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Master Thesis

Monitoring arrangements for the adaptive implementation of Building with Nature projects

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Preface

The topic of this MSc thesis project was suggested by the research Institute Deltares[1] and agreed upon by the author in collaboration with the Dr. Hens Runhaar; Dr. Runhaar is the author's MSc thesis supervisor and Assistant Professor at the Copernicus Institute of Sustainable Development at Utrecht University. Under this agreement, Deltares cooperated with the author for a 10 month internship, during which the research institute assisted the author with knowledge input, guidance, and provision of connections. This MSc thesis project entailed trips to Deltares' headquarters at Delft as well as the Province of South Holland at The Hague (the Netherlands). The needs of the project were fully covered by the research institute.

This research project was conducted exclusively by the author, with the guidance of Dr. Hens Runhaar, and Saskia Hommes and Bouke Ottow from Deltares. It does not necessarily reflect or represent the official position of Deltares on this particular topic.

[1] Deltares is an independent applied research institute in the field of water, subsurface and infrastructure. Deltares focuses on knowledge development on a variety of relevant disciplines such as spatial planning, hydrology, geophysics etc. (http://www.deltares.nl/en/about-deltares)

Acknowledgements

This MSc thesis project is the last step before I complete the MSc program Sustainable Development and more specifically the Environmental Governance Track. I would like to express some thoughts and pay tribute to certain people that made this 'journey' so special.

First and foremost, I would like to thank my parents, without whom I would not have the chance to embark upon this exciting, fulfilling and overwhelming journey in the Netherlands – the attendance of this MSc project. Second I would like to say an enormous thank you to my thesis supervisor Hens Runhaar. There was not a single time when the guidelines, suggestions and remarks of Mr. Runhaar were something less than necessary and to-the-point. His contribution and mentorship to this research was of paramount importance and assisted greatly to bring this project to its final state. Saskia Hommes and Bouke Ottow were my supervisors from Deltares that also helped me greatly with their enthusiasm, positive attitude and guidance to see this project through. Another person I ought to mention for his support and persistence is Georgios Papageorgiou.

I hope you find this project as exciting as I do. Have a pleasant reading.

Ioanna Chatzidimopoulou,

Utrecht, the Netherlands,

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Summary

The need for flood protection of the Delfland coast, as well as for additional space for recreation for the Province of South Holland of the Netherlands, led to the construction of the Sand Engine – a benchmark project of the Building with Nature (BwN) Dutch paradigm in hydraulic engineering. Building with Nature is a concept that is largely applied in environments with intense interaction among nature and humans so far. Therefore, it requires an appropriate and realistic type of management – the adaptive management approach, according to the professional literature. In addition, Building with Nature has only recently started being employed (3 years), and there is a strong need to keep track of its outcomes and implications through monitoring.

However, monitoring is seemingly still approached in the traditional manner within the management of Building with Nature projects, whereas it should evidently be organized according to adaptive principles as well. This implies that the traditional functions monitoring has should be revisited, as the new challenges also require an altered role from monitoring. This research approaches monitoring by analyzing and assessing the organization of processes from a governance perspective. In that respect, and in order to figure out '*what works, where and in what way'* in terms of adaptive monitoring governance of Building with Nature projects, this research assesses the monitoring arrangements of the Sand Engine and another strongly BwN-like (in terms of certain attributes) case. The monitoring arrangements reflect the internal organization-governance of the various monitoring tasks.

In the South Bay of San Francisco in California of the United States, the need for restoration of the 150 year-old salt ponds (for commercial activities) was evident. The salt ponds had largely altered the natural state of the local estuarine environment and tidal processes, which in combination with the climate changes creates the threat of flooding of the surrounding to the Bay regions. Ideas of reinstating the local environmental to a more pristine condition, led to the implementation of the South Salt Pond Restoration (SBSPR) project, in 2003. The monitoring arrangements of the projects of SBSPR and Sand Engine are analyzed and evaluated in terms of the degree to which they meet certain conditions that facilitate the functions which monitoring should have in BwN project management. Furthermore, this research set out to identify factors which appear to influence monitoring effectiveness, and also the ones with the highest degree of influence. Among the most important factors are *distinction of jurisdictions among the parties involved*, *the availability of financial resources of the policymakers*, and *the flexibility of the monitoring program* which reflects the ability of the project to obtain efficiently and effectively the necessary funding for monitoring. This research aims by conducting the aforementioned analysis to come up with certain design principles that can facilitate the adaptive implementation of another project being designed according to the BwN paradigm – the Marker Wadden. Marker Wadden is going to be implemented in the inland gulf of the Netherlands (Markermeer region).

One of the main findings of this research is that the monitoring arrangements of the Sand Engine appear to be moderately effective in terms of the achievement of the learning and evaluation function of monitoring and effective in terms of steering. However, they are ineffective in terms of the fourth function identified by this research i.e. whether they facilitate monitoring to function as a proof mechanism in order for the project to garner stakeholder support. The monitoring arrangements of the SBSPR project appear to be effective in terms of the learning, evaluation and steering functions, but moderately effective in terms of the fourth function. The Marker Wadden

project is going to be applied in the Dutch institutional and organizational context. Hence, the reasons for moderate performance of the Sand Engine's monitoring arrangements have to be taken into account when designing Marker Wadden's monitoring arrangements.

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Chapter 1: Introduction

1.1 Background information

Deltas and coastal zones all over the world historically were, and continue to this day to be, centers of urbanization and economic development. However, along with the encroachment of urbanization in these areas, huge interventions were made in the natural environment of the coastal areas. There are various demands on coastal areas such as transportation, coastal industries and constructions, land use, tourism etc. In addition, the way the significant issues of flood management were approached heretofore, has proven to function usually at the expense of the local environments and natural habitats (Yanagi and Ducrotoy 2003).

