (Veraart et al., 2019). Misaligned priorities, varying knowledge levels, and limited trust among these stakeholders often hinder cohesive action (Mitchell et al., 2020).

Furthermore, NCBs must account for dynamic and uncertain future conditions, which complicate governance and decision-making as their full impacts may only become apparent over decades (Veraart et al., 2019). This underscores the need for collaborative and anticipatory governance to align stakeholders and ensure long-term adaptability.

1.2. Research Aim and Research Questions

To develop more thoughtful and forward-looking solutions, various stakeholders initiate the NL2120 program in the Netherlands. The NL2120 program focuses on leveraging NbS to address current and future societal challenges while integrating ecosystem resilience and climate adaptation (NL2120, 2024). This comparative research aims to explore and compare the key factors that facilitate and hinder collaborative governance for three coastal NCB projects within the NL2120 program. The study aims to offer practical recommendations to enhance the collaborative outcomes of future coastal NCB projects. Central to this study is an analysis of how stakeholder collaboration and governance can be improved through the lens of anticipatory climate governance (Muiderman et al., 2020) and the collaborative governance framework (Emerson et al., 2011). This brings the focus to how different anticipation approaches and collaborative dynamics influence each other and the collaborative outcomes of the projects. The main research question is stated as follows:

> *"How do the system context and drivers shape collaborative and anticipatory governance, and how do these in turn act as barriers or enablers to the outcomes of coastal climate buffer projects?"*

This main question will be supported by the following sub-question:

- How does the system context shape collaborative and anticipatory governance in coastal NCB projects?
- What key drivers motivate stakeholders to engage in stakeholder collaboration for coastal NCB projects?
- What barriers and enablers affect the governance processes throughout project phases?
- How do these governance processes translate into the project outcomes?

1.3. Social Relevance

The planning and management of NCBs are critical for the Netherlands' response to rising sea levels, increased flooding, and more frequent extreme weather events (Zingstra & Vertegaal, 2021). This research is highly socially relevant because it tackles the need for effective, long-term governance. It

involves key stakeholders such as ministries like the Ministry of Infrastructure and Water Management, environmental NGOs, provincial planners, and Dutch water authorities. These actors are directly responsible for translating climate adaptation goals into practice. By exploring how these stakeholders can effectively work together through collaborative and anticipatory governance, the research aims to foster inclusive, sustainable, and adaptive approaches to climate adaptation. Understanding how collaborative governance and different anticipatory approaches shape stakeholder collaboration could help improve the collaborative outcomes within the NCB projects.

This improvement not only contributes to the overall resilience of Dutch society but also helps protect vulnerable communities in the face of a changing climate (Boyd et al., 2015). By incorporating insights on hybrid governance structures and addressing power dynamics among stakeholders, the research seeks to ensure that decision-making processes are more inclusive and equitable. These findings provide valuable insights for project leaders and policymakers for improving long-term climate adaptation projects and policies that incorporate NCBs (Muiderman et al., 2020). Ultimately, improving the governance of NCBs contributes to a more resilient Dutch coastline and safeguards vulnerable communities (Berkes, 2017), while also promoting long-term, equitable climate adaptation strategies that benefit future generations.

1.4. Scientific relevance

Beside social relevance, this research addresses a key scientific gap in the literature on climate adaptation and natural resource management, particularly regarding NbS and NCBs in the Netherlands. While extensive research exists on climate impacts and mitigation (Fawzy et al., 2020; Abbass et al., 2022; Malhi et al., 2021; Raihan, 2023), this study opens a black box by investigating how collaborative and anticipatory governance approaches shape outcomes in NCB projects. It responds to the growing need for governance strategies that can manage long-term uncertainties while promoting inclusive and sustainable decision-making (Van Buuren et al., 2015).

Although prior studies recognize the importance of adaptive, multi-stakeholder governance for NbS (Ascione et al., 2021; Kiss et al., 2022; Ferreira et al., 2020), they rarely explore how collaborative and anticipatory approaches jointly influence stakeholder alignment and project outcomes, especially in coastal NCB contexts. This study builds on the frameworks of Emerson et al. (2011) and Muiderman et al. (2020), extending them to develop a refined typology of multi-stakeholder governance in practice. It introduces a new analytical lens for understanding how alignment and coordination among stakeholders evolve in place specific climate adaptation. In contrast to studies that highlight barriers to collaboration in NbS (Dorst et al., 2021; Toxopeus et al., 2020; Sarabi et al., 2019), this research offers a framework for overcoming those challenges and fostering effective local collaboration. By

empirically examining stakeholder dynamics and anticipatory practices in NCB initiatives, it adds much-needed empirical grounding to conceptual debates on governance under uncertainty.

Anticipatory governance has typically been discussed in abstract or global terms (Guston, 2013; Fuerth, 2009; Berten & Kranke, 2022; Taati et al., 2021), with limited application to specific, place-based strategies like Dutch NCBs (Muiderman, 2022; Umbach, 2024; Vervoort & Gupta, 2018; Peou et al., 2021). This research bridges that gap, contributing to the translation of theoretical insights into practice. By embedding anticipation into collaborative governance, it reconceptualizes stakeholder collaboration as a mechanism for both project coordination and navigation of future uncertainty.

1.5. Report Structure

This report is organized as follows: chapter 2 presents an overview of existing literature relevant to this research and concludes with the developed conceptual model based on theoretical concepts and insights. In chapter 3, the methodological approach of this research is presented in detail. Chapter 4 presents empirical analysis across three case studies focusing on system context, drivers, collaborative dynamics, anticipatory governance approaches, outcomes, and a cross-case comparison of enablers and barriers. Finally, Chapter 5 and 6 offer cross-case comparison and the study's conclusions and broader discussion, reflecting on the findings in relation to the research questions and the theoretical framework.

Chapter 2: Literature Review

This chapter outlines the theoretical foundation by reviewing literature on NbS, stakeholder collaboration, anticipatory governance, and governance complexities to frame the study's conceptual model and analysis of stakeholder dynamics in Dutch coastal NCB projects.

2.1. Application of Natural Climate Buffers

Dutch applications of NCBs, especially in coastal regions, have emphasized the multifunctionality of NCBs in spatial planning and water management. Frameworks such as Integrated Coastal Zone Management (ICZM) and Ecosystem-based Adaptation (EbA) underpin these approaches by combining ecological goals with long-term safety and planning strategies (Keijsers et al., 2012; Zingstra et al., 2021). These studies highlight dunes and ecosystems as buffers enhancing coastal safety and adaptation. Local projects incorporate climate-proofing into spatial and water management through governance integration and stakeholder collaboration (Swart et al., 2013; Veraart et al., 2019). However, governance dynamics such as stakeholder resistance, fragmented planning, funding constraints, and inconsistent monitoring remain under-theorized challenges (Swart et al., 2013; Warner & Wiegel, 2021). Warner and Wiegel (2021) specifically address social impacts and conflicts arising from insufficient stakeholder engagement. While ecological outcomes dominate the literature, detailed insights into stakeholder processes and anticipatory governance over project phases are limited.

This literature shows that NCB success hinges not only on biophysical performance but also on institutional collaboration, social acceptance, and adaptability to future climate risks. These are precisely the elements examined in this study, which investigates how governance processes accommodate complexity, uncertainty, and long-term objectives in Dutch coastal adaptation projects. This will be done by applying collaborative governance (Emerson et al., 2011) to analyze stakeholder arrangements and anticipatory governance (Muiderman et al., 2022) to evaluate long-term orientation. These frameworks help explain how and why certain NCB projects succeed or falter under conditions of social and ecological complexity.

2.2. Stakeholder Collaboration in Environmental Governance

Stakeholder collaboration is crucial in environmental governance for legitimacy, co-production of knowledge, and improved outcomes (Ansell & Gash, 2007; Newig et al., 2023). Key success factors include early and continuous engagement, trust-building, and network structures facilitating information flow (Hovardas, 2021; Fliervoet et al., 2015). Network analyses reveal the importance of connectivity in Nature-based Solutions (NBS) planning (Mitincu et al., 2023). Collaborative governance is effective in decentralized contexts lacking a single decision-maker, but maintaining

accountability and managing power imbalances remain challenges (Lee & Ospina, 2021; Challies et al., 2017; Gunningham, 2009). Power asymmetries, institutional fragmentation, and stakeholder fatigue can undermine collaboration (Challies et al., 2017; Jager et al., 2019). Many studies lack longitudinal insights on how collaborative structures evolve or sustain over time, which is critical in projects with long implementation horizons like coastal adaptation.

NCB projects are deeply embedded in complex social systems requiring alignment across multiple stakeholders, including local communities, regional authorities, and national agencies. Understanding how collaboration is fostered, maintained, or disrupted in such contexts is essential to evaluating project success. This review justifies the use of the Collaborative Governance Framework (Emerson et al., 2011), which provides a structured lens for assessing drivers, dynamics, and outcomes of stakeholder collaboration in complex environmental settings. It also links directly to anticipatory governance by highlighting the need for sustained future-oriented engagement across multiple governance levels.

2.3. Anticipatory Governance in Environmental Contexts

Anticipatory governance refers to capacities enabling governance systems to foresee, prepare for, and adapt to future uncertainties (Guston, 2013). It incorporates foresight, flexibility, inclusivity, and hybrid governance mechanisms (Muiderman et al., 2022). Quay (2010) highlighted the use of foresight tools to address climate risks, while Fuerth (2009) has emphasized embedding foresight in decision-making to enhance resilience. Institutional flexibility allows policies to evolve with new information, enhancing long-term adaptation (Serrao-Neumann et al., 2013). In addition to that, Lysaght (2021) states that inclusive governance legitimizes decisions through broad stakeholder participation (Lysaght, 2021). Collectively, these studies have stressed forward-thinking strategies and diverse governance mechanisms for long-term environmental challenges.

These frameworks have blended theoretical and practical insights. Guston (2013) and Muiderman et al. (2022) have offered robust, multi-dimensional models, while Serrao-Neumann et al. (2013) have provided valuable local case studies. This literature has complemented broader research on sustainability governance and adaptive management, reinforcing the need for forward-thinking strategies that balance ecological, economic, and social priorities.

This study contributes to the literature by applying anticipatory governance theory to place-based NCB projects, an area that remains under-explored. Studies often focus on national-level policy or technological foresight, leaving open questions about how anticipatory principles operate in real-world, place-based governance settings such as NCB projects. The implementation of NCBs in coastal zones demands not only collaboration but also long-term thinking. Anticipatory governance provides analytical tools to examine how foresight and flexibility are built into project design and

governance processes. This literature underpins the Anticipatory Governance Framework (Muiderman et al., 2020) adopted in this study. It complements the collaborative governance perspective by focusing explicitly on future-oriented decision-making and adaptive capacity in the face of uncertainty.

2.4. Governance Complexities in Long-term Environmental Projects

Long-term environmental governance confronts complexity, uncertainty, and value diversity within interconnected socio-ecological systems (Underdal, 2010). As Underdal (2010) states, complexity has arisen from interconnected ecological, social, and economic systems, while uncertainties have stemmed from unpredictable environmental changes and shifting stakeholder priorities. Project proliferation adds coordination challenges but can also foster innovation (Sjöblom & Godenhjelm, 2009). Loorbach (2009) has proposed the Transition Management (TM) framework as a governance strategy, which help balancing these factors via participatory processes, long-term visioning, and iterative policy adjustments. This aligns with calls for flexible, inclusive governance reconciling diverse interests while maintaining ecological integrity (Waylen et al., 2023). These studies have collectively offered robust theoretical frameworks and empirical insights into managing complexity in environmental governance. The inclusion of adaptive management and transition theories (Loorbach, 2009; Aarrevaara et al., 2023) has strengthened the understanding of how to navigate uncertainties. Empirical studies by Waylen et al. (2023) and Sjöblom and Godenhjelm (2009) have provided practical examples of how governance complexities manifest in real-world cases.

The governance of Dutch coastal NCB projects takes place in a complex policy landscape, with multiple actors, long time horizons, and shifting ecological and political conditions. Understanding how governance structures adapt to these complexities is vital for evaluating both collaboration and anticipation. This literature supports integrating collaborative and anticipatory frameworks by illustrating the conditions under which they must operate. Transition Management provides further depth to understanding iterative and inclusive governance strategies, while also highlightling the challenges of applying these models in real-world projects.

2.5. Theoretical Framework, Conceptual Models, and Operationalization

This research builds on two complementary governance frameworks to investigate how stakeholder collaboration and future-oriented thinking influence the development and outcomes of coastal Natural Climate Buffer (NCB) projects in the Netherlands. The first is the Collaborative Governance Framework (Emerson et al., 2011), which provides a structured lens for understanding the internal dynamics of stakeholder interaction. The second is the Anticipatory Governance Framework (Muiderman et al., 2020), which focuses on how actors imagine, prepare for, and respond to future uncertainty. These two frameworks are applied in an integrated way: while Emerson's model helps

trace how collaboration unfolds, Muiderman's framework allows us to explore how anticipatory orientations shape these interactions. By combining both, this research moves beyond identifying whether stakeholders collaborate, to analyze how collaboration is affected by the way futures are perceived, debated, and acted upon.

This integrated approach is particularly applicable for long-term climate adaptation projects like coastal NCBs. This is because multiple stakeholders are required to make decisions under deep uncertainty. The main idea is that anticipatory governance and collaborative governance are not separate processes; anticipation is a component of stakeholder collaboration, and the ability of actors to align or negotiate their expectations for the future is a determining factor in the success of collaboration.

2.5.1. Collaborative Governance Framework

One of the central theoretical foundations of this research is the Collaborative Governance Framework (CGF) developed by Emerson et al. (2011). This framework is particularly suitable for analyzing complex, long-term climate adaptation projects like coastal NCBs, where multiple actors across sectors, levels, and disciplines must work together under uncertainty. In such contexts, governance is not limited to formal hierarchies, but takes shape through dynamic, horizontal collaboration.

The framework provides a structured way to assess how collaborative processes emerge, evolve, and produce outcomes. It conceptualizes collaboration as a function of three core dimensions: principled engagement, shared motivation, and capacity for joint action. These are embedded within a collaborative governance regime that is in turn influenced by broader system context and specific initiating drivers (e.g., ecological urgency, policy change, or interdependence of resources). The collaborative governance dynamics contain the following characteristics:

- *Principled engagement* refers to the quality and inclusiveness of dialogue, joint fact-finding, and problem framing.
- *Shared motivation* captures the presence of mutual trust, legitimacy, and collective commitment.
- *Capacity for joint action* includes leadership, knowledge, resources, and institutional arrangements that enable collaboration.

Figure 1 shows the visualization of Emerson et al.'s collaborative governance framework, including the dynamics mentioned above.

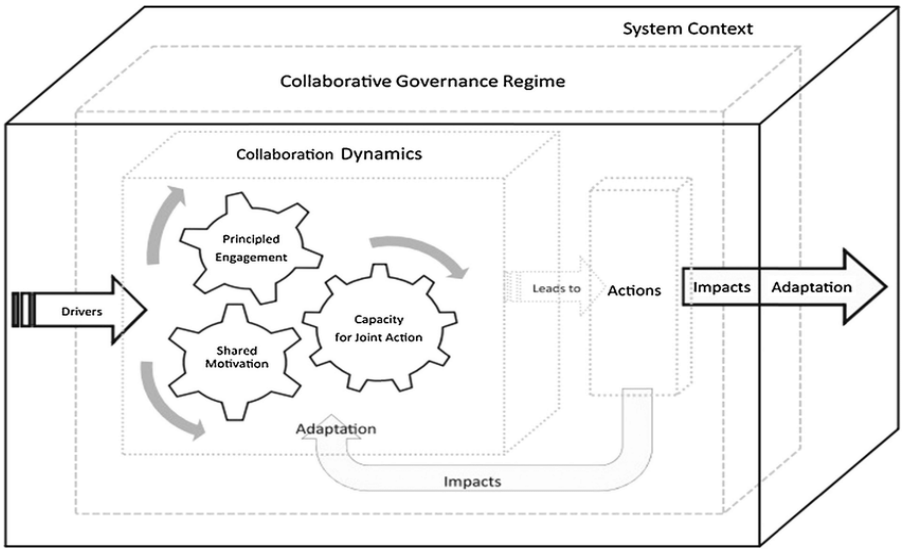

Figure 1: The integrated framework for Collaborative Governance by Emerson et al. (2011)

Crucially, the framework does not assume collaboration to be inherently positive. Rather, it offers a tool to evaluate which governance qualities function as an enabler or barrier to effective cooperation in response to shared challenges. In this study, it helps identify why some NCB projects succeed in fostering stakeholder collaboration and adaptability, while others encounter difficulties.

By applying this framework comparatively across the Sand Motor, Hondsbossche Dunes, and Marconi Salt Marshes, the research seeks to uncover patterns in stakeholder collaboration. It looks at what makes it robust, adaptive, and inclusive, or conversely, what makes it fragile, imbalanced, or unsustainable. Importantly, the framework also allows us to explore how governance processes evolve over time and across project phases. Because this study integrates anticipatory governance into the collaborative framework, it further investigates how the quality of stakeholder collaboration is shaped by future-oriented approaches. This will be discussed in more depth in the following section.

2.5.2. Anticipatory Governance Framework

In addition to analyzing collaboration dynamics, this study draws on the Anticipatory Governance Framework (AGF) as developed by Muiderman et al. (2020). This framework helps to investigate how different actors think about and engage with the future and how these orientations affect governance processes and outcomes. The AGF is based on the premise that governance systems are not only reactive but also inherently future-oriented: they involve decisions made today based on expectations, visions, or fears about tomorrow. Especially in long-term climate adaptation projects like coastal NCBs where outcomes may take decades to materialize and uncertainty is high, understanding how actors anticipate is essential. Stakeholders may differ not just in their current interests, but also in their assumptions about how the future will unfold.

Muiderman et al. (2020) distinguish four dominant approaches to anticipation, shown on the horizontal axis of figure 2. The vertical axis shows the implications for the present. As seen in this figure the future can be conceptualized in the following four futures:

1. Probable futures: Based on predictive modeling, forecasting, and controlling future risks;
2. Plausible futures: Using foresight tools like scenario planning and horizon scanning;
3. Plural futures: Recognizing the coexistence of diverse and contested future visions;
4. Performative futures: Centered on imagination, experimentation, and co-creation of desired futures.