The traditional way in which flood management have been approached so far, was according to the classical civil engineering principles. The classical engineering paradigm implied most times the realization of maritime infrastructure projects that required enormous amounts of materials and energy. As a result, there were negative implications on the natural processes of local environments. The extensive energy cost and the negative effect on local natural processes along with new concepts and technological developments arising called for consideration and revision of engineering methods and techniques. There was the need for techniques that would achieve the same engineering objectives, but in a more integrative and overarching way, that most importantly took the environment into serious account. Decisions such as whether 'business as usual' approaches should continue, or whether they were still affordable had to be made (Mitsch and Jørgensen, 2003). During the last 30 years, a new type of engineering has gained significant momentum, the ecological engineering or eco-engineering. This new paradigm entails the "the design of sustainable ecosystems that integrate human society with its natural environment for the benefit of both. Eco-engineering promotes nature restoration of areas that have been deteriorated by human interference as well as the development of new sustainable ecosystems that provide added value for people and nature" (Mitsch and Jørgensen, 2003, p.1). For the purposes of this thesis research, the focus will be on a certain conceptual branch of eco-engineering, *Building with Nature*, which introduces innovative construction principles for coastal protection and nature development. These principles indicate building flood protection constructs/projects with the help of technology and then leaving natural processes undisturbed of technological interference, to achieve flood protection well as nature development objectives in the long term (de Vriend and van Koningsveld, 2012). In the next sub-sections, the concept of Building with Nature is presented along with a brief description of the implications of its appearance in terms of management and monitoring.

1.1.1 The advent of Building with Nature and its significance

Building with Nature (BwN hereafter) is an eco-engineering concept for flood management and nature development which made its first appearance in 1979. It differs substantially from traditional engineering, in the sense it refrains from the exclusive use of hard engineering techniques for the realization of flood protection infrastructure projects. Instead, it promotes a more environmentally friendly approach for flood protection and coastal development, by making use of natural processes within natural habitats and the functions of eco-engineering species such as oysters, mussels etc. However, it does not completely discard technological means; it indicates the use of technology

when needed in order for the various procedures of the project to be realized smoothly, efficiently and effectively to the greatest possible extent (IADC, 2010).

Traditional flood management practices indicated the construction of hard and often large-scale infrastructure, such as dikes, storm surge barriers etc. (van den Hoek et al., 2012). Although such constructions have proven quite effective in the past, there are significant doubts as to whether they were designed in a way that they can predict and deal with unexpected physical phenomena, e.g. extreme precipitation. In addition, the effects of these rigid structures on the natural processes of the local environments are under-investigated and are considered not to be taken into account to a sufficient degree. The latter fact in combination with the growing belief that human activities have to be more responsible to the environment, gave significant momentum to the adoption of more environmental and ecosystem friendly practices in the field of flood management and protection. BwN, a form of ecological engineering (Mitsch and Jørgensen, 2003) in flood protection promotes the use of natural materials and dynamics (e.g. sediment, vegetation etc.) for the achievement of effective flood protection, while also pursuing opportunities for nature development and preservation (Van Dalfsen and Aarninkhof, 2009).

However, BwN did not only appear merely as a solution deriving from the disappointment or lack of support of the classical engineering. It has its own momentum and has garnered the support and attention of a lot of ecologists, engineers, regulators, project developers and many other types of stakeholders. It has been proven to improve natural and wildlife habitats, attract new species and/or provide new breeding locations. BwN projects serve also a socio-economic purpose; the improvement of industrial and recreational infrastructure (IADC, 2010). These changes alone are considered a significant positive improvement in local environments and constitute BwN worthy of further research. The application of BwN however entails certain challenges in terms of management; those challenges are presented in the section below.

1.1.2 Management challenges related to Building with Nature

Although BwN seems rather promising, it is still a practice which has not been broadly applied with regard to flood management projects. This could have happened for many reasons; either because the classical engineering paradigm was more trusted or BwN has not been promoted in an efficient way etc. The fact that BwN has yet to be adopted widely implies that thus far not much has been figured out in terms of what works best, when and in what ways (Borsje et al., 2011). Hence, the concept of BwN projects is still characterized by a lot of uncertainty and complexity (van den Hoek et al., 2012), which may constitute a barrier for the knowledge creation and its use in BwN decisionmaking processes, implementation and maintenance. The concept so far is linked to a number of challenges that have to be met in order for the concept to be widely understood and adopted.

- **Necessity for more in-depth knowledge on ecosystems functionalities**. Firstly, the fact that the BwN has only recently 'made its first steps' as a flood protection and nature development paradigm, calls for research on a variety of relevant to the concept aspects. For example, there is the need for distinct analyses of the attributes and functionality of the various ecosystems that BwN projects have an impact on. This is a necessity in order to gain sufficient knowledge for each one of them, as most natural ecosystems are inherently volatile and unstable. Moreover,

relevant insights are necessary for the scientists to be able to prevent potential behaviors and to have contingency plans.

- **Integration of the interests and concerns of a large diversity of stakeholders and involved parties.** BwN projects are integrative in their nature and require a multidisciplinary approach in terms of the necessary knowledge. Therefore, equally important, is the incorporation of the knowledge of multiple sources and stakeholders such as for example of local actors, e.g. local fishermen or research results of relevant environmental groups etc. On the one hand, the locals are probably familiar with certain behaviors of the local ecosystems and their expertise can be a great addition to the implementation of the project. On the other hand, the scientific expertise might provide also accurate and appropriate insights (Vanclay, 2012). In order for BwN projects to be broadly accepted and supported by the large diversity of stakeholders, interaction and inclusion processes need to be organized as the stakeholders' concerns and stakes might vary a great deal (Barbier et. al, 2008). Furthermore, the expectations of the parties involved in BwN project, about the environmental objectives they should meet, are still blur and not well-defined. As a result, the parties are not adequately informed and familiar with the "individual" goals they have to meet. In addition, there is concern and skepticism with regard to whether it is wise and efficient to include all stakeholders in all phases of the realization of BwN project (Barbier et. Al, 2008) as not all of them can contribute to the desired result at all phases. However, this is a matter of project management of an individual case, and therefore it is not going to be analyzed in this research.

- **Incorporation of aspects relevant to the numerous different fields and disciplines are implicated in a BwN project**. Apart from the large number of stakeholders involved in BwN projects, a large number of different fields that are also implicated, constituting the governance of BwN projects even more complicated. For example, the field of coastal protection might indicate and underline different needs than the field of ecology; on the one hand coastal protection might require the creation of flood defense constructs while ecology might require avoiding disturbance of local ecosystems. Such conflicts of interest arise quite often and concerning for example the various purposes of land use of coastal areas (Barbier et. Al, 2008). Considering that BwN aims at more than pure, traditional flood protection it is reasonable that the various policy domains have to be conciliated. In other words, BwN might concern equally the field of spatial planning, water management, environmental protection etc. The different stakes of these fields have to be balanced. The various procedures of a BwN project also touch upon social domains for example policy and decision-making. The decision-making arrangements for the realization of a maritime infrastructure project for example, before the introduction of BwN, were quite straightforward. However, the decisionmaking process for BwN projects which entail the consideration and involvement of more and diversified types of stakeholders, makes the process significantly more complex (IADC, 2010).

The next part of this chapter presents the type of management that was designated by the literature review as the most appropriate to deal with BwN challenges in terms of management.

1.1.3 Monitoring challenges related to Building with Nature

BwN is a practice applied in coastal protection projects so far, and the need to keep track of its outcomes and implications is strong; they need to be thoroughly observed and in depth studied. Monitoring BwN projects is a process through which the BwN project's effects on the ecosystem at issue and potential changes that might occur over time are observed, interpreted and analyzed. In BwN projects a natural ecosystem in co-existence (for a certain period of time) with technical means is the initial focus of monitoring. Later on, after the removal of technical means, the focus shifts on the effects and objectives of the BwN project while at the same time the natural processes evolve and develop (in principle) are undisturbed.

Although the technical part of the design of BwN projects was so far quite clear and understandable, certain types of implications of its implementation are not. Firstly, the implications caused by the implementation of a BwN project for the various society related stakes are still elusive (for example implications on recreational use of the BwN project area). Therefore, it is important for monitoring to keep track not only of the technical and nature goals of the project, but also of the 'society' goals and implications of a BwN project. Another problematic aspect is that knowledge and expectations of an ecological process might change during the implementation process of the project due to the volatile and non-linear nature of ecosystems. This implies that BwN monitoring is inherently different than classic engineering monitoring; the former is heavily dependent on the role of ecosystem processes in the achievement of the desirable end result, while the former is almost entirely dependent on technological means and interventions. Finally, monitoring needs to address aspects relevant to the wide variety of disciplines implicated in a BwN project. If a crucial part of a BwN project management i.e. monitoring does not give answers to concerns relating to various implicated disciplines then real adaptive monitoring (and therefore management results) are rather unlikely to be achieved.

Absolute solutions cannot be given to the issues of uncertainty and complexity. What can be achieved however is the articulation of strategies, such as a number of monitoring arrangements that allow for the adaptive implementation of BwN projects. Uncertainty cannot disappear, and even adaptive monitoring cannot solve everything. The next section presents the research objective of this thesis, based on the challenges mentioned above with regard to BwN and its implications in adaptive monitoring.

1.2 Research objective and research questions

The academic and professional literature on monitoring in adaptive management contexts provides a quite extensive amount of information on an 'ideal' monitoring program in adaptive management i.e. how should that monitoring program look like. However, there are two important knowledge gaps when addressing monitoring of a BwN project. Firstly, the practical implications of the 'ideal' monitoring programs are not empirically validated in real life situations (BwN projects). Secondly, insights and knowledge on monitoring BwN or similar to BwN principles projects are highly fragmented. Therefore, this research aims by conducting an analysis on the monitoring programs of two projects, to articulate a set of monitoring arrangements in the form of design principles that facilitates the adaptive implementation of BwN projects. Moreover, this project aspires to present a set of design principles that are believed to be able to facilitate the adaptive implementation of the BwN project of Marker Wadden in the Netherlands (Markermeer region).

It is important at this point to explain what definition this research appoints to a monitoring arrangement. A *monitoring arrangement* is any type of agreement in the form of e.g. negotiation, settlement, or responsibility appointment with regard to the monitoring process of a project (see section 2.2). For this research, an arrangement pertains and defines 'who' i.e. which party involved in monitoring is responsible to do 'what', 'when', in what way etc. More specifically, these are the four core components of a monitoring arrangement. For example, the 'who' refers to the party responsible to incorporate certain changes in the monitoring program, (i.e. the 'what'). These changes have to be made in a specific timeframe (the 'when') by taking a number of actions (the 'in what way'). For the sake of clarity it should be mentioned that this paper will not address types of natural or social conditions/parameters that should be measured by the monitoring plan.

Based on the aforementioned aspects, the central research question that this research project sets out to answer is:

What kind of monitoring arrangements can facilitate the adaptive implementation of Building with Nature projects?

In order for these arrangements to be articulated there are certain aspects that need to be researched and analyzed within the framework of this research. As mentioned before, the professional literature provides certain norms which show how a monitoring program in adaptive management should look like. Firstly, these norms show what kind of functions monitoring is expected to serve in adaptive management; in addition, these functions are achieved as long as certain criteria (of monitoring effectiveness) are met. Finally, those criteria are believed to be influenced by certain explanatory variables. Therefore, this research objective calls for the generation of certain types of knowledge:

- ***Descriptive knowledge*** by describing the main monitoring functions in adaptive management contexts
- ***Evaluative Knowledge*** by articulating criteria based on which the monitoring arrangements of BwN projects will be assessed in terms of the level of contribution to monitoring effectiveness
- ***Explanatory knowledge*** by providing explanatory variables that determine the effectiveness of monitoring arrangements
- ***Prescriptive knowledge*** by providing recommendations based on both literature and case study research as to how existing monitoring arrangements could be improved or adjusted

In respect to the description and explanation of the research purpose of this paper this research project sets out to answer the following main research question as well as sub-questions:

Research Subquestions:

1) Which are the main functions of monitoring in adaptive management of BwN projects?