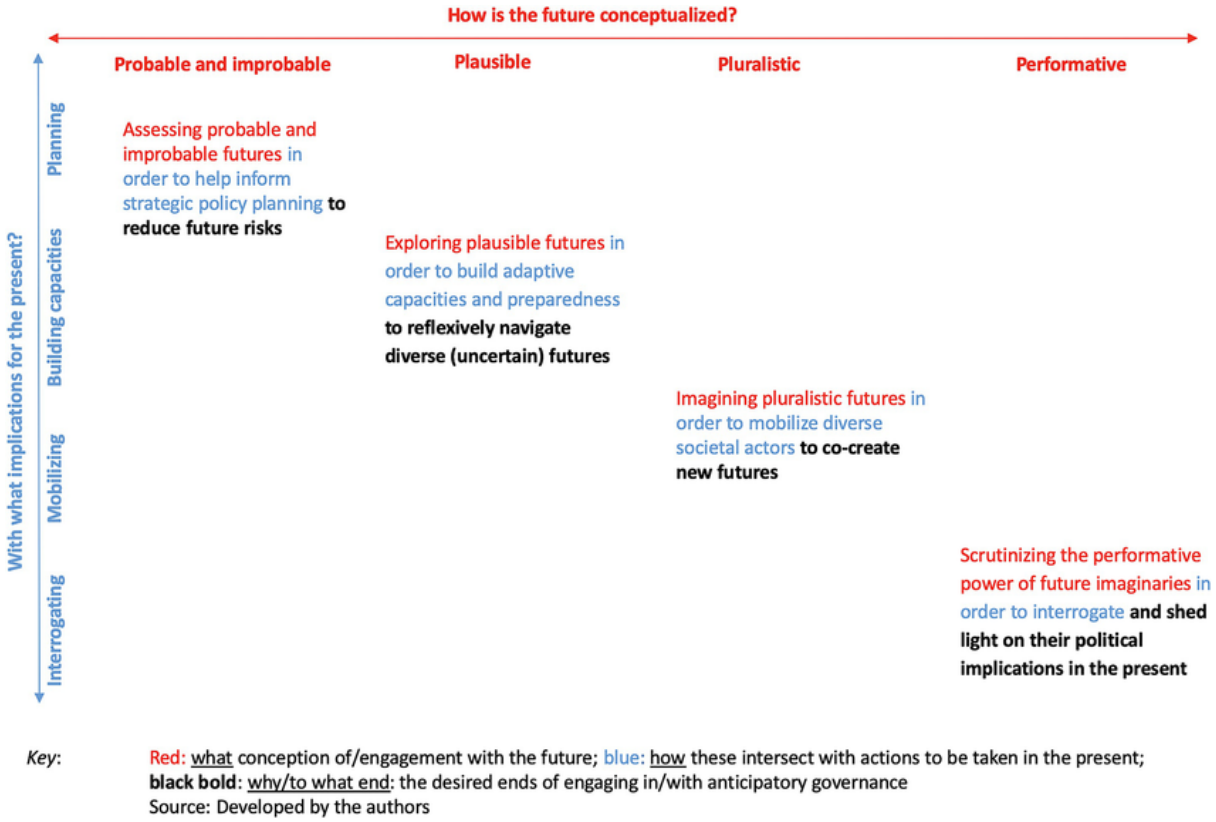

Figure 2: Approaches to Anticipation (Muiderman et al., 2020)

These orientations affect how governance actors frame problems, justify interventions, and relate to one another. For example, a water authority that uses hydrodynamic models (probable) may clash with NGOs that advocate for open-ended ecological restoration (performative or pluralistic). These mismatches can influence not only decisions, but also trust, legitimacy, and the willingness to collaborate.

In this research, anticipation is not treated as a separate or standalone dimension. Instead, anticipatory elements are integrated into collaborative governance dynamics, making them visible within principled engagement, shared motivation, and joint capacity. By coding and analyzing how different actors engage with the future and how these orientations affect collaboration, the study sheds

light on how anticipatory governance can either strengthen or undermine long-term adaptability, and stakeholder collaboration. In some cases, anticipation serves as a driver that catalyzes collaboration; in others, mismatched expectations about the future create barriers. This integrated approach allows the research to go beyond static assessments of governance to explore how long-term thinking, uncertainty, and imagination shape present-day collaboration in Dutch coastal buffer projects.

2.5.3. Conceptual Framework

Based on the integration of the CGF (Emerson et al., 2011) and the AGF (Muiderman et al., 2020), a conceptual framework has been developed to guide this research (Figure 3). This framework provides a structured lens to analyze how collaboration and anticipation interact in shaping stakeholder dynamics and long-term project outcomes in Dutch coastal NCB projects.

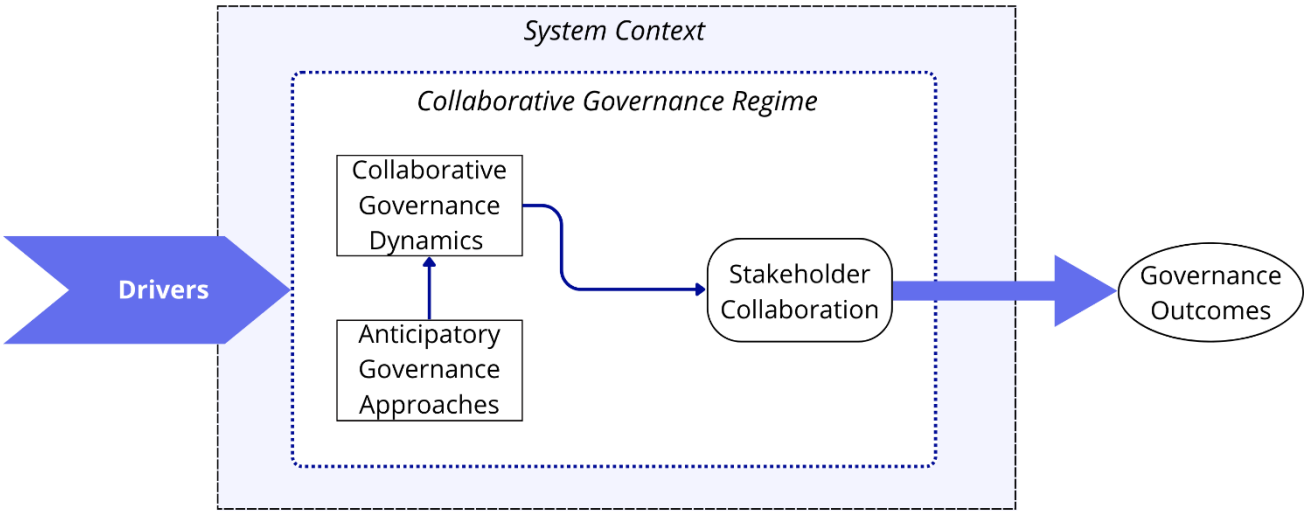

Figure 3: Conceptual framework of the research

The model connects several core components. Drivers are external or contextual pressures (e.g., ecological urgency, regulatory changes, or uncertainty about long-term sediment behavior) that catalyze the need for stakeholder collaboration. They initiate the collaborative process by highlighting interdependence or future risk and are thus the first link in the governance process. These drivers operate within a broader system context, which includes political, ecological, institutional, and socio-economic factors. This system context influences and is influenced by the collaborative governance regime over time. For instance, decentralized water governance in the Netherlands shapes who is involved and how.

In response to drivers, a collaborative governance regime emerges. Following Emerson et al. (2011), this regime is broken into the three dynamic dimensions: principled engagement, shared motivation, and capacity for joint action. This research adds a key innovation by embedding anticipatory governance directly into these collaborative dynamics. Each of Emerson's dimensions is examined

for how it is shaped by anticipatory orientations. Therefore, anticipation is not treated as separate, but as something that shapes the collaborative governance dynamics and influences how actors consider uncertainty, negotiate long-term visions, and design adaptive pathways. Finally, these collaborative and anticipatory dynamics shape the collaborative outcome; the dependent variable in this research. This includes not just whether the project was implemented, but how inclusive, adaptive, and resilient it is in the long term.

In summary, this conceptual model helps investigate the full chain from external pressures and stakeholder collaboration to project performance, while integrating future-oriented approaches into the core of governance analysis. It enables comparative analysis across three case studies, helping to explain what enables or barriers occur to a successful long-term coastal climate adaptation through collaborative and anticipatory governance.

2.5.4. Operationalization

Dimensions	Variables	Indicators	Literature
General System Context	Resource Conditions	- Availability, scarcity, or degradation of resources.	Emerson et al. (2011)
	Policy & Legal Frameworks	- Presence of regulations, administrative structures, and judicial rulings that impact collaboration.	Emerson et al. (2011)
	Political and Power Relations	- Influence of political actors, governance structures, and stakeholder power imbalances. - Degree to which powerful actors shape anticipatory processes and outcomes.	Emerson et al. (2011) Muiderman et al. (2022)
	External events	- Influence of external shocks like elections, policy changes, or environmental disasters on collaboration.	Emerson et al. (2011)
Drivers	Leadership	- Identification of a central figure initiating and guiding collaboration. - Ability to remain neutral, build consensus, and mediate conflicts. - Capacity to secure funding, staffing, and technological support.	Emerson et al. (2011)
	Consequential Incentives	- Perceived benefits or costs that motivate stakeholders to engage in collaboration. - Regulatory requirements, funding opportunities, political pressure, reputational risks, or legal mandates. - Encourages participation when actors recognize that collaboration yields better or more acceptable outcomes than acting alone or maintaining the status quo.	Emerson et al. (2011)
	Interdependence	- Recognition that no single actor can solve the problem independently. - The need for pooled resources, knowledge, jurisdictional authority, or complementary capabilities. - Emphasizes mutual reliance to achieve shared or overlapping goals in complex, cross-sectoral challenges.	Emerson et al. (2011)
	Uncertainty	- Degree of ambiguity in problem definition and potential solutions. - Motivation to collaborate due to uncertain outcomes or shared risks. - Extent to which traditional avenues (e.g., litigation, legislation) fail to provide solutions.	Emerson et al. (2011)
Collaborative Dynamics	Principled Engagement	- ***Discovery***: Identification of shared interests, joint fact-finding activities, and analytical investigations. - ***Definition***: Clarity in common purpose, shared terminology, aligned expectations, and established criteria for decision-making. - ***Deliberation***: Frequency of discussions, conflict resolution effectiveness, presence of structured debate. - ***Determination***: Number of agreements reached, procedural decisions made, and action items implemented.	Emerson et al. (2011)
	Shared motivation	- ***Trust***: Level of reliability among participants, consistency in commitments, and presence of cooperative behavior.	Emerson et al. (2011)

		- ***Mutual Understanding***: Recognition and respect for differing perspectives, evidence of active listening, and reduced misunderstandings. - ***Legitimacy***: Participants' perceptions of the legitimacy of the process and decisions made level of engagement and commitment. - ***Shared Commitment***: Endorsement of collective goals, continuity, and investment of resources.	
	Capacity for joint action	- ***Arrangements***: Existence of governance structures, rules of engagement, and formal agreements. - ***Leadership***: Presence of conveners, facilitators, and leadership roles; ability to resolve disputes and drive collaboration. - ***Knowledge***: Degree of information sharing, joint learning initiatives, and integration of expert knowledge. - ***Resources***: Availability of funding, logistical support, technical expertise, and infrastructure.	Emerson et al. (2011)
Type of anticipation approach	Probable and Improbable Futures	- Stakeholder identifies and characterizes the most likely or probable future. - Predictive stance - Quantitative modelling, extrapolation; trend and megatrend analysis; technology assessment; GIS.	Riedy (2025) Muiderman et al. (2020)
	Plausible Futures	- Stakeholder explores or maps the range of possible futures that could emerge. - Focuses on discontinuities - Scenarios; sensitivity analysis; no or least regrets analysis; futures wheel; Three Horizons; environmental scanning; strategic interviews/Delphi; weak signals; wild cards; causal layered analysis	Riedy (2025) Muiderman et al. (2020)
	Performative Futures	- Stakeholder identifies or imagines desirable futures. - Introduces discontinuities - Visioning; Three Horizons; backcasting; roadmapping; multi-criteria analysis; pathway analysis	Riedy (2025) Muiderman et al. (2020)
	Pluralistic Futures	- Stakeholders engage with multiple, coexisting perspectives and values about the future. - Participatory stance. - Methods include deliberative foresight; participatory scenario building; visioning workshops; role-playing; serious games; storytelling; transdisciplinary co-production; arts-based methods; intercultural dialogues.	Muiderman et al. (2020)

Table 1: Operationalization of the research

Chapter 3: Methodology

3.1. Research Philosophy and Research Design

The ontology underlying this research aligns with a constructivist perspective, emphasizing that knowledge of governance, stakeholder relationships, and socio-ecological dynamics is socially constructed through interactions and experiences (Moon & Blackman, 2014). Reality is seen as shaped by actors' perceptions, values, and actions rather than being objective and static. This is particularly relevant to the study, as diverse people interpret climate challenges and governance processes differently (Broadbent et al., 2016), reinforcing the idea that the future is actively shaped by present decisions and expectations. Epistemologically, the research adopts a constructivist paradigm emphasizing subjectivism, where knowledge emerges through co-creation between the researcher and participants (Moon & Blackman, 2014). Moon and Blackman (2014) distinguish ontology (what exists) from epistemology (how knowledge is obtained), highlighting that governance structures and stakeholder dynamics are socially constructed but influenced by real-world phenomena. The study seeks to understand these constructions through direct stakeholder engagement. Complementing this approach, future studies' epistemology addresses how anticipatory knowledge is formed despite the inherent uncertainty of future events. Clardy (2021) and Sonk (2015) argue that participatory processes, scenario planning, and foresight methods enable stakeholders to envision multiple futures and develop adaptive strategies, aligning with the constructivist focus on collaborative meaning-making.

This research employs qualitative design through three case studies, combining desk and field research, aligning with its constructivist paradigm that emphasizes socially constructed realities and stakeholders' subjective experiences in climate adaptation governance (Guba & Lincoln, 1994; Moon & Blackman, 2014). Qualitative methods offer the depth and flexibility needed to explore how diverse stakeholders perceive climate risks, negotiate governance, and co-construct solutions. These methods uncover stakeholders' interpretations of collaborative and anticipatory governance and its effect on stakeholder collaboration. Given the AGFs' focus on how stakeholders envision uncertain futures, qualitative approaches are well-suited to capture the iterative, interpretive nature of future-oriented knowledge construction (Clardy, 2018; Sonk, 2015). Likewise, the CGF (Emerson et al., 2011) is instrumental in this research as it provides a structured lens to examine how diverse stakeholders engage in joint decision-making, build shared motivation, and coordinate actions.

Furthermore, a comparative case study design was chosen to enable cross-case analysis of stakeholder collaboration and future-oriented governance in diverse contexts. This approach

allows for identifying patterns and variations across cases, enhancing the explanatory power of the research (George & Bennett, 2005). Yin (2014) emphasizes that comparative case studies are particularly valuable when exploring complex governance processes involving multiple actors, time frames, and uncertainty. This fits the study since that is the case in coastal NCB projects.

3.2. Research Methods, Data Collection, and Data Analysis

This research employs a multi-method qualitative approach to understand how stakeholders in the NL2120 program's coastal NCB projects anticipate and govern future climate challenges (Caggiano & Weber, 2023). Methods include stakeholder identification, semi-structured interviews, and document analysis. These approaches explore enablers and barriers in collaborative and anticipatory governance, and the epistemologies underlying stakeholder engagement with futures thinking. While this research is primarily qualitative, it incorporates a light quantitative element by scoring collaborative governance dynamics on a scale from -2 to +2. This scoring system, based on a structured coding framework, enables systematic comparison across cases (Creswell & Plano Clark, 2011), and are applied to each key variable of collaborative governance. Scores were based on a synthesis of coded interview segments and supporting document evidence. This method supports transparent, systematic cross-case comparison.

Semi-structured interviews provide qualitative insights into stakeholder engagement, motivation, capacities, and anticipatory approaches. Participants include project initiators, policymakers, environmental organizations, research institutes, and private sector actors. This method balances open-ended exploration and structured inquiry (Adeoye-Olatunde et al., 2021), enabling participants to share experiences while systematically addressing themes like hybrid governance structures and collaborative dynamics. The interviews dive into the epistemologies of futures by exploring how stakeholders conceptualize uncertainty, time horizons, and desired futures, offering insights into the assumptions and cooperative behavior shaping collaborative outcomes. Questions are guided by the interview guide (Appendix A), which includes descriptive inquiries about collaborative dynamics and anticipation process designs. Furthermore, the interviews investigate how diverse epistemologies of futures interact in multi-stakeholder discussions. They also aim to highlight both conflicts and synergies between perspectives, revealing how anticipatory governance functions when formal and informal actors deliberate together.

Interviews are supplemented by document analysis to validate findings and contextualize viewpoints. This involves reviewing project reports, project evaluations, policy evaluations, and

monitoring reports. The analysis identifies historical stakeholder roles and examines how the system context has influenced collaborative and anticipatory governance in coastal NCB projects. Following the multi-stakeholder approach, stakeholder identification maps involved stakeholders. This approach includes stakeholder categorization, providing insight into how different actors collaborate within projects.

Respondents were selected based on their active involvement in the selected projects and their roles in collaborative or anticipatory governance. They included policy advisors from Rijkswaterstaat, ecological NGO representatives, project coordinators from provincial governments, and researchers from knowledge institutes. Table 2 shows the chosen stakeholder for the interviews, table 3 presents the document types and why they have been selected for this study.