2) Which conditions are believed to facilitate effectiveness of monitoring for BwN projects? (Effectiveness criteria)

3) Which factors are believed to influence the degree to which the aforementioned conditions are satisfied? (Explanatory variables)

1.3 Research framework

The research framework of this paper will follow this structure: firstly, there will be an overview of the existing literature which is expected to come up with the main functions of monitoring in adaptive management. In addition, the conditions that have to be met in order for the aforementioned functions to be achieved will be presented (those conditions will be hereafter referred to as *effectiveness criteria*); the literature is expected to provide knowledge on factors that appear to influence the degree to which those conditions are satisfied (those factors will be hereafter referred to as *explanatory variables*). Those three types of concepts will be empirically tested (i.e. in a real life situation) and are expected to be adjusted e.g. from the empirical testing additional functions, effectiveness criteria, and/or explanatory variables might come up. Based on the adjustments made to the three types of concepts, this research will attempt to articulate a set of design principles for monitoring arrangements that are able to facilitate adaptive implementation of future BwN projects.

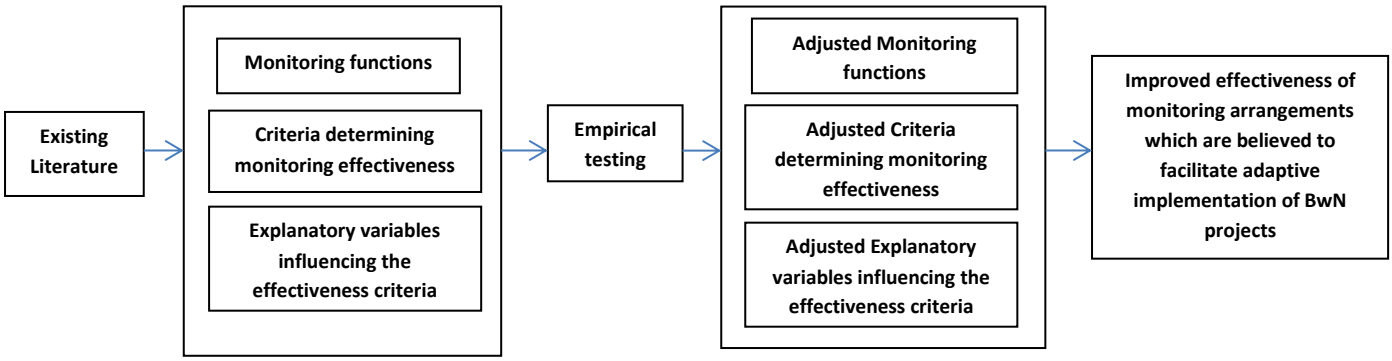

Figure 1: Research framework

1.4 Research strategy

The development of an appropriate research strategy is crucial for the achievement of the project objectives of the research project itself. Certain choices regarding the research strategy of this project depend strongly on the specific questions that will be addressed in the project. However, this project's research strategy was also planned based on the availability of data and the depth of analysis required (van Dijk, 2008).

The research method followed in this project is the 'comparative case study' as it is considered to suit best this research's objectives. According to Howarth (2005) it is useful to conduct a comparative case study research, especially on the occasion when two (or more) cases are adequately comparable and important lessons are expected to be derived from their comparison. Moreover, each case can be better understood when juxtaposed to others. In this particular case study research three cases will be analyzed. Firstly, two ex-post cases will be introduced and analyzed; these cases are actually a BwN and a BwN-like project, whose arrangements will be assessed in terms of the degree to which they facilitate adaptive implementation of the respective project. Then, after comparing the two ex-post cases, certain conclusions will be drawn which will take the form of design principles for the future design of monitoring arrangements for a project that is not implemented or fully designed yet, i.e. an ex-ante case. The ex-post cases were chosen deliberately based on specific criteria. The criteria for the case study selection are the following:

- The cases had to be examples of the application of the BwN concept or examples of BwN-like concepts
- There had to be sufficient access to information for the cases and reachability of contact persons
- At least one of the cases had to be an international case (i.e. outside of the Netherlands) for knowledge and experience exchange on what might work in terms of monitoring arrangements. Preferably the cases should have been realized in a public-private setting as the ex-ante case of Marker Wadden will be realized in the Netherlands where there is also a public-private setting
- The two cases have to have applied some sort of monitoring approach
- The two cases have to already be in the monitoring phase

The first ex-post case chosen is the 'Sand Engine' case in the Netherlands. The Sand Engine is a BwN project which was realized in a public-private setting, provides adequate availability of information, has a monitoring approach (that was however articulated after the implementation of the project) and has actually entered the monitoring phase. The second case chosen is the South Bay Salt Pond Restoration project. This is a nature restoration project per se, but is largely conceptually related to the BwN concept, and therefore considered a good fit for a second ex-post case. It is realized in San Francisco, United States, meeting the requirement of the international case also realized in a public-private setting. This case provides a plethora of information and contact persons. It has an articulated monitoring methodology and is already in the monitoring phase.

One additional reason behind the choice of the ex-post cases, besides the fact that the conditions making the three cases comparable were satisfied, is that the analysis of the ex post cases' monitoring approaches will provide lessons for the design of monitoring arrangements for the ex-ante case of Marker Wadden. Further justification and explanation of the choice of the research method and the underline logic behind this choice can be found in section 3.4.