	#	Name	Organization	(Project) Position
Hondsbossche Dunes	1	Bob Kuijper	Hoogheemraadschap Noord-Hollands Kwartier	Contact Manager
	2	Yaron Daniel	Hoogheemraadschap Noord-Hollands Kwartier	Project Secretary
	3	Willem Bodde	Witteveen + Bos	Project Engineer
	4	Stéphanie Ijff	Deltares	Biologist
Marconi	5	Geert Kloetstra	LTO Noord	Provincial Advisor
	6	Petra Danker	EcoShape	Project Manager
	7	Matthijs Buurman	Province Groningen	Policy Advisor
	8	Paul Vertegaal	Natuurmonumenten	Expert Climate Buffers
Sand Motor	9	Rob Ammerlaan	Hoogheemraadschap Delfland	Member Advisory Committee
	10	*Anonymous*	Province South-Holland	Landscape Architec
	11	Marc Janssen	Stichting Duinbehoud	Director Stichting Duinbehoud
	12	Carola van Gelder	Rijkswaterstaat	Project Manager
	13	Boukelien Bos	Staatsbosbeheer	Member of NL2120 coalition

Table 2: Interview respondents with numbering

	Source	Type	Why selected?
Hondsbossche	Bodde et al. (2019)	Project Report	Details project design, implementation, monitoring, and outcomes.
	Leenders et al. (2018)	Project Report	Details enhanced coastal flood defense while accommodating natural dynamics, and stakeholder objectives.
	IJff, Arens & Bodde (2015)	Project Evaluation	Links measurements to stakeholder experiences of sand, and evaluates the effectiveness of mitigation measures.
Sand Motor	Luijendijk & van Oudenhoven (2019)	Project Evaluation	Reflects on six years of project research across themes of coastal safety, dune formation, ecology, hydrology and governance.
	Huisman et al. (2021)	Project Report	Evaluation of the Sand Motor pilot over its first decade on dune growth, coastal safety, ecological development, recreation, innovation, and management.
	Gerdes et al. (2021)	Policy Evaluation	Assesses whether the project met its policy goals and effectiveness in practice.
Marconi	Leuven et al. (2021)	Project Report	Information about the design, construction, and early development of a pilot salt marsh. Shares practical insights and lessons learned.
	Baptist (2020)	Monitor Report	Integrates lessons from experiments in a manual for future land managers. Offers recommendations for additional monitoring to support long-term and adaptive management.
	De Vries et al. (2021)	Monitor Report	Presents the outcomes of the monitoring program. Evaluates stakeholder involvement, perception and recreation, and integration into the urban context.
	Veraart (2019)	Project Report	Presents a game-based role-play pilot exploring the concept of ecological resilience. Explores stakeholder decision-making and system responses to environmental stressors.

Table 3: Documents selected for this research

This multi-method approach aims to understand stakeholder dynamics in coastal climate adaptation efforts comprehensively. It explores how stakeholders anticipate and govern future climate challenges while examining how collaborative governance shapes successful NCB outcomes. Analyzing drivers and the system context reveals their impact on the collaborative regime. Additionally, the study investigates epistemologies guiding stakeholder collaboration, uncovering how various ways of knowing and envisioning the future affect governance practices. Together, these methods offer a nuanced analysis and actionable recommendations to enhance adaptability, inclusivity, and resilience in coastal climate adaptation projects.

Thematic analysis is used for qualitative data from interviews and document reviews, identifying patterns related to collaboration, anticipatory approaches, and collaborative outcomes. Data from interviews and documents were analyzed using thematic coding in Atlas.ti, guided by the operationalization framework developed in Chapter 2. The coding process combined deductive elements with inductive themes emerging from the data. Thematic saturation was considered reached after nine interviews. Cross-case analysis was

used to identify patterns and differences in collaborative and anticipatory governance across the three NCB projects.

Using the operationalization, the code book explains each criterion. The analysis of interviews and documents used non-probability sampling by using non-random criteria availability, geographical proximity, and expert knowledge of the individuals (Schreuder et al., 2001).

3.3. Validity and reliability of the research

Franklin, Cody, and Ballan (2010) address the concepts of reliability and validity within the context of qualitative research. They acknowledge that, traditionally, these terms are rooted in quantitative research, focusing on measurement consistency and accuracy. However, in qualitative research, these concepts are reinterpreted to fit the nature of exploratory and interpretive inquiry. To enhance reliability and validity in qualitative research, the authors recommend strategies such as triangulation, member checking, and maintaining an audit trail. Triangulation involves using multiple data sources or methods to cross-verify findings. Member checking entails sharing findings with participants to confirm the accuracy of interpretations. An audit trail provides a transparent description of the research steps taken, allowing others to follow the decision-making process throughout the study.

As this study on coastal NCBs operates within a constructivist paradigm that values the co-construction of knowledge through interactions with stakeholders, it is essential to incorporate these definitions. By applying the recommended strategies, the researcher enhances the trustworthiness of the findings. This helps to provide a good foundation for improving stakeholder collaboration and governance through collaborative and anticipatory governance frameworks.

The constructivist ontology assumes reality is socially constructed through interactions, enhancing validity by capturing diverse stakeholder perspectives in coastal NCB projects (Moon & Blackman, 2014). This inclusivity ensures findings reflect the complexity of governance, climate risks, and stakeholder relationships. Epistemologically, the subjectivist stance emphasizes co-creation of knowledge through participatory methods like member checking, triangulation, and reflexivity, validating stakeholder perspectives and grounding the research in their lived experiences. The sample of the interviews and documents is based on stakeholders and documents within the case studies. The study aimed to interview a minimum of nine stakeholders (three per case), and six documents (two per case) depending on length and alignment with the context of the research. Stakeholder identification contributed to the preparation of the interview sample. Due to project timelines and institutional turnover, not all originally involved stakeholders were available, especially in the Marconi case. This introduced

variability in interview data availability across cases. For the document analysis, samples were selected through purposive sampling for specific cases. The samples were analyzed through coding (Appendix B) using a codebook to ensure validity and reliability.

A key challenge is eliciting detailed perspectives on future uncertainties, as many stakeholders are more comfortable discussing past events than abstract futures. This is addressed by using prompts such as “What if…” scenarios and referring to existing foresight exercises. Conflicting narratives are resolved through triangulation with policy documents or by presenting divergent views side-by-side in the analysis.

Chapter 4: Analysis

4.1. The Collaborative Outcomes

To understand the influences of collaborative and anticipatory governance, this section highlights the collaborative outcomes as dependent variable for each project. At the end of this chapter, these will be analyzed through the observed dynamics discussed below in sections 4.2 to 4.4.

4.1.1. Sand Motor

The Sand Motor project has produced diverse collaborative outcomes across ecological, social, scientific, and governance domains. Its most notable achievement is creating a dynamic, long-term coastal safety zone. Natural processes of sediment dispersion and dune formation have reinforced the Delfland coastline and improved flood protection (Huisman et al., 2021; Gerdes et al., 2021).

Ecologically, the project has fostered new, evolving habitats. Since 2016, embryonic dunes have developed, supporting coastal bird populations (Huisman et al., 2021). However, vegetation growth and habitat development have lagged due to disturbances from recreation, vehicles, and cleaning activities (Huisman et al., 2021). The project also demonstrated that large-scale nourishment could contribute to biodiversity, with marine benthic communities adapting to the changing seabed morphology, illustrating a tangible material and ecological outcome (Huisman et al., 2021). Yet, the analysis shows a lack of ecological integration, hindering full potential for ecological dynamics.

Socially, the Sand Motor has added recreational value. It attracts visitors for walking, kitesurfing, and peaceful nature experiences, consistently rated more positively than conventional beaches (Gerdes et al., 2021; Huisman et al., 2021). The area is valued for its open character and supports both artistic and scientific activities, though tensions remain

between ecological and recreational uses (Gerdes et al., 2021). Interviewed stakeholders highlighted strengthened regional identity and pride, reflecting symbolic outcomes of the intervention (Gerdes et al., 2021).

From a governance perspective, the project has served as a prototype for adaptive coastal management, promoting NbS and influencing policy both nationally and internationally (Luijendijk & Van Oudenhoven, 2019; Huisman et al., 2021; R10; R12). It fostered new institutional relationships among Rijkswaterstaat, provinces, municipalities, and research institutes, building collaborative capacity and cross-sectoral trust (Huisman et al., 2021). Yet concerns persist about the long-term sustainability of its collaborative arrangements, especially due to their non-binding nature and the lack of a vision beyond the pilot phase (Gerdes et al., 2019; Huisman et al., 2021). The lack of formalized governance for continued management underscores a limitation in sustaining these collaborative outcomes (Gerdes et al., 2021).

Scientifically, the Sand Motor enabled interdisciplinary research and advanced understanding of coastal dynamics and ecosystem behavior. Its insights have been applied to other projects and strengthened Dutch coastal management's global standing (Huisman et al., 2021; Luijendijk & Van Oudenhoven, 2019).

4.1.2. Hondsbossche Dunes

One of the most prominent collaborative outcomes of the Hondsbossche Dunes is the implementation of sand-based coastal reinforcement and habitat creation. These physical interventions have contributed to long-term flood protection and ecological resilience through the development of soft dune landscapes that integrate safety with spatial and environmental quality (Leenders et al., 2018; Ijff et al., 2015).

Ecologically, the project has led to the formation of new habitats and morphological features. The gradual development of vegetated dunes and dynamic coastal zones reflects a collaborative effort toward building with nature. Adaptive monitoring efforts were initiated to track these changes, though some ecological indicators such as vegetation establishment showed uneven progress, and monitoring efforts were eventually discontinued in places (Ijff et al., 2015; Politi et al., 2019).

Socially, the area has gained recreational and experiential value. Improvements to beach access and the creation of scenic walking and cycling paths contributed to the public appreciation of the landscape. Although some elements, such as the accumulation of sand on bike paths and access routes, led to ongoing maintenance issues, the area is widely viewed as an accessible and attractive coastal zone (Ijff et al., 2015). Stakeholder interviews reported

enhanced local pride and increased visitor numbers, indicating symbolic and social outcomes beyond flood protection alone.

Governance-wise, the project generated process innovations in design and implementation. This includes flexible tender specifications that allowed for integrated ecological and engineering solutions (Leenders et al., 2018). This reflects a collaborative outcome in the form of institutional learning and procurement innovation, fostering conditions for future nature-based coastal projects (Emerson et al., 2011).

4.1.3. Marconi Salt Marshes

The Marconi Salt Marshes project delivered collaborative outcomes across ecological, social, scientific, and governance domains, driven by strong cooperation during planning and implementation. Still, several post-implementation issues have raised concerns about long-term durability.

Ecologically, the project established a constructed salt marsh system that enhances coastal protection and habitat quality. The 15-hectare pilot marsh and salt marsh park created a gradual land-water transition, supporting species diversity. Vegetation thrived in areas with 20–50% mud content, while Salicornia seeding had limited long-term success (De Vries et al., 2021; Leuven et al., 2021). Pioneer vegetation and tidal creek formation improved ecological value, aiding sediment transport and fish habitats. Still, underdeveloped creek networks, mixed sedimentation results, and slow vegetation growth in some zones reflected uneven ecological outcomes (De Vries et al., 2021).

Socially, the project reconnected Delfzijl residents with the Wadden Sea through the accessible city salt marsh (stadskwelder) and public infrastructure. These elements boosted recreational and aesthetic value and blended ecological goals with urban renewal. The integrated bird breeding island added symbolic, educational, and biodiversity benefits (Leuven et al., 2021). Scientifically, the project produced valuable interdisciplinary data on salt marsh morphology, vegetation development, and substrate effects. The experimental use of varying mud contents and rigorous monitoring contributed to the broader body of NbS research (Leuven et al., 2021; Baptist, 2020).

Governance-wise, the project brought together municipalities, NGOs, researchers, and funders in a cross-sectoral model, yielding a shared monitoring program and a multi-stakeholder pilot marsh (Leuven et al., 2021; De Vries et al., 2021). Despite these gains, governance limitations emerged. Roles remained consultative rather than co-productive (R5),

and regulatory misalignments constrained adaptive approaches (R6), raising concerns about long-term institutionalization (Emerson et al., 2011; De Vries et al., 2021).

4.2. System Context

All projects operate through a multi-level governance framework. Here national, provincial, and local governmental organizations come together with scientific institutes, businesses, and non-profit organizations (Huisman et al., 2021; Bodde et al., 2019; de Vries et al., 2021). This multi-actor environment reflects a dense governance landscape typical of Dutch coastal and water management. By exploring the starting situation of the projects, this paragraph answers the sub-question on how the system context influences governance in Dutch coastal NCB projects.

This multi-leveled environment is regulated by several legal and policy frameworks, which the projects must consider. In this section we mention the seven most important regulative frameworks. Starting with the EU legal frameworks, one of the frameworks is the Natura 2000 (Huisman et al., 2021; Bodde et al., 2019; Baptist, 2020). All three projects are adjacent to Natura 2000 sites. They require compliance with the EU Habitats Directive 92/43/EEC and the EU Birds Directive 2009/147/EC (Huisman et al., 2021; Bodde et al., 2019; Baptist, 2020). This means that every activity must undergo an Appropriate Assessment to ensure there is no significant negative impact on the conservation objectives of these protected areas (Möckel, 2017). Other regulations such as the EU Water Framework Directive and the EU Marine Strategy Framework Directive also apply in the three projects (European Commission, 2000).

Besides the EU regulations, the projects need to comply with national and regional Dutch legal and policy frameworks. The Dutch Water Act is an important one for this kind of projects. This legal framework governs flood risk management and water system maintenance (Ministry of Transport, Public Works and Water Management, 2010). All three projects are seen as an act of “dynamic coastal management” (Luijendijk & Van Oudenhoven, 2019; Bodde et al., 2019; Leuven et al., 2021). Since 1990, dynamic coastal management has been a fundamental part of national coastal policy (Löffler, 2010). Dynamic coastal management is part of the national water policy, as defined in the National Water Program 2022-2027 (Kustbeleid | Dynamisch Kustbeheer, n.d.). Furthermore, the Dutch Environmental Act, in force since 2024, must be considered within the already existing projects. This regulation integrates the former Flora and Fauna Act, Forest Act, and Nature Conservation Act. It also operationalizes Natura 2000 obligations in national law.

Figure 4: Policy and legal context

This law requires permits for interventions affecting protected species or habitats (Inhoud Van De Omgevingswet, n.d.). In addition, these projects are aligned with long-term strategies under the first Delta Programme. The aim of the Delta Programme is to continue to protect the Netherlands against high water and to maintain the freshwater supply (Informatiepunt Leefomgeving, n.d.).

The Netherlands has a long history of doing sand nourishment, present in all three projects. Since the 1970s, the Netherlands sprayed sand on the coastline to increase safety. The Dutch government took on the task of stopping structural coastal degradation and took the responsibility for the sand nourishments (Roelse, 2002). This ensures that the Netherlands has the knowledge, experience, and technical resources to implement the projects.

External system pressures such as climate change, sea level rise, and extreme weather further complicate the governance context (De Vries et al., 2021; Huisman et al., 2021; Baptist, 2020). Within coastal climate buffer projects there are a few external events that are present. Legal rigidity and contested permitting processes often involved high-level courts or ministries. These disrupted or delayed project implementation and required negotiation or adaptation (R7; R1; R2). Political instability or volatility, whether through reactive governance delayed action or forced course corrections (R7; R10; R13). Another external event that such projects faced was the possibility of public resistance, causing delaying procedures at the Council of State (R1; R2; R4).

4.2.1. Sand Motor

Within the Sand Motor project lay a complex governance system. This is a multi-layered system involving various administrative levels, institutional frameworks, and societal interests (Huisman et al., 2021; Gerdes et al., 2021). The respondents of the interview showed a strong embeddedness in this multi-level governance structure where national, provincial, and local governmental organizations came together with scientific institutes, businesses, and non-profit organizations (Huisman et al., 2021). Within the collaboration of all participating organizations, there is a mix of hierarchical and horizontal relationships. What made the Sand Motor special in system context was that it also functioned as a “living lab” where policy, knowledge development, and management were assessed in real-life conditions (Luijendijk & Van Oudenhoven, 2019). This living lab model allowed stakeholders to explore long-term coastal dynamics through iterative learning, though later phases revealed weak institutional structures to sustain such learning post-implementation.

According to a respondent of an interview about the Sand Motor in 2019, funding of the Sand Motor was one of the bottlenecks for this project. He stated that Rijkswaterstaat would probably

remain the chief management authority, and they had limited funds for monitoring the Sand Motor. He emphasized that this was where the shoe pinched, because nobody would do the monitoring by themselves (Luijendijk & Van Oudenhoven, 2019). An interview with a Climate Buffer expert confirmed the financial shortage. Respondent 13, on behalf of Staatsbosbeheer, said:

> "*The whole natural climate buffers program started with a grant of 20 million in 2006 or 2008 and there it was that that was available for 20 projects, say, one million each. (…) So, in the first phase, we had money, and we could actually implement projects in the coalition. When that was over… Then the coalition actually kind of sagged."*

The province of South Holland led the Sand Motor project, which was unusual, since provincial governments are not formally responsible for coastal management in the Netherlands. While non-experimental projects were initiated and managed by water authorities under the Water Act, experimental projects could be conducted by actors who were not water authorities, as was the case with the Sand Motor (Luijendijk & Van Oudenhoven, 2019). From the interviews we see that the legal and policy context was fragmented. This was partly due to institutional silos between ministries and the lack of formal nature protection status, such as Natura 2000, for the area. This restricted integrative approaches and multifunctional management, emphasizing coastal safety as a priority that sometimes conflicted with nature conservation and recreational interests (R9; R11). Besides that, the project existed within a dynamic ecological context with operational constraints caused by seasonal factors such as storms and breeding seasons, which affected practical implementation (R10; R11).

4.2.2. Hondbossche Dunes

Just like the Sand Motor project, the interviews and literature on the Hondsbossche Dunes revealed a multi-leveled governance environment (R1; R2; R3; R4; Bodde et al., 2019; Ijf et al., 2018). It was also marked by ecological sensitivity, multi-level regulatory frameworks, and institutional fragmentation. This multi-actor setting both enabled diversity and complexity, due to a range of expertise and perspectives, but also differing cultures and priorities (Craps et al., 2019). According to respondent 4, institutional rigidity was a significant barrier to realizing holistic coastal zone management and NbS. Within this project, there were fragmented institutional roles between Rijkswaterstaat and waterboard Hoogheemraadschap Hollands Noorderkwartier (HHNK) that amplified challenges.

The project operated within a highly regulated setting. This was shaped by formal rules including subsidy schemes like the high-water protection program (HWBP), strict nature conservation laws like Natura 2000, and procedural requirements. While these frameworks

provided structure and accountability, they also caused administrative burdens and procedural bottlenecks. Two respondents agreed that this could influence adaptive and flexible collaboration (R2; R4). The project was under a lot of political and public attention (R1), which raised the pressure to succeed but also made it harder to coordinate. Differences in administrative culture between organizations contributed to friction within governance processes (R1; R2). Friction in this matter will be further discussed in section 4.3.2.