The next chapter introduces the theoretical foundation of this thesis. The chapter will present what literature shows with regard to the theoretical debate on monitoring in adaptive management of BwN projects and its expected functions. In addition, the criteria of monitoring effectiveness (defined in chapter 2 by the criteria) will be presented, as well as the factors deriving from literature appearing to influence the degree to which the criteria are met. All the aforementioned aspects will be summarized in a conceptual diagram. The chapter will be finalized by presenting design principles for monitoring arrangements based on the knowledge gained by the literature review.

Chapter 2: Theoretical Framework

This chapter starts by describing the traditional flood management approach. Next, the main monitoring functions in this traditional type of management are presented, as monitoring is the central concept of this research. Following, the theoretical framework zooms in the BwN paradigm the emerged in flood management; BwN projects appear to have certain needs in terms of management based on the related challenges, described in Chapter 1. The theoretical foundation of this research supports that adaptive principles assist in the achievement of better management results for BwN projects. The challenges and new management needs extend also to the monitoring programs of environmental projects; monitoring is elevated to a crucial and vital part according to the adaptive management approach. But are the functions of monitoring the same in adaptive management contexts (as in the traditional type)? If not, are the adjusted or do they change completely? Which conditions have to be met in order for the new (or adjusted) monitoring functions to be achieved? And what factors influence the degree to which those conditions are met? The chapter will conclude by presenting design principles for monitoring arrangements that are believed to facilitate the adaptive implementation of a BwN project.

2.1 Traditional flood management

Historically, flood management practices focused almost entirely on flood control and protection of the coastal lines. The inherent uncertainty and limitations to the knowledge and understanding of the frequency and magnitude of extreme flood events is nowadays aggravated by climate change effects. Furthermore, flood management largely indicated structural measures (e.g. dikes, dams etc.) which ensured protection up to a finite, pre-defined security level. In other words, there was uncertainty with regard to what additional measures were required in case the aforementioned structural measures failed due to e.g. an overtopping occasion. Flood management tended also to be applied and approached in a mono-disciplinary manner. Classic civil engineering has dominated flood control practices, while effects and implications of traditional practices were not taken into consideration. More specifically, the ecological, economic and social costs associated with the implementation of traditional flood management practices were in many cases almost entirely ignored. Practices largely dependent on a single disciplinary and the knowledge of the respective experts, has proven to cause negative effects in the long term on the hydrological cycle of the area, the health of the ecosystem at issue and the social conditions of affected communities (Hamburg University of Technology, 2014).

As monitoring is one of the cornerstone concepts of this paper, it is important to present certain relevant definitions that will be used in the theory chapter as well in the methodology and analyses' chapters.

2.2 Monitoring in traditional coastal management

The traditional definition of monitoring was the "systematic sampling of air, water, soil, and biota in order to observe and study the environment, as well as to derive knowledge from this process" (Weston, 2011, p.1). In other words, already obvious from the definition, monitoring focused on specific kinds of indicators, mainly technical and natural. However, for the purposes of this research a monitoring program as a whole is defined as follows.

A *monitoring program* entails the sum of processes of systematic collection, analysis, interpretation and use of information from environmental projects, stakeholders and policymakers (adapted by PSO, 2004). In order for the sum of processes to be governed and conducted in an efficient and effective certain arrangements have to be made. This research will define a *monitoring arrangement* as any type of agreement in the form of e.g. settlement, negotiation and/or responsibility appointment that relates to the monitoring processes of a BwN project. For example, a monitoring arrangement might indicate the uptake of certain monitoring responsibilities by external to the project entities such as NGOs, social groups, Ministries etc. Another monitoring arrangement might define the degree and form of stakeholder participation and involvement in the various monitoring processes of a BwN project. More specifically, a project might entail a monitoring arrangement that requires some sort of involvement of stakeholders in the monitoring processes. Based on the aforementioned, the main components of a monitoring arrangement are the '*who*, *what*, *how*, *why*' relating to a monitoring process. More specifically, *who* is responsible for a particular monitoring task (i.e. for *what*), *how* are they expected to deal with the appointed task, and *why* does the task have to be dealt with in this way and by specific individuals or groups of people (SPREP, 2014).

Monitoring in flood management, similarly to other fields, had traditionally the following main functions. Firstly, monitoring aimed at the provision of lessons mainly based on past experiences and flood management practices – the *learning* function (Lynam and Stafford Smith, 2004). However, lessons were derived mainly by looking on what effects previous management actions incurred; lessons were not provided by proactive learning processes among the parties involved and integration of multiple types of knowledge. Another function of monitoring with regard to flood management aimed at assessing the progress of such a project with regard to the objectives stated – the *evaluation* function. This function focused on ad-hoc observations and monitoring that would give answers and information on progress only at specific times and on a limited amount of aspects related to the project. As a result, monitoring could not give a comprehensive and all-encompassing evaluation and overview of all relevant to the project aspects, or how the project reached that situation. Finally, monitoring had traditionally the *steering* function. This function aimed at improving mainly project level decisionmaking (i.e. project managers tried to make better decisions based on previous decisions they had made). The steering function aimed also at triggering changes in higher level flood management policymaking, without however being particularly effective. This ineffectiveness related to the fact that the link between the monitoring results and policymaking was weak (Cundill and Fabricius, 2009, Bellamy et al., 2001). The functions mentioned are adapted by the main categories of functions presented in PSO (2004).

Due to the aforementioned impediments of the traditional monitoring functions, as well as of the overall traditional management practices, in addressing the ever increasing demands of social and ecological needs, the need for a new type of management was evident. The concept of *adaptive* management gained prominence already around mid-1970's (Holling, 1978), when among other fields, the adaptive approach was largely promoted in the field of flood management. One of the paradigms promoting and at the same time requiring adaptive management appears to be the Dutch paradigm in hydraulic engineering BwN, already presented in Chapter 1. BwN entails innovative principles for the achievement of flood protection combined with nature development opportunities. The next subsection explains why the adaptive approach of management seems fit for BwN projects, based on the challenges mentioned in the first chapter.

2.3 Adaptive management of BwN projects

According to Redman et al., (2004), there has not been a single time in the known human history when humans and nature did not form coherent systems that comprised a wide variety of biophysical and social factors that interacted in a resilient and perpetual manner. Various scholars have given various definitions to those systems; this research will use the definition 'social-ecological' system introduced by Berkes and Folke (1998). The authors aimed at emphasizing that humans are an integral part of nature and basically attempts of distinction between social and ecological systems is unsubstantial. Adaptive management (Holling, 1978) is believed to provide a more realistic and approach to cope with the challenges of a social-ecological system. After having presented the main BwN challenges in Chapter 1, adaptive appears to gives answers also to BwN challenges. De Vriend and van Koningsveld (2012) argued that BwN is a paradigm that not only aims at merely building a flood protection project but also to create nature development opportunities. In order for this to happen there is the need to take a step back and analyze crucial physical, ecological and social attributes of the social-ecological system in which the BwN project is being or is planned to be implemented.

The first challenge related to the BwN concept indicates **more in-depth knowledge on ecosystems functionalities**. In order for this challenge to be dealt with, the BwN project needs to be managed in an adaptive way that ensures iterative *learning* processes and adaptive monitoring (Holling, 1978). Such processes are able to result in generation of important types of knowledge on various social-ecological ecosystem aspects. In this way, by obtaining more and deeper knowledge on how the ecosystem functions the uncertainty of complex ecosystems is better dealt with (Gunderson and Holling, 2002). A second challenge when managing a BwN project is the **integration of the interests and concerns of a large diversity of stakeholders and involved parties.** BwN is a paradigm that was designed to be implemented in largely urbanized area areas; therefore the number of affected parties is high. Adaptive management is an approach that gives prominence to inclusive and participatory processes that aim at promoting and facilitating collaboration among multiple stakeholders in order to achieve results as responsive as possible to local needs and demands (McLain and Lee, 1996). The third management challenge associated with BwN is the need for **integration of aspects relevant to the numerous different fields and disciplines implicated in a BwN project**. The core focus of BwN being the study and sustainable development of social-ecological systems creates demands with regard to the number of fields and disciplines that have to be taken into account when managing a BwN project. In other words, BwN's approach to flood protection does not have a mono-disciplinary character. Adaptive management seems to be able to cope with the coordination and reconciliation of the demands of the variety of disciplines in the best possible way, by studying implications and accounting for them through knowledge creation by learning processes and monitoring (Allan and Stankey, 2009).

After having presented briefly how adaptive management answers to BwN challenges, it is important to zoom in monitoring in adaptive management. The next part of this chapter presents how traditional monitoring functions are reformed in adaptive management contexts. For the sake of clarity, it is important to mention that this theoretical framework will address the use of collaborative practices within the adaptive monitoring functions but it will not address the co-management approach per se.

2.4 Monitoring functions in adaptive management

Previously, the traditional functions of monitoring were described and briefly why they could not address the demanding complex social and ecological needs. In addition, there was an explanation why adaptive management appears to be able to cope with BwN challenges. Below, there is a description of the main monitoring functions in adaptive management of BwN projects:

Learning

As mentioned above, traditionally, the learning function of monitoring aimed at providing knowledge on ecosystem functions and responses, mainly based on past experiences. Adaptive and collaborative principles indicate adjustments to the monitoring function. Collaborative learning in adaptive management is the process when various types of parties such as individuals (e.g. scientists, policymakers, project managers), or groups of people (e.g. environmental groups, government departments) set out to collaboratively and deliberately gain knowledge on social and ecological needs, and articulate specific strategies to deal with the respective challenges. In support of the substantial role of learning within management of social and ecological systems, which are also a core focus of BwN, are also Allan and Stankey (2009). These authors maintain that such a system cannot be managed adaptively if the management approach does not entail iterative learning processes among all the involved parties.

A participatory learning approach in monitoring involves active social and stakeholder involvement in the monitoring processes (Cundill and Fabricius, 2009). According to Keen et al. (2005b) participatory learning represents the collective action by interested parties, in their effort to jointly achieve better results in terms of management of a social-ecological system. Similarly, that could assist in the achievement of more focused and to the-point results with regard to monitoring. Berkes (2009, p.1699) argues that successful adaptive management requires a knowledge partnership. “Different levels of organization and actors have comparative advantages in the mobilization and generation of different kinds of knowledge.” This statement is in accordance with the argumentation of Pahl-Wostl et al. (2007) who also underline the importance of collaboration in ecosystem management; they advocate explicitly the significance of taking into consideration diverging perceptions and views, also when monitoring projects implemented in complex systems (BwN projects in this case). All in all, the learning function of monitoring which implied traditionally looking back mainly at previous management actions is altered; collaborative learning for and from monitoring means that knowledge is necessary from various groups affected such as stakeholders, project managers and policymakers. In this way, multiple perspectives and concerns are heard, enhancing the quality and effectiveness of decisions for further action, both at a project level and environmental policymaking level. This research does not address collaborative monitoring i.e. the participation of stakeholders in monitoring processes such as data collection or analysis. However, it regards as collaborative learning in monitoring a process during which stakeholders have the opportunity by expressing their opinions and ideas (with regard to the projects past and future actions) as well as bringing knowledge to the table, to be able to contribute and shape the course of development of monitoring activities.

Evaluation

The evaluation function of traditional monitoring which mainly aimed at keeping track and assessing the changes incurred by project (management) actions also evolves in adaptive monitoring settings.