EcoShape functions as consortium for this project. It introduces a policy space focused on innovation and *Building with Nature* (concept used by EcoShape, 2021a). This way they tend to balance ecological and infrastructural objectives. Yet, respondent 3 states that innovation efforts must navigate the institutional complexities and regulatory environment.

4.2.3. Marconi Salt Marshes

Across all interviews, stakeholders consistently pointed to the interplay of multiple governmental levels. For this project it contained municipal, provincial, and national levels, alongside various non-governmental actors, and the environmental consortium of EcoShape. Just like the other two projects, Marconi Salt Marshes were embedded in a region marked by competing land-use priorities and regulatory constraints. Respondents highlighted the historical fragmentation in the Eems-Dollard area where agricultural interests, ecological restoration, flood protection, and economic development frequently collided (R5; R6; R7). This resulted in a governance setting where coordination was challenging and decision-making was often slowed by bureaucratic procedures and sectoral silos.

Since this project is categorized as CO2 sink and living coast, it especially plays a significant role in strategies to CO2 reduction and sea level rise (Klimaatbuffers, n.d.-a; n.d.-b). These environmental uncertainties influence the project's design and underscore the need for adaptive, eco-dynamic approaches, as emphasized by respondents 6 and 8.

Overall, the system context of the Marconi project reflects a complex and fragmented governance environment, shaped by ecological urgency, socio-economic tensions, and institutional arrangements. These are all factors that influence the collaborative dynamics at play. In section 4.3.3. we zoom in to these and other influences in detail.

4.3. Drivers

The collaboration within the NCB governance is motivated by several key drivers based on Emerson et al.'s (2011) integrative framework. In this paragraph the most prominent drivers for the case studies are highlighted. By overviewing these, this section contributes to

answering the sub-question on what key drivers motivate actors to engage in collaborative governance for coastal NCB projects.

4.3.1. Sand Motor

One of the main drivers for the project is the presence of uncertainties and complexities. Uncertainties relate to sediment transport, ecological impacts, long term effectiveness, and climate change (R11; R12; Luijendijk & van Oudenhoven, 2019). Due to these factors, there is a strong necessity for joint action and adaptive coastal management. Another critical driver is interdependence, as no single actor can achieve the project's main goals (safety, nature conservation, and recreation) independently. Shared mandates, complementary knowledge, and pooled resources necessitate collaboration.

Also, the consequential dimension is a strong driver for the Sand Motor. Societal urgency around climate adaptation and coastal safety constitutes the foremost motivation (Luijendijk & van Oudenhoven, 2019; Huisman et al., 2021). This is an important reason for the stakeholders to work together, despite their differences. Besides, for Stichting Duinbehoud ecological conservation acts as an additional driver. They emphasize environmental sustainability alongside safety concerns (R11). The respondent of the province mentions a layered set of drivers. He states that the number one driver is coastal safety. This is followed by ecological restoration and maintenance of natural coastal dynamics. Social interests like recreation and tourism are seen as a secondary consideration by the province (R10).

4.3.2. Hondsbossche Dunes

For the Hondsbossche Dunes, interdependence emerges strongly across respondents as a foundational driver. Governments like HHNK and Rijkswaterstaat rely on each other to fulfill complementary roles. Other stakeholders emphasize the importance of mutual dependence for knowledge sharing, technical capacity, and legitimacy. Collaboration is necessary in this project since no one actor can accomplish the project goals on their own.

Consequential incentives are linked to the project's high stakes: the large financial investment and an urgent imperative of coastal protection could create performance pressures (R1; Van Donk et al., 2019). Failure would have led to significant damage for both the involved stakeholders and safety of the area. Uncertainty in both ecology and technology is an important driver for this project. Sea level rise and climate change increase this uncertainty, necessitating adaptive approaches to changing circumstances (Bodde et al., 2019). Legal and regulatory pressures, such as Natura 2000 restrictions and subsidy requirements, are additional motivators. These forces both forced cooperation of the various stakeholders (Emerson et al., 2011).

4.3.3. Marconi Salt Marshes

Across the interviews, four primary drivers emerged for this project: leadership initiative, interdependency, consequential incentives, and uncertainty management.

A key factor in starting and forming the stakeholder collaboration was *leadership initiative*. The Province of Groningen and the consortium EcoShape were actively present in initiating the project and promoting NBS as a central approach (R6; R7). These actors provided strategic direction and mobilized other stakeholders to collaborate. Everyone recognized the importance of *interdependence* as a driver. All respondents emphasized that no single organization had the capacity, mandate, or expertise to address the challenges of coastal safety, ecological restoration, and spatial development on their own. The necessity of bringing together shared knowledge, resources, and decision-making established a need for stakeholder collaboration (R6; EcoShape, 2021a). *Consequential incentives* further motivated participation. The prospect of achieving multiple objectives like flood protection, ecological conservation, and urban spatial planning encouraged alignment among stakeholders (R6). This drove governmental actors and technical partners. They viewed the project as a strategic opportunity to integrate innovation into regional coastal policy (Leuven et al., 2021). Another key factor was that there was an important driver *uncertainty management*. Adaptive planning and experimental governance techniques were necessary due to the unpredictable nature of climate change and ecosystem development (De Vries et al., 2021). Despite these enabling drivers, there were concerns of the province that institutional and regulatory constraints could undermine long-term collaboration (R7).

4.4. Barriers and Enablers in Collaborative Dynamics

This paragraph explores the practical challenges and supports in collaborative dynamics, including factors such as principled engagement, shared motivation, and the capacity for joint action. By doing so, it contributes to an explanation to the sub-question on what barriers and enablers affect the collaboration and anticipatory governance during distinct phases of coastal NCB projects. Each case is discussed in detail. Scores are given to the collaborative dynamics to show the influence of the presented enablers and barriers.

4.4.1. Sand Motor

Principled Engagement with Anticipatory Aspects

Principled engagement, when sustained over time and aligned with inclusive long-term visions, is crucial to the adaptive governance of dynamic coastal systems. The Sand Motor project demonstrates a varied but constructive level of principled engagement among stakeholders. This is reflected in efforts to enable inclusive participation, deliberation, and joint sense-

making. Across interviews, there was recognition of the importance of open dialogue and coordination. However, the quality, frequency, and inclusiveness of engagement were inconsistent.

Early discovery phases featured inclusive engagement, particularly via collaborations with NatureCoast and TU Delft. These partnerships enhanced legitimacy and positioned the Sand Motor as a learning-oriented pilot (R12). Rijkswaterstaat emphasizes the active participation of a variety of stakeholders, especially scientific partners like universities, who offer research projects and insights based on data (R12). This aligns the improvement of strong scientific knowledge capacity and collaboration. Anticipatory governance played a significant enabling role during these early stages. Scenario modelling and sediment flow forecasts supported a plausible futures approach, while learning-by-doing and iterative experimentation reflected a performative futures logic. These tools informed decision-making and fostered a shared sense of innovation, particularly among technical stakeholders. However, as the project transitioned into the deliberation and determination phases, the quality and inclusiveness of engagement declined.

During the deliberation phase, anticipatory modelling helped align technical actors, but this was not matched by inclusive processes for long-term visioning. As a result, the determination phase lacked shared strategic direction, especially among ecological and recreational stakeholders. The absence of co-created future scenarios or backcasting exercises meant that diverging expectations went unresolved. The absence of inclusive future visioning tools meant that different future expectations (e.g., ecological protection vs. recreational development) were never fully reconciled. This created latent conflict, undermined mutual understanding, and ultimately limited the legitimacy of post-implementation governance. For instance, Stichting Duinbehoud expected stronger commitments to long-term ecological management, which were unmet. Partially, this was due to weak enforcement (e.g., dog walking restrictions) (R11) and the absence of a shared vision for post-implementation management (Gerdes et al., 2021). The divergence in perspectives illustrated fragmentation in long-term goal alignment and gaps in institutional coordination.

Interviews with both Rijkswaterstaat and Hoogheemraadschap Delfland revealed that engagement was primarily instrumental and technical. Scientific stakeholders and Rijkswaterstaat applied real-time ecological monitoring, using anticipatory tools (e.g., models forecasting sediment flows) to inform engagement processes (R9; R12). During the deliberation phase, anticipatory modelling helped align technical actors, but this was not matched by inclusive processes for long-term visioning. As a result, the determination phase lacked shared strategic direction, especially among ecological and recreational stakeholders.

While scientific knowledge and scenario tools were present, there was limited normative inclusiveness or co-decision-making (Ansell & Torfing, 2021). Over time, the frequency of deliberation declined. Hoogheemraadschap Delfland noted that limited capacity and competing priorities hindered a deeper sense of deliberative engagement (R9). Moreover, local communities and NGOs were largely excluded from ongoing dialogue. Stichting Duinbehoud, for instance, engaged in the planning phase but withdrew later due to lack of capacity and absence of formal mechanisms to stay engaged:

> *"There are some moments in the entire process when we have been highly active. But when it was laid out at one point, we did not get involved at all for several years."* (R11).

Later-stage conflicts highlighted unresolved differences in future visions and a lack of adaptive conflict resolution mechanisms. Both Rijkswaterstaat as well as the province expressed concern that the kitesurfing club, on behalf of the recreational purpose, would want to re-excavate the inner lake within the Sand Motor (R12; R10). This underscores the challenge of managing competing interests without adaptive or co-created conflict resolution mechanisms. Nature organizations tended to assume reactive watchdog roles rather than actively shaping decisions (R11). The dominance of governmental actors, particularly Rijkswaterstaat and the Province, further limited shared ownership. As Gerdes et al. (2021) noted, no formal shared vision existed after construction. This absence of co-created long-term visions posed a critical barrier to principled engagement, weakening both strategic alignment and legitimacy. Another barrier for the determination process lay within the lack of sustained institutional clarity, role assignment, and coordination structure for the long term (Gerdes et al., 2021). The lack of clearly mandated roles and enduring coordination structures post-implementation (Gerdes et al., 2021) aligns with Emerson et al.'s (2011) concern that, without protocols, collaborative governance becomes fragmented and ad hoc. As a summary, the barriers and enablers of the principled engagement within the Sand Motor project are summarized in the table below.

Governance Dynamic	Project	Main Enablers	Main Barriers
Principled Engagement	Sand Motor	• Early co-creation with scientific partners. • Use of monitoring models for adaptive engagement (plausible futures). • Open deliberation in early stages.	• Misaligned expectations over recreation/ecology. • No co-created long-term vision (performative futures). • Faded engagement post-implementation.

Table 4: Summary barriers and enables Principled Engagement of the Sand Motor

Shared motivation with Anticipatory Aspects

Shared motivation within this project was generally strong, but sometimes fragile among its core stakeholders. This section examines how interpersonal trust, understanding, legitimacy, and commitment was shaped by both the collaborative setting and anticipatory orientations. These bring to light the barriers and enablers within the dynamic.

In the early phases, shared pride in the Sand Motor's experimental and sustainable nature fostered collective purpose, trust, and scientific collaboration (R9; R11). Trust appeared well-established, supported by clear communication, regular alignment, and mutual respect, particularly noted by Rijkswaterstaat. A respondent of one of the interviews by Luijendijk & van Oudenhoven (2019) highlighted that many parties were against the Sand Motor when it started. They were afraid that things might go wrong, and swimmer safety would be at stake. According to the article, scientific collaboration played a significant role in trust-building during the early stage of the project. Shared knowledge production, open data, and monitoring partnerships supported mutual understanding and legitimacy. Particularly between Rijkswaterstaat and academic institutions (R12). These dynamics reflect a performative futures approach, wherein learning-by-doing and experimentation helped build a shared sense of purpose and commitment.

However, as the project moved beyond the implementation phase, this cohesion began to weaken when stakeholder interests clashed over recreational access versus ecological and morphological goals. One driver of the erosions was the divergence in anticipatory orientations. As Rijkswaterstaat emphasized risk mitigation, predictive modelling, and technical control, they approached the project from a probable futures perspective. On the other hand, NGOs like Stichting Duinbehoud adopted a pluralistic futures stance, prioritizing ecological uncertainty and adaptability (R11). These mismatched visions were not actively reconciled, and due to absence of formal future visioning tools misalignment could not be decreased. These mismatches weakened legitimacy, especially for NGOs like Duinbehoud, who cited unmet ecological commitments and a missing governance vision.

The province emphasized a collective interest in prioritizing coastal safety and natural coastal dynamics, reinforcing shared commitment. Furthermore, the project's framing as a long-term adaptive experiment reflected a performative futures approach, which enabled the establishment of a collective identity rooted in resilience and sustainable innovation. However, this shared identity began to unravel as differences in anticipatory orientation emerged between actors. While Rijkswaterstaat relied on predictive modelling and linear risk management (R12), NGOs like Duinbehoud emphasized ecological uncertainty and open-ended, nature-driven change. These mismatches weakened long-term motivation, particularly

in the absence of co-owned visions and effective enforcement mechanisms. These misalignments particularly undermined internal legitimacy, as stakeholders felt their long-term priorities were not adequately recognized. Weak enforcement (e.g., dog policy) and absent long-term governance vision fueled NGO frustration (R11). Conflicts over recreational use further eroded shared motivation. The kitesurfer association's calls to re-excavate the lagoon were seen as a threat to ecological and monitoring goals (Gerdes et al., 2021). Respondent 12 described how power asymmetries influenced decision-making:

> "*Those inland waters are getting smaller and smaller, and those kitesurfers say, "Soon I won't have any water left to kitesurf," so they go to the province and say, "Dig that thing open." And then I think, that is something we do not really want. (...) Those are discussion points that we may well have."* (R12).

Such examples reveal how unresolved future conflicts, and the absence of co-created long-term visions, weakened mutual trust and commitment. The phrase "*Wie betaalt, bepaalt*" ("Who pays, decides"), cited by R12, captures how governmental funders like Rijkswaterstaat and the Province of South Holland retained disproportionate influence, undermining perceptions of fairness and inclusiveness.

There appears to be a common *commitment* to NbS, innovation, and coastal safety. This forms a strong motivational foundation that unites stakeholders despite differences in specific visions or priorities. While there was broad support for innovation and sustainability, the lack of mechanisms to manage evolving interests eroded cohesion. The foundation of shared commitment seems to be the shared pride in the project's innovative and sustainable approach (R9; R11). Though, according to some of the respondents, ecological and recreational objectives sometimes clash. This leads to frustration over enforcement and regulatory support (R11; R12). Van Gelder highlights the complex structure of different goals:

> "*Hoogheemraadschap, they would like to have as much sand in the dunes as possible, also for the future, but because those dunes are going to grow very much and there is a lot of marram grass, that sand is actually held back. That does not drift into the dunes, so the waterboard would like to dig trenches to make sure that that sand flows back into the dune area or blows in. We do not find that very convenient, because you are kind of breaking up our monitoring area with that. (…) You must deal with that in such a dynamic system."* (R12)

This suggested that while motivation was strong around technical success, it was less robust regarding deep consensus on ecological values.

Despite the strong shared foundation around innovation, NbS, and coastal safety, motivational cohesion suffered from a lack of institutional mechanisms to adapt to evolving interests. This became especially evident after construction when formal engagement structures dissolved and the project lost momentum. Staff turnover and poor handover processes disrupted institutional memory, leading to a decline in knowledge continuity and stakeholder commitment (Gerdes et al., 2021). As one respondent noted, time and energy were lost by transferring information to new team members (R9), slowing down decision-making and reducing shared ownership.

Finally, without clear accountability or long-term engagement mechanisms, motivation became conditional and ad hoc. Stakeholders were expected to stay involved but lacked the support to sustain their role. As Hoogheemraadschap Delfland warned:

> *"You do have to be very careful with these kinds of projects that you do not start losing people because it takes too much energy. Especially when things get exciting or stressful, that is one thing that is very important."* (R9)

In summary, shared motivation was initially strong, rooted in innovation, scientific legitimacy, and a performative anticipatory stance. Yet, over time, diverging futures, unclear enforcement, and weak long-term structures caused trust and legitimacy to erode. The absence of inclusive future visioning processes meant that shared motivation lacked the adaptability needed to endure beyond the project's initial success. The barriers and enablers of this dynamic are summarized in the following table.

Governance Dynamic	Project	Main Enablers	Main Barriers
Shared Motivation	Sand Motor	• Pride in flagship innovation. • Scientific legitimacy. • Early trust across sectors.	• Future orientation misaligned (probable vs. pluralistic). • Power asymmetries • No shared future vision.

Table 5: Summary barriers and enables Shared Motivation of the Sand Motor

Capacity for Joint Action with Anticipatory Aspects

The Sand Motor project showed a generally strong capacity for joint action, especially in its early phases. This dimension was initially supported by well-structured partnerships, high scientific engagement, and strong governmental commitment. However, this capacity was not fully sustained post-implementation, and anticipatory capacities, while present, remained largely technocratic and centralized.

From the start, institutional arrangements were robust. Rijkswaterstaat and the Province led implementation, supported by universities and NGOs. Leadership roles were clearly assigned

during early phases (Luijendijk & van Oudenhoven, 2019; Gerdes et al., 2021; R12; R10). In 2008, the province produced plans for the Sand Motor. In cooperation with Rijkswaterstaat and representatives of the Dutch hydraulic engineering sector, this plan was realized in 2011 (Huisman et al., 2021). From the tender phase in 2010, the project was taken over by Rijkswaterstaat (Gerdes et al., 2021). An advisory board with a high-profile chair was established to ensure broad representation. This improved legitimacy and inclusiveness during early phases of decision-making (R12; Luijendijk & van Oudenhoven, 2019; Gerdes et al., 2021). This structure reflects improvement in enabling stakeholder collaboration. 4TU Centre for Research Data, Delft University of Technology and Deltares lead the creation of the data management system to store and share the Sand Motor data (Luijendijk & van Oudenhoven, 2019). The coordination and implementation of monitoring is mainly done by Deltares (in cooperation with other monitoring and consultancy organizations), Wageningen Marine Research, and Stichting Zuid-Hollands Landschap. Monitoring is done and funded by Rijkswaterstaat in collaboration with Deltares and Wageningen Marine Research (Huisman et al., 2021). Some sources indicated that no clear role was given for Sand Motor's management of maintenance after implementation, leading to unclear accountability and hindering collaboration (Huisman et al., 2021; R11).

Stichting Duinbehoud highlighted strengths in ecological monitoring and the emergence of informal, self-organized initiatives like the beach community (R11). Hoogheemraadschap Delfland's reflections underscored practical adaptations to ecological and operational constraints, such as phased work schedules and scenario planning for climate change impacts (R9). Both Huisman et al. (2021) and Gerdes et al. (2021) highlighted that the lack of formally assigned maintenance roles post-construction created accountability gaps, hindering efficient collaboration. This was particularly evident in the interviews with the province and the water board (R10; R9). The challenge of coordinating daily spatial decisions with strategic objectives was further demonstrated by operational conflicts such as controlling sand movement versus maintaining monitoring zones (R11; R12). These mismatches showed the challenge of fragmented governance regimes and lack of horizontal coordination.

The capacity for knowledge production and sharing was particularly strong. A key asset was the project's intensive knowledge generation and use. Interviewees mention monitoring systems as key enabler for adaptive management (R10; R12). Real-time ecological monitoring, dune morphology modelling, and sediment transport simulations were applied extensively throughout the design and early implementation phases (Huisman et al., 2021; R9; R11; R12). These reflect the integration of probable futures tools, supporting risk management and adaptive design decisions. Anticipatory capacity was also demonstrated through the

projects' learning-by-doing approach, a hallmark of the performative futures perspective. This enabled stakeholders to adapt strategies and calibrate their interventions as new data emerged (R10; R12). However, this anticipatory capacity was not equally distributed or institutionalized. While scientific and governmental actors had access to foresight tools and model outputs, civil society organizations and local stakeholders seemed to have fewer opportunities to engage in forward-looking planning. Luijendijk & Van Oudenhoven (2019) emphasizes the experimental and adaptive nature of the project, in which shared learning is key. Nonetheless, there was little evidence of pluralistic or co-created anticipatory tools, such as participatory foresight exercises or inclusive scenario planning. As a result, long-term flexibility was limited to technical domains, with fewer institutional mechanisms for inclusive future governance.

Capacity for joint action also declined after construction. Once the project transitioned from implementation to post-monitoring, coordination structures dissolved, and leadership became more fragmented. There was no clear post-construction steering group, and role clarity diminished. As Gerdes et al. (2021) observed, long-term governance arrangements were lacking, with institutional ambiguity leading to gaps in responsibility and follow-up action. This reflects a breakdown in institutional resilience. Staff turnover further weakened knowledge continuity. Several respondents noted delays due to the time required to transfer institutional knowledge to new personnel (R9). In the absence of formal memory systems or role handovers, knowledge networks became thinner, undermining joint capacity for adaptive management and response. This was especially problematic for anticipatory governance, which relies on maintaining long-term datasets, learning cycles, and inter-institutional reflexivity.

In summary, the Sand Motor's early-stage capacity for joint action was characterized by strong technical leadership, excellent scientific input, and well-funded institutional support. Anticipatory tools supported adaptive management in the short term. However, the lack of inclusive foresight processes, declining coordination after implementation, and the lack of long-term funding for ecological maintenance constrained long-term capacity for joint action.

Governance Dynamic	Project	Main Enablers	Main Barriers
Capacity for joint action	Sand Motor	• Strong technical leadership. • Strong scientific capacity. • Robust project funding.	• Lack of inclusive foresight processes. • Declining coordination post-implementation. • No long-term funding for ecological maintenance.

Table 6: Summary barriers and enables Capacity for Joint Action of the Sand Motor

Scores for Collaborative Governance Dynamics

To support cross-case comparison, the collaborative governance dynamics of the Sand Motor project were systematically assessed using a Likert-style scoring method ranging from -2 (strong barrier) to +2 (strong enabler). Scores were assigned across Emerson's three collaborative dimensions: principled engagement, shared motivation, and capacity for joint action, with anticipatory aspects integrated into each.

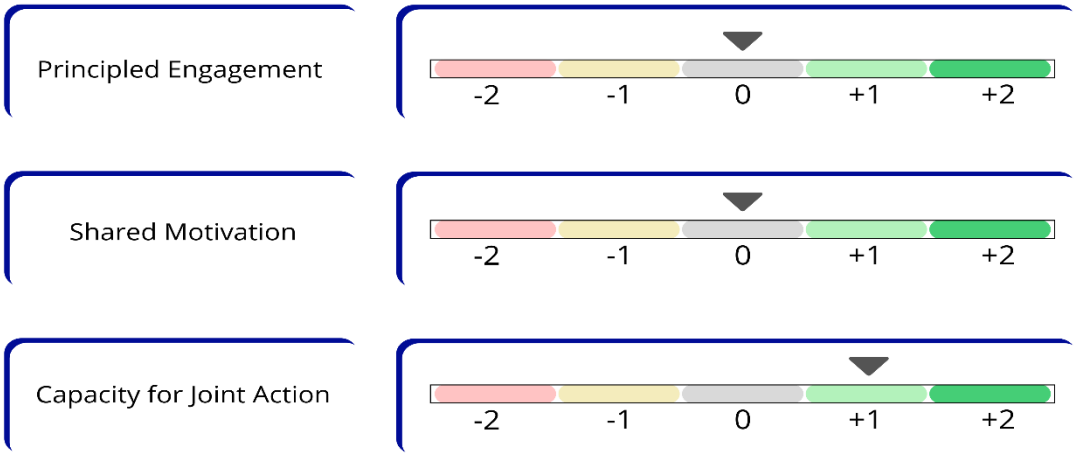

Table 7: Scores Collaborative Governance Dynamics for the Sand Motor project

Principled engagement in the Sand Motor case was neutral (0). Key enablers were found in the early project stages, particularly in the discovery and definition phases. Here, collaboration between Rijkswaterstaat, scientific partners, and consultancies allowed for inclusive joint sense-making. Anticipatory tools like scenario modelling and real-time sediment forecasting reflected plausible and performative futures and helped shape a forward-looking experimental vision. However, these early gains were later undermined by significant barriers. As the project entered the determination phase, engagement became increasingly technical and top-down, excluding NGOs and local communities from ongoing deliberation. The lack of co-created long-term visions, unresolved stakeholder conflicts (e.g., over lagoon management), and institutional fragmentation weakened inclusive engagement. Ecological actors like were not structurally involved in long-term decision-making and lacked formal channels to voice concerns. These offsetting forces result in a neutral score. Principled engagement neither clearly enabled nor significantly obstructed long-term collaboration.

In the early phases, shared motivation was enabled by high levels of trust, pride, and symbolic value. Stakeholders were united around the Sand Motor's identity as a global innovation in nature-based climate adaptation. Transparent collaboration, especially in scientific monitoring, created a sense of legitimacy and cohesion. The project's performative framing further enhanced early alignment. Nonetheless, this motivation became fragile over time. A key barrier

was the divergence in anticipatory orientations. Without inclusive visioning or backcasting tools, the differing expectations were never reconciled. Additional barriers included power asymmetries, unresolved conflicts, and post-implementation staff turnover. While strong symbolic alignment and trust existed early on, these were not institutionalized or reinforced over time, leading again to a neutral score. The dynamic enabled motivation initially but failed to sustain it long term.

The Sand Motor's most robust governance dynamic was its capacity for joint action, particularly evident during the design and construction phases. This strength was supported by several enabling factors. Leadership roles were clearly defined, and there was involvement of strong technical and research partners. Furthermore, interdisciplinary monitoring fostered effective knowledge co-production, and the project's integration of adaptive design and anticipatory learning contributed to responsive and informed implementation. These capacities enabled smooth coordination and reflected a high degree of anticipatory governance in the short term. However, important barriers emerged after implementation. Formal coordination structures were dissolved, and there was no shared accountability framework for long-term governance or maintenance. Disputes such as the ecological-recreational trade-offs lacked structured mechanisms for resolution. Additionally, civil society actors had limited influence in post-implementation decision-making processes. Besides these barriers, the presence of strong early-phase institutional capacity, scientific collaboration, and anticipatory tools justify a score of +1. Overall, capacity for joint action functioned as a moderate enabler for collaboration.

4.4.2. Hondsbossche Dunes

Principled Engagement with Anticipatory Aspects

The interviews and analyzed documents revealed that principled engagement within the Hondsbossche Dunes project was present but limited, especially during the early stages. Stakeholders consistently emphasized that engagement was reactive, top-down, and constrained by technocratic traditions (R1; R4; Bodde et al., 2019). This reduced the quality of the discovery phase, where ecological experts and NGOs were excluded from early deliberation (R3; R4). As a result, goal-setting and problem definition were conducted without pluralistic input or strategic anticipation.

Anticipatory governance capacities were weak across all phases of engagement. There was no evidence of foresight tools (e.g., scenario planning, backcasting, participatory visioning) being applied to shape collective understanding of long-term trade-offs or uncertain futures. Instead, technical planning was conducted in a largely probable futures paradigm, focused on risk reduction and safety standards (Leenders et al., 2018). NGOs and ecologists, who might have introduced more pluralistic or performative anticipatory perspectives, were involved only

after key design choices had already been made (R4). The absence of co-created long-term visions weakened mutual understanding and made it difficult to form a shared sense of interdependence (Emerson et al., 2011). Several respondents reported that deliberation occurred only after technical plans were finalized, limiting the space for value-based dialogue (R1; R2; R4). As a result, the definition phase lacked collaborative legitimacy: objectives were not co-produced, and environmental priorities were subordinated to hydraulic and safety imperatives.

Furthermore, the collaboration suffered from unclear ownership and fragmented responsibility. Rijkswaterstaat and HHNK provided joint leadership, resulting in friction between those two (R1). This reflected a governance barrier due to unclear delegation and role ambiguity, undermining shared identification with the project's goals. Respondent 1 highlighted this tension:

> "*We give Rijkswaterstaat the assignment to do that for us, which they find very strange. They themselves struggled with it a lot as well. Now things are finally going well again, but there were moments when they were almost at loggerheads."* (R1)

Deliberation and dialogue were also hampered by hierarchical and siloed information flows (R3; R4). Respondents indicated that individual and collective interests were not fully considered early on (R3). Several respondents experienced communication challenges during the implementation and monitoring of the project. Respondent 4 mentioned hierarchical information flow as a barrier. According to her, transmission of information often went through Rijkswaterstaat rather than directly to the immediate stakeholder. This slowed down knowledge sharing processes and led to misunderstandings.

According to respondent 3, although some collaborative learning took place, it was largely incidental rather than institutionalized. Learning lacked continuity and structure. This contrasts sharply with anticipatory governance principles that emphasize iterative learning and long-term adaptive capacity (Muiderman et al., 2020). The project's lack of anticipatory structure also became apparent in post-implementation phases. Without shared scenarios or future-oriented governance tools, ecological concerns were difficult to elevate to strategic importance. Traditional engineering framings dominated, and while internal commitment within HHNK remained strong (R1), broader stakeholder ownership over project outcomes was weak.

In sum, the Hondsbossche Dunes project successfully achieved its technical objectives but fell short in fostering early-stage deliberation, shared goal-setting, or long-term vision alignment. The absence of anticipatory methods meant that engagement remained reactive, siloed, and

prone to institutional friction. Due to these enablers and barriers, principled engagement was present in form but limited in function.

Governance Dynamic	Project	Main Enablers	Main Barriers
Principled Engagement	Hondsbossche Dunes	• Strong formal collaboration agreements. • Inclusive planning workshops.	• Mostly top-down deliberation. • Limited anticipatory dialogue. • Little engagement beyond formal meetings.

Table 8: Summary barriers and enables Principled Engagement of the Hondsbossche Dunes

Shared motivation with Anticipatory Aspects

The Hondsbossche Dunes project demonstrated mixed levels of shared motivation among its stakeholders. While institutional actors like HHNK and Rijkswaterstaat showed strong internal commitment to safety and innovation goals, broader motivational cohesion remained limited. Key elements such as mutual trust, internal legitimacy, and shared understanding were inconsistently developed throughout the project phases.

At the center of early shared motivation was a strong institutional commitment to flood safety and the innovative character of the sand-dune hybrid design. HHNK and Rijkswaterstaat were proud of the project's scale and ambition, which enabled technical experimentation and multifunctional land use (Bodde et al., 2019). However, this pride did not translate into inclusive motivational alignment. These motivational barriers stemmed in part from the absence of anticipatory co-creation. Several interviewees pointed out that ecological actors and NGOs were brought in only after major design decisions had already been made, which weakened the sense of shared purpose and led to persistent frustration (R4). The project lacked forums or tools for stakeholders to develop a shared long-term vision for how the landscape would evolve over time. While engineering goals were framed around probable futures (i.e., predictable safety outcomes and stable dune formation) ecological stakeholders sought to work with more pluralistic or performative anticipatory frames, valuing uncertainty, adaptability, and ecological spontaneity (R4). Without mechanisms for reconciling these perspectives shared motivation was never fully anchored in a common future horizon.

A lack of trust characterized the relationship among several partners, influencing the collaborative governance process. Mutual trust between key technical actors was present, particularly between HHNK and contractors, who engaged in frequent informal contact (R1). However, this trust did not extend to external actors. As Respondent 4 noted, "we were brought in too late to feel like co-owners." This lack of early involvement damaged both internal legitimacy and the broader perception of fairness and recognition. Mutual frustration and

institutional distrust were repeatedly highlighted, particularly among ecological experts, who perceived the project's sustainability framing as performative rather than substantive (R4; IJff et al., 2015). These tensions weakened stakeholder motivation and reduced willingness to engage beyond formal participation rounds. Nonetheless, some deliberate efforts were made to enhance inclusivity and legitimacy. A consultation panel was formed that brought together residents and local stakeholders, allowing different voices to influence the project's design. This was positively received and offered stakeholders a rare moment of ownership. As Respondent 2 recalled:

> "At the time we presented the plans on December 11, 2013, a lot of people were like 'Oh, but we came up with that!', so we got a plan there that we really genuinely didn't know what, except for a few outlines, would come out of it." (R2)

While this moment of co-creation helped improve legitimacy in the public sphere, it did not fully offset the earlier exclusion of ecological actors, whose environmental priorities remained under-integrated throughout the project. As a result, shared motivation remained uneven across the stakeholder landscape.

Similarly, while there was general appreciation for the aesthetic and recreational benefits of the dunes, tensions remained unresolved. Interviewees described how different users (e.g., municipalities, conservationists, recreational visitors) had diverging expectations about the purpose and long-term use of the area. Without a shared framework to negotiate these visions, stakeholders defaulted to their institutional silos (R3; R4), limiting the project's motivational resilience.

Much of the stakeholder involvement occurred too late in the project cycle, which significantly hindered shared understanding and trust-building. In particular, one of the most significant hindrances was the lack of trust between key institutional actors Rijkswaterstaat and HHNK (R1). However, respondent 2 said that advocacy between the two parties did go well because of active participation between them. The relationship between Rijkswaterstaat and HHNK was marked by institutional friction, especially around contract design and division of responsibilities. Respondent 2 also emphasized flexibility and saw cultural and procedural differences between organizations as a barrier for collaboration. According to respondent 2, these differences appeared in Rijkswaterstaat's risk-averse approach contrasted with HHNK's more flexible attitude. These differences created motivational misalignments, which Emerson et al. (2011) identify as a major barrier to long-term collaboration. Legalistic and rigid agreements replaced adaptive collaboration, creating a transactional dynamic (R3; R4; Bodde et al., 2019). Although respondent 2 (HHNK) also pointed out that active engagement helped

to reduce this tension, respondent 1 (HHNK) referred to the trust issues hindering collaborative governance.

Post-implementation, these weaknesses became more pronounced. The project had no formal structures to maintain stakeholder involvement or reinforce shared ownership over time. As IJff et al. (2015) and Bodde et al. (2019) show, discussions about long-term ecological management (e.g., dune succession, sand transport) became increasingly fragmented, with some NGOs withdrawing due to capacity constraints and ambiguity over influence. The absence of shared future planning created a vacuum where maintenance became technical and reactive rather than participatory and strategic.

In conclusion, shared motivation in the Hondsbossche Dunes project was anchored in institutional pride and technical achievement but lacked deeper alignment across diverse stakeholders. The absence of anticipatory visioning (especially tools to mediate differing future orientations) meant that mutual understanding and legitimacy could not evolve alongside the project. As a result, motivation remained stable within the core institutions but fragile and conditional in the broader collaborative network.

Governance Dynamic	Project	Main Enablers	Main Barriers
Shared Motivation	Hondsbossche Dunes	• Shared commitment to coastal safety. • Familiarity among regional actors.	• Motivation instrumental for many actors. • Weak ecological vision alignment (performative). • No adaptive strategy post-project.

Table 9: Summary barriers and enables Shared Motivation of the Hondsbossche Dunes

Capacity for Joint Action with Anticipatory Aspects

All respondents highlighted strong technical and ecological capacities. This brought considerable experience and knowledge in coastal management (Powell et al., 2018), improving collaborative outcomes (Emerson et al., 2011). Collaborative efforts in tendering, permitting, and joint monitoring demonstrated institutional capacity-building (R1; R2; R3). One of the clearest barriers was the absence of clear and coherent procedural frameworks. Contractual and legal arrangements for long-term maintenance and monitoring were described as confusing and inefficient (R1; R2). These frameworks created friction and ambiguity around who was responsible for what. Especially when long-term adaptive changes were needed. This illustrated a significant barrier to coordination at the system level. Respondent 1 also emphasized the slow pace of action regarding formal responses after the planning stage:

> *"In this case it goes to the state board and that takes two years. Because then you have had all the other courts first before they go to the council of state. After that (…) we*

must go to the state attorney again. Yes, those are thrilling things, and you cannot do anything against that." (R1)

Based on the interviews, leadership weaknesses were also repeatedly emphasized. Respondents (R1; R3; R4) and literature (Bodde et al., 2019; Leenders et al., 2018) identified a lack of integrative leadership after construction, limiting long-term coordination and vision.