Monitoring activities used to be narrowed down to giving answers only to a limited amount of aspects relating to the project's stated objectives; adaptive monitoring aims at evaluating the whole process of monitoring itself and the overall project management. Keen et al. (2005b) underline the importance of continuous reflection on the knowledge gained among the involved groups; this applies also to the monitoring part. The reflection is further focused on aspects such as stakeholder interests and concerns, the treatment of the knowledge obtained and the values and perspectives of the people involved. It is important that the monitoring program promotes and produces results relevant to shared issues of concern among the involved parties - both the producers and the users of the information (Boyle, 2001). The policymakers are also included as users of the information implying that monitoring can function as a reflection/evaluation mechanism on policymakers concerns and interests (even more if they also deliberate and evaluate the knowledge and processes).

One aspect of the reformed monitoring function of evaluation is the clarification of roles and responsibilities of the people involved in monitoring. In order to ensure to-the-point evaluation of the monitoring (and the overall project's progress) there is the need to have a clear picture and comprehensive overview of the management and monitoring processes. This theoretical framework supports that the institutionalization of the various monitoring processes and tasks (data collection, interpretation and use) assists the comprehensive evaluation of the monitoring part of a BwN project; when the tasks and responsibilities are clarified and in if necessary institutionalized, it is easier to figure out which 'gear' or mechanism might need reinforcement or change. Also, in this way, in light of new (monitoring) needs there are clearer guidelines, that also entail potential updates in the roles and responsibilities ensure adaptive capacity of the monitoring program – the changes are made more easily and the monitoring needs are addressed efficiently and effectively.

As a *monitoring need* this research defines any change, e.g. addition that needs to be made with regard to the monitoring processes of data collection, analysis, interpretation and use. These changes are largely related to the management of BwN and the respective project's objectives. For example, a monitoring need might translate in addition of a data collection process for a new aspect relevant to the project. More specifically, existing monitoring results might indicate the necessity for an additional aspect to be addressed by monitoring, that was not addressed before. Another monitoring need is a potential change in the processes of interpretation of the monitoring results i.e. further discussions and meetings for deliberation on the evidence deriving from the monitoring results. Monitoring needs usually require additional funding in order to be satisfied.

Steering

Traditionally, monitoring had a third main function, the one of steering future decisions both on the project level, as well as higher level policymaking. For the purposes of this research it is important to make a distinction among project level decisionmakers (the actors managing and funding a project) and policy-level decisionmakers (actors, usually governmental agencies or departments, having permitting and policymaking authority over a project's activities). The former are going to be referred to hereafter as *project managers* and the latter as *policymakers*. For the purposes of this research, policymakers are considered to contribute a portion of the funding for the monitoring needs of the project (both ex-post cases entail funding from policymaking entities). That specification is made because the projects under investigation are at least partially managed and funded by certain governmental and/or regulatory authorities. Therefore, the results are expected

to be more fitting for projects with similar organizational structure (governmental authorities as co-project managers and co-founders).

The steering function of monitoring traditionally entailed mostly, merely a presentation of monitoring results to project managers and policymakers, with the 'hope' of steering further decisions to a more desired path. This was often problematic as usually project managers and policymakers were distanced and unfamiliar with the monitoring needs of the project at issue. Adaptive and collaborative principles however illustrate a different attitude towards the link between decisionmaking and monitoring, both towards project managers and policymakers. The policymakers and project managers are considered as equally important parties in the learning and evaluation processes with regard to monitoring. This perception aims to create a stronger link between monitoring project-level and policy-level decisionmaking by avoiding their former usually typical relation i.e. the feeding of 'crude' monitoring results that were hard to translate and interpret to useful environmental policies (in this case flood protection policies) and further management actions (Cundill and Fabricius, 2009).

During this processes of collaborative learning and evaluation increased transparency and accountability is achieved as well as trust is fostered among the involved parties (and also policymakers). This facilitates a broader acceptance and acknowledgement of the monitoring needs. In addition, the way in which the steering function evolves facilitates a smoother path and an enhanced and strengthened link between monitoring needs and decisionmaking resulting in an increase of the probability that monitoring results will be acted upon and used to make relevant and more appropriate decisions for further action (Fernandez-Gimenez et al. 2008).

The next sub-section will present therefore certain conditions that are considered necessary for the facilitation of adaptive monitoring of BwN projects.

2.4.1 Key requirements for adaptive monitoring Building with Nature projects

The challenges related to the BwN concept were elaborated in Chapter 1. But which are the key requirements for the facilitation of adaptive monitoring? In order to deal with the main BwN monitoring challenges there are certain important requirements that have to be met.

Although the technical part of the design of BwN projects was so far quite clear and understandable, certain types of implications of its implementation are not. Firstly, the implications caused by the implementation of a BwN project for the various society related stakes are still elusive (for example implications on recreational use of the BwN project area). Therefore, it is important for monitoring to keep track not only of the technical and nature goals of the project, but also of the 'society' goals and implications of a BwN project. Another problematic aspect is that knowledge and expectations of an ecological process might change during the implementation process of the project due to the volatile and non-linear nature of ecosystems. This implies that BwN monitoring is inherently different than classic engineering monitoring; the former is heavily dependent on the role of ecosystem processes in the achievement of the desirable end result, while the former is almost entirely dependent on technological means and interventions. Finally, monitoring needs to address aspects relevant to the wide variety of disciplines implicated in a BwN project. If a crucial part of a BwN project management i.e. monitoring does not give answers to concerns relating to various implicated disciplines then real adaptive monitoring (and therefore management results) are rather unlikely to be achieved.