Several research actors were active in the project and actively participated in consistent knowledge sharing, improving collaborative outcomes. *Knowledge-sharing* mechanisms were also inhibited by both internal and external barriers. For example, dredging contractors refused to share technical data, restricting access to crucial information on morphological change (R4). Also from an anticipatory governance perspective, the project's capacity to engage with future uncertainty was limited. While technical foresight tools such as sediment modeling and hydraulic simulations were applied (reflecting a probable futures approach) there were no efforts to co-create long-term scenarios or embed pluralistic or performative learning frameworks. As a result, the project lacked the institutional flexibility needed to adapt governance strategies over time or to incorporate dynamic ecological shifts (e.g., windblown sand challenges). Respondent 4 emphasized that learning occurred mostly informally or reactively, and there was no formal structure to revisit assumptions or recalibrate based on stakeholder feedback.

In addition, research institutions reported barriers to underwater data collection (R3; R4), further limiting the capacity for adaptive learning and undermining the knowledge indicator (Emerson et al., 2011). Cross-disciplinary collaboration among research actors was minimal, and ecological monitoring lacked sufficient support or continuity (R3; R4; Ijf et al., 2018). According to Leenders et al. (2018), the lack of a shared monitoring system and the absence of post-construction feedback loops severely restricted adaptive capacity. This revealed another core hindrance: the lack of a systemic and collaborative research infrastructure. Finally, capacity for joint action was weakened by discontinuities over project phases (R1).

The project's formal engagement mechanisms did help incorporate some local input, particularly from residents and recreational users (R2). However, there were no mechanisms to maintain this engagement into the post-implementation phase. Ecological NGOs and local actors were left without a defined role in future governance, and no formal structure existed for post-project adaptation or long-term stewardship. This weakens not only long-term capacity but also the ability to embed anticipatory governance over time.

In sum, while the Hondsbossche Dunes project demonstrated strong technical and institutional capacity during implementation, its collaborative capacity was limited by top-down knowledge flow, leadership ambiguity, and the absence of inclusive, future-oriented governance tools. Adaptive learning remained confined to technical feedback loops, and long-term institutional sustainability was not structurally embedded.

Governance Dynamic	Project	Main Enablers	Main Barriers
Capacity for Joint Action	Hondsbossche Dunes	• Clear division of implementation tasks. • Strong engineering & policy integration. • Funding security.	• Limited monitoring for adaptive learning. • Anticipation not embedded in action plans. • No institutional learning structure.

Table 10: Summary barriers and enables Capacity for Joint Action of the Hondsbossche Dunes

Scores for Collaborative Governance Dynamics

This section provides a brief evaluation of collaborative governance, focusing on how engagement, shared motivation, and the capacity for joint action function as overall enablers or barriers to stakeholder collaboration.

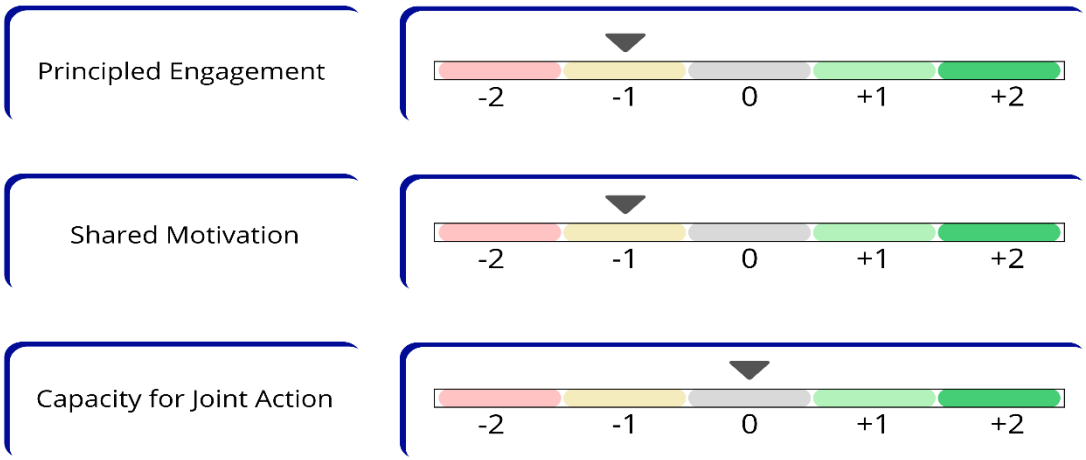

Table 11: Scores Collaborative Governance Dynamics for the Hondsbossche Dunes project

Principled engagement is assessed as a moderate barrier, scoring -1. This score is largely driven by the weak stakeholder involvement during the discovery and definition phases. Early engagement was dominated by technical and governmental actors, while NGOs and ecological interests were either absent or included too late to shape project direction. The exclusion of key actors from early agenda-setting and the lack of transparent, inclusive goal formation prevented collective ownership of the project's core ambitions. Anticipatory governance was limited to predictive modelling, aligning with a probable futures approach, but this technical foresight was not balanced with pluralistic tools such as scenario planning or co-visioning. Later deliberation occurred under time pressure and was largely reactive, further weakening

legitimacy. Fragmented responsibilities created operational silos that obstructed coordination. Without co-created long-term visions or adaptive engagement strategies, principled engagement lacked the institutional reflexivity necessary for inclusive and future-oriented collaboration.

Shared motivation also received a score of -1, reflecting moderate barriers to mutual understanding and commitment. While some stakeholders expressed pride in the project's scale and symbolic value, deeper trust and shared visioning were missing. Anticipatory alignment was weak: Rijkswaterstaat and HHNK were oriented toward probable futures focused on coastal safety, while ecological actors preferred more adaptive, open-ended visions. The absence of any formal foresight process or shared long-term orientation meant that these divergent perspectives were never reconciled. Institutional trust was fragile, particularly between the two lead agencies, and tensions emerged around decision-making authority and ecological goals. NGOs felt tokenized in the process, which weakened internal legitimacy and reduced motivation to remain involved post-implementation. Contractual rigidity and lack of adaptive mechanisms further prevented the kind of flexible cooperation needed for sustained shared motivation.

Capacity for joint action was the most neutral of the three dynamics and scored 0. This reflects a balance between the notable enablers and persistent structural barriers. On the enabling side, the project benefited from a strong technical knowledge base, particularly in coastal engineering and ecological monitoring. Access to expertise, reliable data, and adequate resources during implementation allowed for effective delivery of technical objectives. However, these strengths were counteracted by fragmented procedural arrangements, unclear leadership roles, and a lack of institutional continuity. Coordination between Rijkswaterstaat and HHNK remained weak, and no mechanism was put in place for adaptive governance or shared responsibility beyond the early phase. From an anticipatory perspective, the project applied technical modelling tools but lacked long-term adaptive frameworks or pluralistic engagement mechanisms. Civil society actors had limited capacity to shape post-implementation decision-making, and learning remained siloed within technical institutions. These weaknesses prevented the dynamic from functioning as a sustained enabler, justifying the neutral score.

4.4.3. Marconi Salt Marshes

Principled Engagement with Anticipatory Aspects

Early engagement in the Marconi Salt Marsh project was relatively strong among core institutional and scientific actors. During the definition phase, stakeholders such as EcoShape, Rijkswaterstaat, and knowledge institutes participated in jointly setting goals around coastal

safety, ecological restoration, and spatial development (R6; R7). As Leuven et al. (2021) emphasize, this early interdisciplinary collaboration was essential in translating scientific insights into NbS design. EcoShape facilitated a systems-thinking approach that enabled structured dialogue and inclusive framing of technical and ecological objectives (R5; R6).

Anticipatory elements were embedded in early deliberation through an exploratory stance (R6). Stakeholders engaged in shared learning and co-creation around NbS potentials, reflect a performative anticipatory approach. This allowed future scenarios to be considered during initial design conversations. Especially those around ecological resilience and coastal adaptation. However, not all actors were equally included in this forward-looking dialogue. As Respondent 5 noted, their engagement began only after key design choices had been made, limiting their ability to influence early framing and restricting discovery-phase ownership. This selective inclusion created power asymmetry and hindered the collaborative legitimacy of the process.

Deliberation during the definition and determination phases was described as constructive but time-sensitive. Stakeholders agreed on the need to balance agricultural use, ecological goals, and recreational ambitions (R5; R6; R8). But in the end, pragmatism prevailed over drawn-out discussions over conflicting interests. As both Respondents 5 and 7 emphasized, discussions must eventually close to ensure implementation progress. This outcome-oriented culture facilitated consensus-building, though at the cost of deeper, iterative dialogue that might have enhanced anticipatory reflexivity (Emerson et al., 2011).

Engagement after implementation emerged as a weak point for principled engagement. Across interviews, there was concern about the lack of structured processes for ongoing *deliberation*, cooperative monitoring, and adaptive management (R6; R7). Especially after the initial implementation. Respondent 6 and respondent 7 both noted that once initial funding ended and ownership became ambiguous, engagement around long-term evaluation and learning dropped. Respondent 6 explained in more detail how this works:

> "*We do use extensive monitoring for these kinds of projects, so that you can indeed learn how it works and so that you can indeed make any necessary adjustments afterwards. The problem is, however, that EcoShape has done this partially and at a certain point the budget stops and what you always see, and in this project, is that the subsequent management and thus the continuation of the monitoring is not well organized.*" (R6)

This lack of sustained engagement mechanisms meant that data from monitoring programs was not actively interpreted or used in collective decision-making after project completion (R6).

As a result, adaptive learning and anticipatory reflection became fragmented and reactive rather than institutionalized.

Notably, Veraart et al. (2019) conducted an anticipatory role-play experiment with stakeholders involved in the Marconi project. The exercise explored six resilience dimensions (functioning, knowledge, diversity, redundancy, innovation, connectivity), simulating future stress scenarios. While this performative foresight tool was valuable for discovering resilience logic, it was conducted outside the formal project structure. Its lessons were not fully translated into ongoing governance frameworks, again illustrating the disconnect between exploratory anticipation and long-term engagement.

In summary, the Marconi project demonstrated early-stage engagement with exploratory and forward-looking elements, supported by interdisciplinary collaboration and co-creation. However, engagement was not equally inclusive across stakeholders, and anticipatory tools remained peripheral rather than structurally embedded. Post-implementation, the absence of institutionalized feedback loops, joint monitoring, or co-decision-making processes led to declining engagement quality and limited the project's ability to sustain collaborative learning over time.

Governance Dynamic	Project	Main Enablers	Main Barriers
Principled Engagement	Marconi Salt Marshes	• System-thinking approach. • Early exploration of NbS options. • Experimental role-play (performative futures).	• Late involvement of key stakeholders. • No institutionalized follow-up or post-project engagement.

Table 12: Summary barriers and enables Principled Engagement of the Marconi Salt Marshes

Shared Motivation with Anticipatory Aspects

In the Marconi case, shared motivation was mainly present during the planning and design stages. In the post-implementation phase this weakened. Among key actors there was a foundation of trust built through prior collaboration and shared goals related to NbS (R6; R7). However, the agricultural organization that joined later in the process experienced lower levels of trust and inclusion (R5). From the interview it is notable that this limited their sense of influence. This trust was reinforced by EcoShape's facilitative leadership and a consortium model that valued system thinking and open knowledge exchange (EcoShape, 2021b). However, motivation across the broader stakeholder field was uneven. Respondent 5 (representing the agricultural organization) described a lower sense of trust and influence, stating that their involvement came too late to shape the early agenda. The timing of engagement and divergent sectoral priorities, particularly around nitrogen regulation and Natura 2000 sensitivities, limited their motivational alignment. As Respondent 5 explained:

> *"We are not against nature, but if you cooperate in creating new nature in certain areas or nature 2000 areas, there you are likely to shoot yourself in the foot if it is going to become nitrogen sensitive again."* (R5)

This protective stance reflects a probable and risk-averse anticipatory orientation, contrasting with the performative and exploratory approach held by EcoShape and ecological actors. Such anticipatory misalignment limited deeper mutual understanding and constrained trust-building across sectors.

Mutual understanding developed among partners during the early stages, particularly around the shared vision for eco-dynamic coastal development. EcoShape played a key role in facilitating this understanding by developing a consortium with key stakeholders (EcoShape, 2021; R6). Within this consortium they really valued a knowledge-sharing and system-thinking approach (R6). Nevertheless, respondent 5 mentioned a more limited mutual understanding. Partially due to the timing of their engagement and differing sectoral priorities (R5).

While a shared vision existed for eco-dynamic coastal development during the design phase, it did not translate into a robust long-term motivational framework. Interviews revealed that after implementation, shared commitment diminished due to unclear post-project roles and responsibilities (R7). According to respondent 7, uncertainty about ownership and monitoring obligations undermined actors' willingness to remain involved. This ambiguity also weakened the project's internal legitimacy, particularly for those who had no formal mandate or recognized role in the post-construction phase (R7). Still, there were signs of continued willingness to engage. The anticipatory role-play exercise described by Veraart et al. (2019) illustrates that shared motivation can be reignited through performative foresight tools. The experiment fostered reflection on resilience principles (diversity, redundancy, innovation) and revealed appetite for strategic long-term thinking. However, this exercise remained a one-time pilot rather than an institutionalized element of post-implementation governance.

Overall, shared motivation in the Marconi project was rooted in early trust and commitment to shared goals but was not structurally reinforced through institutional clarity or long-term visioning. Anticipatory framings diverged across stakeholders, with ecological actors favoring exploratory learning and others preferring stable, risk-averse scenarios. Without tools to reconcile these perspectives, motivation became fragile. It was strong in principle, but vulnerable to institutional drift.

Governance Dynamic	Project	Main Enablers	Main Barriers
Shared Motivation	Marconi Salt Marshes	• Strong trust among early partners. • Shared vision during design. • Role-play for collective reflection.	• Post-implementation loss of momentum. • Limited ownership beyond core partners. • No durable vision or foresight practices (performative/pluralistic)

Table 13: Summary barriers and enables Shared Motivation of the Marconi Salt Marshes

Capacity for Joint Action with Anticipatory Aspects

Just like the shared motivation, capacity for joint action in this project was strong during the planning and implementation phases. This dynamic too became weaker due to arrangements and resources for long-term adaptive governance.

Procedural and institutional arrangements were clearly defined during the implementation phase. The adaptive design and experimental framing within the project aligned with a performative futures approach, encouraging real-time adjustments based on monitoring and stakeholder input. The division of responsibilities among key stakeholders such as Province of Groningen, Rijkswaterstaat, and EcoShape was functional and contributed to effective execution (R5; R6; R7). However, most interviewed parties noted a lack of structured governance mechanisms after implementation (R5; R7; R8). The anticipatory tools were not institutionalized beyond the pilot phase. No scenario-based planning, backcasting, or formalized foresight processes were applied during or after implementation. As a result, the project lacked the institutional flexibility to evolve its governance framework in response to ecological or social shifts over time. Furthermore, respondent 5 showed their influence was limited by its late entry and advisory role, with procedural frameworks already largely established by the time of engagement.

Leadership was described as strong but somewhat uneven. There were two water boards involved which due to different stances experienced friction while leading their responsibilities (R8). Though, leadership by the Province, Rijkswaterstaat, and EcoShape helped to drive innovation and coordination. They particularly helped in framing the project as a nature-based alternative to traditional existing infrastructure (R6; R7). The inclusiveness in leadership is debatable. From respondents' 5 perception, they were excluded from early agenda-setting processes. Leadership continuity within the province was beneficial, though other areas experienced disruptions due to political and institutional turnovers (R7).

Knowledge capacity was high during the design and pilot phase. The EcoShape consortium provided technical and research partners who brought significant expertise in adaptive design,

NbS, and environmental monitoring (EcoShape 2021; R6). From an anticipatory governance perspective, the project showed early signs of future-oriented learning. Continuity, as mentioned above, also seems an issue in knowledge capacity. Knowledge continuity was undermined over time by staff turnover (R7). This was also an issue for conducting this very research in stakeholder gathering. Three of the eight e-mailed stakeholders could not find someone in the organization with information about the collaborative experiences in the Marconi project. In addition, there appears to be a lack of institutional mechanisms for capturing and sharing expertise (R5). Similarly, De Vries et al. (2021) highlight how early collaborative learning through monitoring yielded valuable insights. Yet, it does not show a formal structure of feedback in the collaborative processes.

Resources were adequate during early stages, with public funding supporting design and implementation. Here we also see constraints emerging after project delivery. Two of the respondents identified insufficient long-term funding and unclear responsibilities for maintenance and monitoring as key barriers to sustained collaboration (R5; R6).

In summary, the Marconi project demonstrated a strong short-term capacity for joint action but lacked structures to sustain collaboration and learning over time. Leadership was competent but inconsistent across actors, knowledge sharing was informal and fragile, and besides adaptive design tools, anticipatory tools remained underdeveloped. These limitations constrained the project's ability to institutionalize long-term, adaptive, and collaborative governance.

Governance Dynamic	Project	Main Enablers	Main Barriers
Capacity for Joint Action	Marconi Salt Marshes	• Multi-level coordination. • Knowledge co-production across sectors. • Adaptive design tools (performative futures)	• Staff turnover and weak institutional memory. • No funding for long-term monitoring. • No structured knowledge sharing or foresight integration.

Table 14: Summary barriers and enables Capacity for Joint Action of the Marconi Salt Marshes

Scores for Collaborative Governance Dynamics

As in the previous cases, this section applies a -2 to +2 Likert-style scoring method to assess the enabling or hindering effect of collaborative governance dynamics across three dimensions.

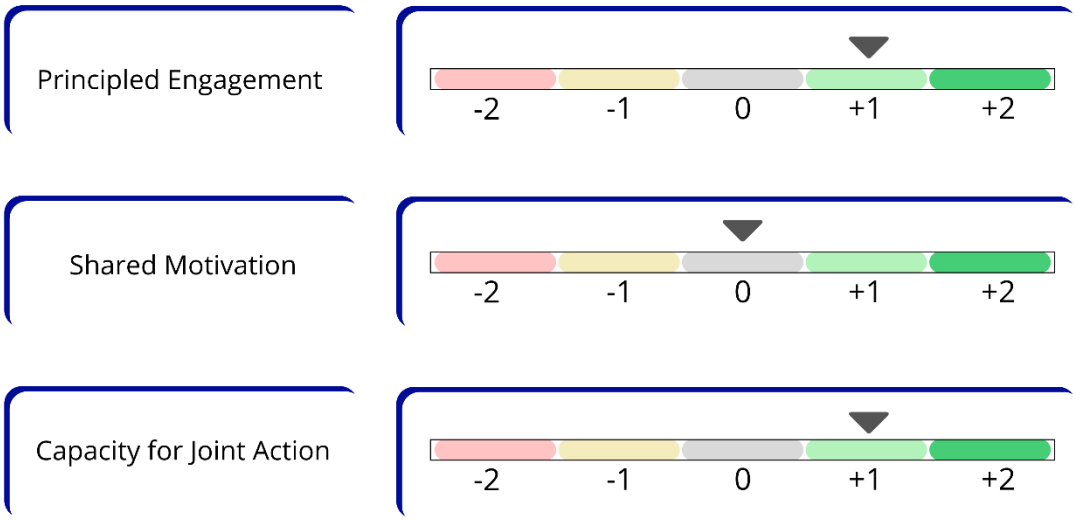

Table 15: Scores Collaborative Governance Dynamics for the Marconi Salt Marshes project

Principled engagement in the Marconi Salt Marshes project functions as an overall enabling dynamic with a score of +1. There were strong enabling conditions during early collaboration but with barriers emerging in long-term deliberation and co-decision-making. In the discovery phase, engagement was broad and active. Core stakeholders helped define goals and set a shared agenda that integrated coastal protection, ecological restoration, and economic revitalization. These early inclusive efforts were key enablers, ensuring multiple interests were considered and fostering a strong foundation for collaboration. The participatory definition phase also included many relevant actors, reinforcing transparency and buy-in. However, partial exclusion of agricultural stakeholders in the early stages created a sense of marginalization that persisted throughout the project. This exclusion functioned as a moderate barrier, weakening legitimacy in certain segments. Deliberation between ecological and agricultural priorities was substantive, and compromises were achieved. The use of a role-play exercise facilitated anticipatory reflection and helped stakeholders explore future land-use visions, marking an important enabler. However, the exercise was a one-time intervention rather than a sustained process, limiting its long-term impact.

In the determination phase, while agreements were reached collaboratively, no formalized co-decision structures were institutionalized for follow-up governance or monitoring. This lack of embedded procedures for continued engagement and conflict resolution weakened principled engagement over time. Nonetheless, the early participatory planning, inclusive definition process, and experimental foresight justify a score of +1.

Shared motivation is scored at 0, reflecting a dynamic characterized by strong early alignment but declining cohesion later in the project. Initially, trust between stakeholders was high,

particularly among actors with a history of regional collaboration. Shared commitment to NbS, regional revitalization, and climate resilience served as strong motivational enablers. Leadership continuity from the Province of Groningen further reinforced legitimacy and long-term visioning. However, barriers gradually outweighed these early enablers. Agricultural actors expressed skepticism, largely due to late involvement and perceived underrepresentation. This reduced their sense of commitment and internal legitimacy. Furthermore, anticipatory misalignments were never reconciled. These tensions were compounded by knowledge discontinuity following staff turnover, which diluted the initial collective identity. As a result, shared motivation weakened over time and could not function as enabler nor barrier.

Capacity for joint action receives a score of +1, making it an overall enabling dynamic. It reflects a strong implementation-phase collaboration, supported by clearly defined roles and effective inter-organizational communication. Cross-sector learning and coordination were well-established, and early funding was adequate. However, post-implementation capacity weakened due to the absence of institutionalized structures for long-term governance, monitoring, or resource continuity. Staff turnover further disrupted institutional memory. While anticipatory elements like experimental framing were present, the lack of embedded foresight tools or adaptive feedback mechanisms constrained long-term adaptability. Thus, while the project showed strong joint capacity during implementation, these limitations justify a moderate enabler score of +1.

Summary of enablers and barriers of each project

Below is a clear comparative table that summarizes the main barriers and enablers for each of the three collaborative governance across the three cases: Sand Motor, Hondsbossche Dunes, and Marconi Salt Marshes. Additional to this summary, section 4.4. provides a table with the key enablers and barriers in line with the collaborative outcomes of each project.

Dynamic	Project	Main Enablers	Main Barriers
Principled Engagement	Sand Motor	• Early co-creation with scientific partners. • Use of monitoring models for adaptive engagement (plausible futures). • Open deliberation in early stages.	• Misaligned expectations over recreation/ecology. • No co-created long-term vision (performative). • Faded engagement post-implementation.
	Hondsbossche Dunes	• Strong formal collaboration agreements. • Inclusive planning workshops.	• Mostly top-down deliberation. • Limited anticipatory dialogue. • Little engagement beyond formal meetings.
	Marconi Salt Marshes	• System-thinking approach. • Early exploration of NbS options. • Experimental role-play (performative futures).	• Late involvement of key stakeholders. • No institutionalized follow-up or post-project engagement.
Shared Motivation	Sand Motor	• Pride in flagship innovation. • Scientific legitimacy. • Early trust across sectors.	• Future orientation misaligned (probable vs. pluralistic). • Power asymmetries • No shared future vision.
	Hondsbossche Dunes	• Shared commitment to coastal safety. • Familiarity among regional actors.	• Motivation instrumental for many actors. • Weak ecological vision alignment (performative). • No adaptive strategy post-project.
	Marconi Salt Marshes	• Strong trust among early partners. • Shared vision during design. • Role-play for collective reflection.	• Post-implementation loss of momentum. • Limited ownership beyond core partners. • No durable vision or foresight practices (performative/pluralistic)
Capacity for joint action	Sand Motor	• Strong scientific capacity. • Access to real-time ecological data. • Robust project funding.	• No long-term funding for ecological maintenance. • Weak post-project leadership roles. • Technical foresight not linked to governance.
	Hondsbossche Dunes	• Clear division of implementation tasks. • Strong engineering & policy integration. • Funding security.	• Limited monitoring for adaptive learning. • Anticipation not embedded in action plans. • No institutional learning structure.
	Marconi Salt Marshes	• Multi-level coordination. • Knowledge co-production across sectors. • Adaptive design tools (performative foresight)	• Staff turnover and weak institutional memory. • No funding for long-term monitoring. • No structured knowledge sharing or foresight integration.

Table 16: Summary of enablers and barriers of each project

4.5. Influences on Collaborative Outcomes

Following the table above, Table 17 will elaborate further on the outcomes from the three coastal climate buffer case studies by linking them to key collaborative governance dynamics: principled engagement (PE), shared motivation (SM), and capacity for joint action (CJA). It identifies enabling and hindering factors, showing how these are tied not only to relational and institutional conditions but also to anticipatory governance capacities. The presence of tools like scenario planning, system thinking, and early co-creation often led to more adaptive, inclusive, and lasting outcomes. In contrast, their absence weakened collaboration over time. This analysis directly informs the central research question by revealing how ecological, social, symbolic, and institutional outcomes are shaped by governance dynamics. It also underscores that anticipatory governance is not separate but embedded in the quality of collaboration. The table thus lays the groundwork for conclusions on fostering resilient, future-oriented governance in long-term coastal projects.

Project	**Collaborative Outcomes**	**Key Dynamic**	**Main Enablers**	**Main Barriers**
Sand Motor	Dynamic coastal safety zone through pilot-based nourishment.	CJA	+ Strong technical expertise. + Cross-sector alignment on safety. + Use of performative futures approach (adaptive monitoring).	– No shared long-term governance structure. – Fragmented post-implementation management.
	Recreational and symbolic value creation.	PE SM	+ Early deliberation on spatial design. + Pride in innovation and symbolic identity.	– Misaligned long-term expectations (ecology vs. recreation). – Lack of co-created vision (performative anticipatory governance).
	Knowledge production and international influence.	CJA	+ Joint scientific design and real-time monitoring. + Shared research platforms.	– Staff turnover disrupted institutional memory. – Weak continuity structures.
	Partial ecological gains (dune & marine habitats).	PE CJA	+ Scenario modeling guided placement (with probable futures approach). + Monitoring aligned with ecological forecasts (probable futures approach).	– Insufficient enforcement of ecological agreements. – Lack of adaptive response to recreation pressure (performative futures approach).
Hondsbossche Dunes	Sand-based flood protection integrated with landscape values.	CJA	+ Technical collaboration between waterboard and contractors.	– Friction between leadership roles Rijkswaterstaat and HHNK. – Lack of anticipatory flexibility post-project.

			+ Predictive modeling (probable futures approach).	
	New dune ecosystems and soft coastal zones.	PE CJA	+ Adaptive monitoring during design phase (performative futures approach). + Ecological input during tendering.	– Ecologists engaged too late in design. – Discontinued monitoring and no feedback loop.
	Recreational access and symbolic public value.	PE SM	+ Citizen engagement through design panels. + Familiarity among local partners.	– Limited long-term visioning of social use (performative/pluralistic future approaches). – Lack of inclusive participatory foresight tools
	Process innovation in design & tendering.	CJA	+ Flexibility in project execution. + Interdisciplinary planning integration.	– No structure for long-term learning. – Narrow technical framing (limited pluralism).
Marconi Salt Marshes	Creation of functional salt marsh habitat.	PE CJA	+ Joint planning with EcoShape + Exploratory framing (performative futures approach). + NbS experimentation.	– Some stakeholders joined too late to influence design. – Weak follow-up on adaptive management.
	Integration of urban and ecological objectives.	PE SM	+ Co-design approach valued multifunctionality. + Shared vision early in project.	– Fragmented post-implementation commitment. – Lack of institutional follow-through.
	Symbolic and educational value.	SM	+ Shared identity in region-building. + Performative/Pluralistic foresight (resilience role-play)	– Motivation is fragile beyond pilot phase. – Inclusion limited to formal partners.
	High-quality interdisciplinary research.	CJA	+ Technical consortium & knowledge co-production. + Real-time monitoring during implementation.	– Knowledge sharing not institutionalized – Monitoring funding ended prematurely – Decreasing knowledge continuity due to high staff turnover.

Table 17: Enablers and Barriers of Dynamics influencing Collaborative Outcome

In the next chapter, the three cases are brought together to create an integrated overview of recurring barriers and enablers across the projects. This cross-case synthesis forms the basis for answering the central research question on how collaborative and anticipatory governance dynamics influence the success of coastal climate buffer projects.

Chapter 5: Conclusion

This thesis set out to answer the main research question: “How do the system context and drivers shape collaborative and anticipatory governance, and how do these in turn function as barriers or enablers to the outcomes of coastal climate buffer projects?” To answer this question, a comparative case study was conducted on three Dutch NCB projects. This chapter synthesizes the core insights across these cases and traces how contextual and motivational conditions influenced collaborative and anticipatory dynamics, which in turn influenced the collaborative outcomes.

A key insight from the research is that system context and stakeholder drivers strongly shape how collaborative and anticipatory governance unfold. Institutional complexity, ecological urgency, and evolving regulatory frameworks define the operational environment of these projects. Drivers such as interdependence, societal urgency (e.g., coastal safety), and opportunities for innovation initially motivated stakeholders to collaborate. However, whether this momentum translated into long-term success depended on how well collaborative and anticipatory governance was structured and sustained over time. The research shows that system context not only constrains action through institutional complexity but also shapes the types of drivers that emerge. For example, legal rigidity or fragmented responsibilities made collaboration difficult in the Hondsbossche Dunes, while the absence of ecological protection status in the Sand Motor created room for anticipatory flexibility. These contextual conditions influence whether drivers like urgency or interdependence led to inclusive engagement or more hierarchical control.

Across all three projects, governance dynamics such as early engagement, interdisciplinary learning, clear leadership, and adaptive management were essential. Where these were institutionalized across project phases, they enabled more inclusive, durable, and adaptive outcomes. However, the same factors became barriers when they were inconsistently applied, weakened post-implementation, or failed to include marginalized actors. For example, the Sand Motor and Marconi Salt Marshes benefited from early-stage co-creation, while Hondsbossche Dunes struggled with more hierarchical coordination. Anticipatory governance tools such as scenario modeling, experimental pilots, and forecasting were integrated into the design and implementation phases. This often helped to build scientific legitimacy and innovation. Yet, these tools were rarely extended after project delivery. The failure to institutionalize collaboration and foresight created a feedback loop in which stakeholder disengagement reduced adaptive capacity, which in turn led to less inclusive decision-making

and weaker long-term outcomes. This dynamic was most visible in the erosion of shared motivation post-implementation in all three projects.

A common pattern across cases was the decline of shared motivation and collaboration after implementation. This was driven by unclear ownership, insufficient funding, and a lack of long-term institutional roles. Even when trust and commitment were strong during implementation, the absence of forward-looking and inclusive governance structures made it difficult to maintain that momentum. Furthermore, despite differences in project focus and culture all projects experienced similar challenges when post-implementation structures were weak or when long-term visions were not created among all stakeholders.

To synthesize these findings, the comparative table (Table 18) identifies the overlapping barriers and enablers across phases of each project. These show important interactions. First, the system context set the boundaries within which governance could operate, which often complicated project collaboration. Second, the drivers mobilized stakeholders but also faded since these were weakly reinforced over time. Looking at collaborative and anticipatory governance dynamics, these were essential for shaping both short-term implementation and long-term governance. Finally, the analyses show that where anticipatory thinking was exclusive, overly technical, or disconnected from stakeholder values, it failed to result in resilient outcomes.

From the scores throughout the research, we can see some important interactions. One of them is that strong early engagement and co-creation (as in the Marconi and Sand Motor project) lead to higher levels of shared motivation. Besides, technical leadership and capacity shown in the Sand Motor and Hondsbossche dunes project can drive short-term effectiveness but do not guarantee inclusive or anticipatory governance unless embedded in co-produced structures. Furthermore, a lack of long-term role clarity, funding, and feedback mechanisms weakens capacity for joint action. Lastly, from the scores we can see that anticipatory governance is most effective when foresight tools (e.g., scenario modelling, adaptive design, shared visioning) are co-owned and embedded beyond the implementation phase. When these tools remain exclusive to technical actors, their contribution to shared motivation and principled engagement is limited. Thus, the scores confirm that project outcomes are not just shaped by initial design or leadership, but by how well collaboration and anticipation are institutionalized across time. Effective NCB governance must be understood as a longitudinal process, one that evolves through feedback, shared learning, and inclusive planning.

Stage	Dynamic	Enablers	Barriers
Pre- implementation	PE	• Early inclusive engagement. • Joint fact-finding and scenario exploration. • Scientific legitimacy and shared urgency.	• Late or symbolic stakeholder involvement. • Exclusion of NGOs or local groups. • Absence of co-created future visions.
	SM	• Shared pride in innovation and nature-based design. • Recognition of interdependence and shared values.	• Initial distrust or skepticism due to risk perceptions. • Power asymmetries.
	CJA	• Strong leadership from key public bodies. • Early alignment of resources and technical expertise. • Initiation of adaptive, learning-based planning.	• Lack of long-term planning structures. • Fragmented institutional frameworks from the start.
Implementation	PE	• Regular alignment meetings and feedback loops. • Interdisciplinary collaboration. • Adaptive design processes.	• Diminishing inclusivity over time. • Technical dialogue overtaking participatory engagement.
	SM	• Common commitment to innovation and sustainability. • Functional communication and shared legitimacy. • Strong co-ownership.	• Emergent tensions of expectations. • Conflicts over risk vs. openness to uncertainty. • Weak anticipatory alignment.
	CJA	• Robust resource flows during implementation. • Use of foresight tools. • Institutional coordination.	• Weak capacity-building for future roles. • Few mechanisms for formal knowledge retention. • No integrated adaptive (performative) learning across all actors.
Post- implementation	PE	• Ongoing dialogue with key stakeholders.	• Formal engagement structures dissolved. • Citizen and stakeholder feedback not institutionalized.
	SM	• Residual sense of pride in flagship identity.	• Decline in trust and motivation. • Misalignment of future visions. • Lack of long-term legitimacy.
	CJA	• Adaptive management insights available.	• High staff turnover. • Loss of knowledge continuity. • No clear governance roles post-implementation. • No durable financial/institutional arrangements.

Table 18: Overlapping enablers and barriers through project stages

While all three cases involved collaborative and anticipatory governance, they differed in important ways. The Sand Motor featured strong early technical collaboration and adaptive experimentation but struggled with fragmented management and stakeholder disengagement after implementation. The Hondsbossche Dunes excelled in innovative design-phase collaboration but lacked flexibility and sustained ecological input later on. In contrast, the Marconi Salt Marshes uniquely prioritized early shared visioning and inclusive co-design, yet suffered from eroding motivation and weak post-implementation governance. These

differences highlight how the timing and structure of stakeholder involvement, as well as the continuity of governance arrangements, critically shaped each project's outcomes.

In conclusion, this thesis finds that the outcomes of coastal climate buffer projects depend heavily on how well system conditions and stakeholder motivations are translated into inclusive, adaptive, and forward-looking governance. Effective collaboration and anticipation require more than temporary alignment. They demand enduring institutional support, shared long-term visions, and embedded mechanisms for learning and adaptation. Without these, even innovative or well-resourced projects risk losing their transformative potential over time.

Chapter 6: Discussion

This chapter reflects on the key findings of the study and situates them within broader academic and practical debates on collaborative and anticipatory governance in climate adaptation. It evaluates the theoretical and practical implications of integrating the CGF (Emerson et al., 2011) with the AGF (Muiderman et al., 2020), highlighting how their interplay deepens our understanding of long-term, multi-actor environmental governance. The chapter also addresses the limitations of the study and outlines recommendations for both practitioners and future research.

6.1. Interpretations of the Results

This study set out to explore how collaborative and anticipatory governance affect the outcomes of coastal NCB projects. The findings illustrate that effective long-term governance is contingent on several interdependent factors: early inclusive engagement, knowledge continuity, shared motivation, and adaptive design. These qualities are essential not just for producing innovative project designs, but for ensuring that benefits endure post-implementation.

The results align with governance challenges identified in prior research (e.g., Emerson et al., 2011; Muiderman et al., 2020), particularly in relation to institutional fragmentation, unclear long-term roles, and the absence of feedback loops. The added empirical evidence from the three case studies contributes practical insights into the evolution of these dynamics over time. The role of anticipatory governance, which is often underexplored in case-based studies, is shown to be vital in shaping how actors prepare for and deal with uncertainty of long-term projects. However, the disconnect between early-stage engagement and post-project collaboration reveals the limitations of temporary governance structures in ensuring long-term resilience.

6.2. Application of Theoretical Frameworks

The application of the collaborative and anticipatory governance frameworks has proved valuable for analyzing the dynamics of stakeholder collaboration in coastal NCB projects. The Sand Motor, Hondsbossche Dunes, and Marconi Salt Marshes projects reveal both the utility and limitations of these frameworks when confronted with the practical complexities of long-term, multi-stakeholder projects under uncertainty.

From the collaborative governance perspective (Emerson et al., 2011), the cases confirm the importance of principled engagement, shared motivation, and capacity for joint action as foundational dimensions. However, the research refines this framework by emphasizing the need for temporal depth in collaboration. Specifically, the importance of maintaining engagement, trust, and leadership continuity beyond the initial implementation phases. For instance, the Sand Motor showed strong discovery and definition phases but suffered from a lack of institutionalized follow-up mechanisms. This confirms Waylen et al. (2023), who argue that hybrid and adaptive governance strategies must extend across the full project lifecycle to remain effective. This study extends Emerson's notion of "capacity for joint action" by demonstrating that it is not just the presence of knowledge and resources that matters, but the institutionalization of knowledge sharing, leadership consistency, and continuity of collaborative structures. This aligns with findings by Ansell and Gash (2007), who stress that institutional fragmentation can erode collaborative momentum, even in well-designed participatory structures.

Regarding anticipatory governance (Muiderman et al., 2020), the framework proved essential for analyzing how future-oriented thinking shaped stakeholder alignment. The research shows that divergent anticipatory orientations are a significant but under-recognized barrier to collaboration. These anticipatory misalignments were especially visible in the Marconi Salt Marshes and Hondsbossche Dunes cases, where ecological actors felt excluded due to a narrow reliance on predictive approaches. This insight builds on Riedy (2025) and Vervoort & Gupta (2018), who argue that foresight must be participatory and pluralistic to enhance legitimacy and co-ownership. The lack of structural foresight mechanisms undermined the projects' long-term governance capacity. As Muiderman et al. (2020) suggest, anticipatory governance is not effective unless foresight is institutionalized and co-produced across actor groups. The findings thus contribute to the practical insight that anticipatory capacity must be embedded across collaborative phases, not front-loaded in experimentation, or isolated in technical modeling.

While collaboration and anticipation are separate theories, they are empirically intertwined. For example, anticipatory tools can catalyze principled engagement or mutual understanding, but

only when inclusively applied. This supports Umbach (2024), who stresses the need for reflexive governance that enables actors to collectively navigate uncertainty, rather than deferring to technical models or predefined end-goals. Finally, this research proposes a typology of how collaborative and anticipatory dynamics vary across project phases from early-stage agenda setting to long-term implementation and monitoring. It shows that many governance innovations remain fragile without institutional scaffolding, particularly under conditions of uncertainty. By integrating collaborative and anticipatory governance frameworks, this research helps bridge two strands of scholarship often treated in isolation. Table 19 summarizes how the findings refine existing theory.

Theme	Existing Literature	Research Findings	Theoretical Contribution
Motivation and Legitimacy	Trust, shared values, and legitimacy support collaboration (Ansell & Gash, 2007)	Shared pride supports early motivation, but misaligned expectations erodes legitimacy post-implementation.	Confirms importance of shared values but emphasizes that long-term legitimacy requires conflict resolution and future-alignment mechanisms.
Leadership and Role Clarity	Leadership is crucial for initiating collaboration (Guston, 2013; Emerson et al., 2011).	Clear leadership during design/implementation, but fragmentation and turnover weakened governance.	Highlights that sustained leadership and continuity structures are critical for long-term collaboration.
Adaptive Management and Learning	Adaptive capacity improves resilience and learning (Emerson et al., 2011; Muiderman et al., 2020; Loorbach, 2009).	Monitoring and iterative learning supports adaptation.	Supports existing theory and adds that adaptive learning must be both institutionalized and inclusive to sustain collaborative capacity.
Hybrid Governance Models	Integration of formal and informal actors enhances resilience (Guston, 2013; Muiderman et al., 2022).	Projects succeed where governments and civil society co-produce knowledge. Yet, informal actors often lacked long-term involvement.	Confirms value of hybrid models, but extends theory by showing that institutionalized co-ownership is required for long-term collaboration.
Anticipatory Alignment	Anticipatory governance requires foresight tools and flexible institutions (Quay, 2010; Muiderman et al., 2020; Guston, 2013).	Scenario modelling and role-play offered anticipatory reflection. However, anticipatory tools were often one-off and not embedded.	Adds to anticipatory governance theory by identifying the need to institutionalize foresight practices and align pluralistic future visions to avoid misalignment.
Stakeholder Inclusion	Inclusive processes enhance legitimacy and ownership (Lee & Ospina, 2021; Hovardas, 2021).	Early inclusion is a strong enabler, but some groups were excluded post-implementation across cases.	Reinforces the need for long-term inclusion strategies. Participation must extend beyond planning to ensure sustainable governance outcomes.

Table 19: Theoretical contributions to existing literature

6.3. Practical and Theoretical Implications

The findings of this study offer several important implications for both practice and theory in the field of collaborative and anticipatory governance for coastal climate adaptation. From a practical standpoint, the results underscore the critical need for institutional embedding of long-term stakeholder collaboration beyond project implementation. Without sustained engagement mechanisms, knowledge continuity, and adaptive governance structures, the durability of collaborative outcomes remains uncertain. Similarly, the importance of aligning stakeholders' anticipatory perspectives emerges as a key factor influencing governance effectiveness. Divergent expectations about future risks and opportunities can undermine cooperation if not

actively managed. These practical insights highlight essential considerations for enhancing the resilience and inclusiveness of NCB projects.

Theoretically, this research contributes to advancing governance frameworks by emphasizing temporal continuity as a dimension often overlooked in collaborative governance literature. Furthermore, the study shows how anticipatory governance and collaborative governance are deeply intertwined rather than distinct processes. This interplay suggests that governance scholarship would benefit from integrative models that account for how future-oriented thinking shapes stakeholder alignment and collaboration over time.

6.4. Limitations and Critical Reflection

This research faced several limitations. First, due to time constraints and reduced staff capacity, the sample size of interviews could not be expanded beyond the three case studies. This may limit the generalizability of findings. Second, document analysis for the Marconi Salt Marshes project revealed a lack of recorded collaboration dynamics, which may have skewed comparison. Despite these limitations, the triangulation of interviews and the available documents for this and across the other cases supports the validity of the key findings.
The results presented in this study are based on a limited sample of stakeholders, as not all relevant organizations involved in the NCB projects were interviewed. Certain points of view were unintentionally left out due to time limits and a significant number of rejections, which frequently resulted from staff turnover or a lack of employees with adequate project knowledge. In terms of accurately reflecting the range of experiences and perspectives across the stakeholder network, this restricted the study's validity.

Furthermore, the reliability of the findings is affected by this inconsistency in participant involvement. The variety in stakeholder availability may have resulted in inconsistent data quality. In the Marconi Salt Marshes case three of the eight approached stakeholders were unable to participate because the original project members had left the organization. This limited the ability to reconstruct full collaborative histories for that case. As a result, the assessment of governance processes in the Marconi case relied more heavily on secondary sources and fewer firsthand accounts than in the Sand Motor case, where more original stakeholders were interviewed. This occurred despite the careful application of theoretical frameworks and the use of triangulation through document analysis to increase interpretative stability. This is especially relevant in projects where institutional memory was weak or when significant actors had already left the organization. Thus, even though the themes and patterns found align with the theory of collaborative governance, they should be regarded as indicative rather than conclusive. Additionally, the comparative analysis included projects differing in type and objectives, which provided broad insights but also introduced variability in enablers and

barriers. While this allowed for a rich cross-case comparison, it may have masked context-specific factors that would be more visible in studies focused on a single project type. Finally, despite stakeholders expressed interest in serving as international examples, this study focused only on national collaborations.

6.5. Recommendations for Praxis and Future Research

This research has shown that collaborative and anticipatory governance are essential for the success of coastal NCB projects, but their impact is highly dependent on the timing, structure, and inclusiveness of stakeholder involvement. Based on the comparative analysis of the three Dutch case studies, several practical and academic recommendations emerge.

From a practical perspective, stakeholders involved in NCB projects should prioritize the institutionalization of collaborative mechanisms beyond the implementation phase. In all three cases, collaboration weakened once project delivery was completed, due to fading role clarity, a lack of budget for monitoring, and absent long-term governance structures. To avoid this, project leaders should embed co-decision-making mechanisms into post-implementation arrangements, ensuring continued stakeholder involvement in monitoring, conflict resolution, and adaptive management. In addition, the early use of anticipatory tools should be structurally integrated into the project process. As shown in the Marconi Salt Marshes case, these tools foster a shared understanding of future uncertainties and help reconcile different anticipatory logics (e.g., probable vs. pluralistic visions). Governance fragmentation and power asymmetries also emerged as key barriers. Public agencies often retained decision-making authority, sidelining civil society and NGOs after implementation. Therefore, hybrid governance models are recommended, combining top-down regulatory stability with bottom-up ownership. This includes clarifying roles for local communities and ecological stakeholders, for example through community-led monitoring, participatory budgeting, or localized stewardship agreements. Building trust through transparent communication, ensuring continuity in leadership, and fostering early involvement of underrepresented stakeholders are further strategies to improve collaborative outcomes.

From an academic perspective, the findings reveal several gaps for future research. First, future studies should explore how different institutional structures influence post-implementation collaboration. A longitudinal design tracking stakeholder engagement across project phases would provide deeper insight into how motivation and legitimacy evolve over time. Second, this study focused on formal actors, which limits the understanding of broader societal inclusion. Further research into the role of local communities and how they perceive and experience inclusion in NCB governance could address this limitation and provide more

socially robust recommendations. Third, while power disparities were observed across all cases, they were rarely addressed directly in practice. Research into mechanisms for equitable participation, such as participatory governance tools or institutional safeguards, is needed to make collaboration not only more inclusive but also more just. Fourth, the comparison in this thesis involved projects with diverse goals and contexts. A more focused comparative study within one project type (e.g., only salt marsh projects or only beach nourishment initiatives) could produce more targeted insights into context-specific enablers and barriers. Fifth, the role of digital platforms and knowledge-sharing technologies in supporting collaboration and adaptive learning in governance deserves further investigation. These tools could help overcome discontinuities in engagement and institutional memory.

Furthermore, the involvement of private actors and the use of innovative financing mechanisms remain underexplored in NCB governance. Future studies should examine how these actors and tools can contribute to long-term maintenance and investment strategies. Finally, since Dutch projects such as the Sand Motor are often cited internationally, comparative international studies would be valuable. Investigating how collaborative and anticipatory governance is practiced in different cultural, institutional, and ecological contexts could reveal transferable lessons and inspire new approaches to climate adaptation.

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Appendix A – Interview Guide

Introductie

Introductie afnemer en onderzoek

Om een goed beeld te kunnen krijgen van wie ik ben zal ik eerst even mezelf voorstellen. Ik ben Donna Slaman, masterstudent Environmental Justice and Governance aan de Radboud Universiteit in Nijmegen. Voor mijn masterscriptie doe ik onderzoek naar samenwerkingsverbanden en anticiperend bestuur binnen klimaatbufferprojecten aan de kust. Mijn doel is om een helder overzicht en advies te geven over de dynamiek en uitkomsten van de samenwerkingen binnen de projecten. Specifiek kijk ik naar leiderschap, onzekerheden, betrokkenheid, gedeelde motivatie, capaciteit voor gezamenlijke actie en benaderingen van anticipatie op de toekomst van de projecten.

Toestemming voor dataopslag en opnames

Voor dit onderzoek zou ik graag dit interview willen opnemen, zodat ik zeker weet dat ik niets mis. De opname en het transcript zullen alleen toegankelijk zijn voor mij, mijn stagebegeleider en mijn scriptiebegeleider. Heeft u hier bezwaar tegen, of geeft u toestemming voor de opname?

Informatie loop van het interview

Allereerst bedankt voor uw tijd en deelname aan dit interview! Het gesprek zal ongeveer een uur duren. Deelname is volledig vrijwillig, dus u kunt op elk moment besluiten te stoppen. Er zijn geen juiste of onjuiste antwoorden; ik ben vooral benieuwd naar uw perspectief. Mocht u tijdens het interview vragen of opmerkingen hebben, stel ze gerust!

Anonimiteit en vertrouwelijkheid

Voor de betrouwbaarheid van het onderzoek is het waardevol om de resultaten transparant te rapporteren, waarbij ik uw naam en organisatie kan noemen. Echter, als u liever anoniem blijft of een pseudoniem hanteert, is dat ook mogelijk. In dat geval kan ik alleen uw organisatie vermelden of uw gegevens volledig anonimiseren. Vindt u het goed als ik uw naam en organisatie noem in het transcript en in mijn masterscriptie? Of heeft u liever dat ik alleen uw organisatie noem of volledige anonimiteit hanteer? U kunt hier uiteraard ook later in het interview nog op terugkomen.

Heeft u nog toevoegingen of vragen voordat we het interview starten?

Achtergrondinformatie

- Zou u zich kort kunnen voorstellen? Wie bent u, wat is uw rol binnen *[organisatie]*?
- Kunt u kort uw rol en betrokkenheid bij *[projectnaam]* toelichten?

- Hoe lang bent u betrokken (geweest) bij dit project?
- Welke organisaties of belanghebbenden spelen een belangrijke rol in dit project?
- Was het voor iedere partij duidelijk welk probleem het project moest oplossen en waren zij het daarover eens?

Samenwerking en Besluitvorming

- Wat verstaat u onder een goede samenwerking?
- Met wie werken/werkten jullie samen aan dit project?
- Hoe zou u de samenwerking tussen verschillende partijen in dit project omschrijven?
- Welke factoren dragen volgens u bij aan een effectieve samenwerking?
- Tegen welke uitdagingen loopt u aan in de samenwerking?
- Hoe worden besluiten genomen en hoe worden verschillende belangen meegenomen?
    - Heeft u het gevoel dat dit effectief is? Waarom wel/niet?
- In hoeverre ervaart u vertrouwen en gedeelde motivatie binnen de samenwerking?
- Hoe worden hulpbronnen verdeeld? Afhankelijk van de context: onderling (intern), tussen concurrenten (extern)
- Wie/welke organisaties, bedrijven en instituten staan u in de weg?
- Waar is men het over eens in dit project?
- Waar is men het over oneens?
- Met welke formele spelregels heeft u te maken en hoe werken die in het voordeel/nadeel van de samenwerking van het project? Denk aan beleid, procedures, protocollen etc
- Zijn er ook informele spelregels die in het voor of nadeel werken? Denk aan gewoontes, tradities etc.
- Heeft u het gevoel dat alle potentie uit de samenwerking gehaald is en hoe kan dit eventueel verbeterd worden?

Toekomstgericht Bestuur

- Hoe wordt binnen dit project rekening gehouden met toekomstige onzekerheden binnen...
    - ...klimaatverandering?
    - ...veranderlijkheid van de klimaatbuffer?
- Welke methoden of instrumenten worden gebruikt om deze toekomstige ontwikkelingen te anticiperen? (Bijv. scenario's, adaptieve planning, innovatieve technieken).

- In hoeverre is het project flexibel genoeg om zich aan veranderende omstandigheden aan te passen?
- Worden er structureel evaluaties of aanpassingen gedaan op basis van nieuwe inzichten?
- Hoe ervaart u de balans tussen korte termijn doelen en lange termijn duurzaamheid binnen het project?

Uitdagingen en Verbeteringen

- Wat zijn volgens u de grootste uitdagingen in samenwerking binnen [*projectnaam]*?
- Wat zijn volgens u de grootste uitdagingen in toekomstgericht bestuur binnen *[projectnaam]*?
- Welke verbeteringen zouden volgens u kunnen bijdragen aan een effectiever kustklimaatbufferproject?
- Wat zou u andere projecten aanraden op basis van uw ervaringen binnen dit project?

Afsluiting

- Is er nog iets dat u wilt toevoegen of dat we niet besproken hebben?
- Is er iets waar u nog op wil terugkomen uit dit interview?
- Wilt u op de hoogte blijven van de onderzoeksresultaten?
- Wilt u een digitale kopie ontvangen van het transcript?
- In het geval dat het analyseren van de gegevens vragen oproept, kan ik dan opnieuw contact met u opnemen?

Ik wil u onwijs bedanken voor de tijd en waardevolle informatie. Ik wil u eraan herinneren dat u op elk moment nog kan terugkomen op de manier van het behoud van anonimiteit en vertrouwen, mocht u dit later of nu nog willen wijzigen.

Heeft u nog vragen voor mij? Of opmerkingen of feedback over het onderzoek of het interview?

Appendix B – List of Codes

Codes Report – Grouped by: Code Groups

Created on: 17-02-2025

All: (26) codes

Atlas.TI - Version 25.0.1.32924

General System Context (6)

- Resource condition
- Policy framework
- Legal framework
- Political relation
- Power relation
- External event

Drivers for Engagement (4)

- Facilitating leadership
- Consequential incentive
- Interdependence
- Uncertainty

Collaborative Dynamics (12)

- Principled engagement: discovery
- Principled engagement: definition
- Principled engagement: deliberation
- Principled engagement: determination
- Shared motivation: trust
- Shared motivation: mutual understanding
- Shared motivation: legitimacy
- Shared motivation: shared commitment
- Capacity for joint action: procedural arrangement
- Capacity for joint action: process leadership
- Capacity for joint action: knowledge sharing
- Capacity for joint action: resource

Anticipation approach (4)

- Probable future
- Plausible future
- Performative future
- Pluralistic future

Appendix C – Statement on Generative AI

In compliance with the thesis policy regarding the use of generative AI systems, I confirm that I wrote the entire thesis myself. None of the thesis's material was generated, augmented, or drafted using generative AI technologies.

Throughout the thesis preparation, I used AI in a limited and explorative way to provide suggestions for data visualization. This was done alongside several other sources on data visualization like scribbr.nl, atlasti.com, and the book “Schrijven voor de Wetenschap” by Jansen and van der Deijl. These were treated as brainstorming tools only. All final visualizations were developed independently and based on my own interpretation of the data.

At no point did I rely on AI to generate original content, conduct analysis, or make arguments presented in the thesis.

I am aware that AI tools should be used carefully and responsibly. Therefore I used these tools minimally and in a careful way, following the university’s policy about the use of generative AI.