A first requirement indicates the existence of *effective monitoring arrangements* that clarify and define *who* is responsible to do *what* with regard to monitoring, *in what way* and *why* as already explained earlier. For example, such a monitoring arrangement might pertain to the parties/agencies/authorities responsible to perform data collection/analysis/interpretation within a specific timeframe, under certain guidelines of communication and cooperation with the other parties involved in monitoring because it aims at facilitating the acknowledgement of monitoring needs among the parties involved. The second requirement relates to the creation and maintenance of *a vivid interest* towards the project and its monitoring program among the involved parties. This interest is largely connected with the achievement of the project to catch and maintain the attention of stakeholders and policymakers for example towards the project activities and general objectives (Cundill and Fabricius, 2009). In this way the project stands a better chance to engage the various parties for more time and its monitoring needs to be better heard by policymakers or (co-)funders of its monitoring activities. The third requirement relates with the latter argument; there should be *sufficient funding* for the set up and continuation of the monitoring program. In this way, practical issues stemming from the monitoring needs themselves as well as from the collaboration challenges among the parties involved mentioned above, are enabled and better organized (Cundill and Fabricius, 2009).

The next subsection will present the conditions that have to be met in order for the aforementioned functions of monitoring in adaptive management of BwN projects to be achieved. These conditions were defined in the first chapter as criteria of effectiveness.

2.4.2 Defining monitoring effectiveness

This research considers the monitoring arrangements of a project as effective if they are able to achieve the functions mentioned before. Therefore, there is the need to define monitoring effectiveness through a number of criteria that appear to address monitoring effectiveness according to the theory:

1. Stakeholders, project managers, scientists reach a ***shared vision*** with regard to the objectives of the project at issue;
2. The policymakers are **aware** of the monitoring needs of the project at issue;
3. The policymakers are **willing to act** on the monitoring needs of the project at issue;
4. The monitoring plan has sufficient ***adaptive capacity*** in light of ***new monitoring needs*** and ***legal requirements***

The choice of those criteria is deliberate as they are believed to facilitate *monitoring effectiveness* if they are met. The diagram in the next page illustrates the way in which the monitoring functions relate to the four effectiveness criteria, i.e. which criteria relate to the fulfillment of which function. The *learning* function of monitoring is enhanced when a shared vision of the project's objectives is fostered among the scientists, project managers and stakeholders. Those three groups are deliberately addressed by the first criterion as a common vision is important to be created among them on the overall project objectives. As mentioned before, this research will not address stakeholders' participation in the monitoring processes per se. Therefore, it is significant for them to share a vision of the project objectives, if they are not very familiar with the monitoring program itself; by acknowledging the objectives, they appear to be convinced that their interests and concerns were taken into account. In addition, policymakers 'vision' about the monitoring needs is

addressed separately by criteria 2 and 3 because the association they have with each project is different. The learning functions is also boosted if there are arrangements that create awareness among policymakers on the monitoring needs, implying that policymakers participated in learning processes with regard to monitoring. A shared vision also boosts the *evaluation* function of monitoring, as by trying and achieving to form a shared vision there is evaluation from stakeholders, project managers and scientists; considering that those groups had the opportunity to reflect upon the project and monitoring. In order to sufficiently and comprehensively evaluate the project's progress but also its monitoring (and management) processes, there is the need to have a clear picture and distinction of monitoring tasks and the responsible individuals for those tasks. If there is confusion about the distinction of roles, then during the evaluation of the monitoring processes it will not be easy to track a 'faulty' process and fix it. This clear distinction is ensured by the fourth criterion that indicates the need for adaptive capacity of the monitoring by ensuring clear division of tasks and keeping track of relevant legal requirements for constant legal compliance.

In addition, the evaluation is comprehensive when the policymakers can gain awareness of the monitoring needs by having the opportunity to participate in evaluation and processes. When the monitoring processes are evaluated by the policymakers, their trust, interest and knowledge on the project and its monitoring needs is enhanced. Furthermore, the evaluation processes provide both the project and the policymakers with important information for further action. At the same time, the *steering* function of monitoring is boosted, as the policymakers are able to make well-informed decisions (after understanding and knowing more of the project's (and the local ecosystem's) monitoring needs. Also, as long as the policymakers are willing to act upon the results the steering function is further reinforced. In order for them to be willing they have to obtain knowledge with regard to the project able to evaluate its progress and effects.

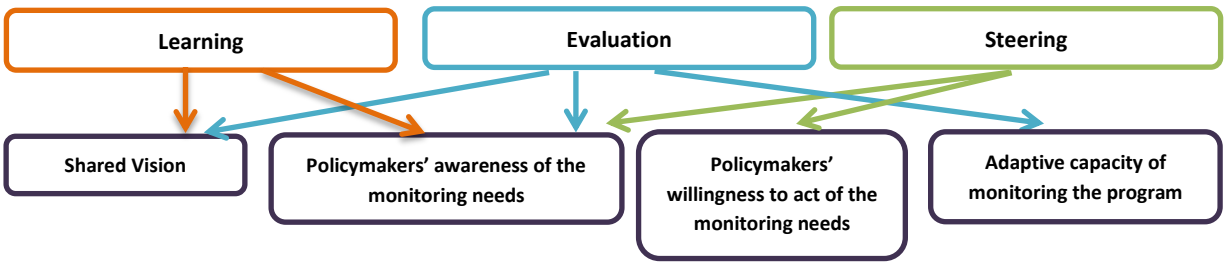

Figure 2: The relation of the monitoring functions with the effectiveness criteria

Based on the reformed monitoring functions' relation with the effectiveness criteria the following six explanatory variables are extracted that are believed to condition monitoring effectiveness:

Table 1: Explanatory variables conditioning monitoring effectiveness

Explanatory variables
Stakeholders' interests and concerns integration
Integration of multiple types of knowledge
Communication and cooperation on the monitoring results and needs
Strength of the link between monitoring results and policymaking
Feedback mechanisms on knowledge and monitoring results
Flexibility of the monitoring program

After having defined effectiveness, and presenting which variables seem to influence it, it is important to clarify certain key requirements for monitoring BwN projects in adaptive management contexts. The next sub-section presents those key requirements.

After having presented the key requirements it is considered useful to visualize the path towards better adaptive management results for BwN projects, within the framework of this research. The following diagram presents the comprehensive overview of the interrelations among the monitoring functions, effectiveness criteria, and the explanatory variables.

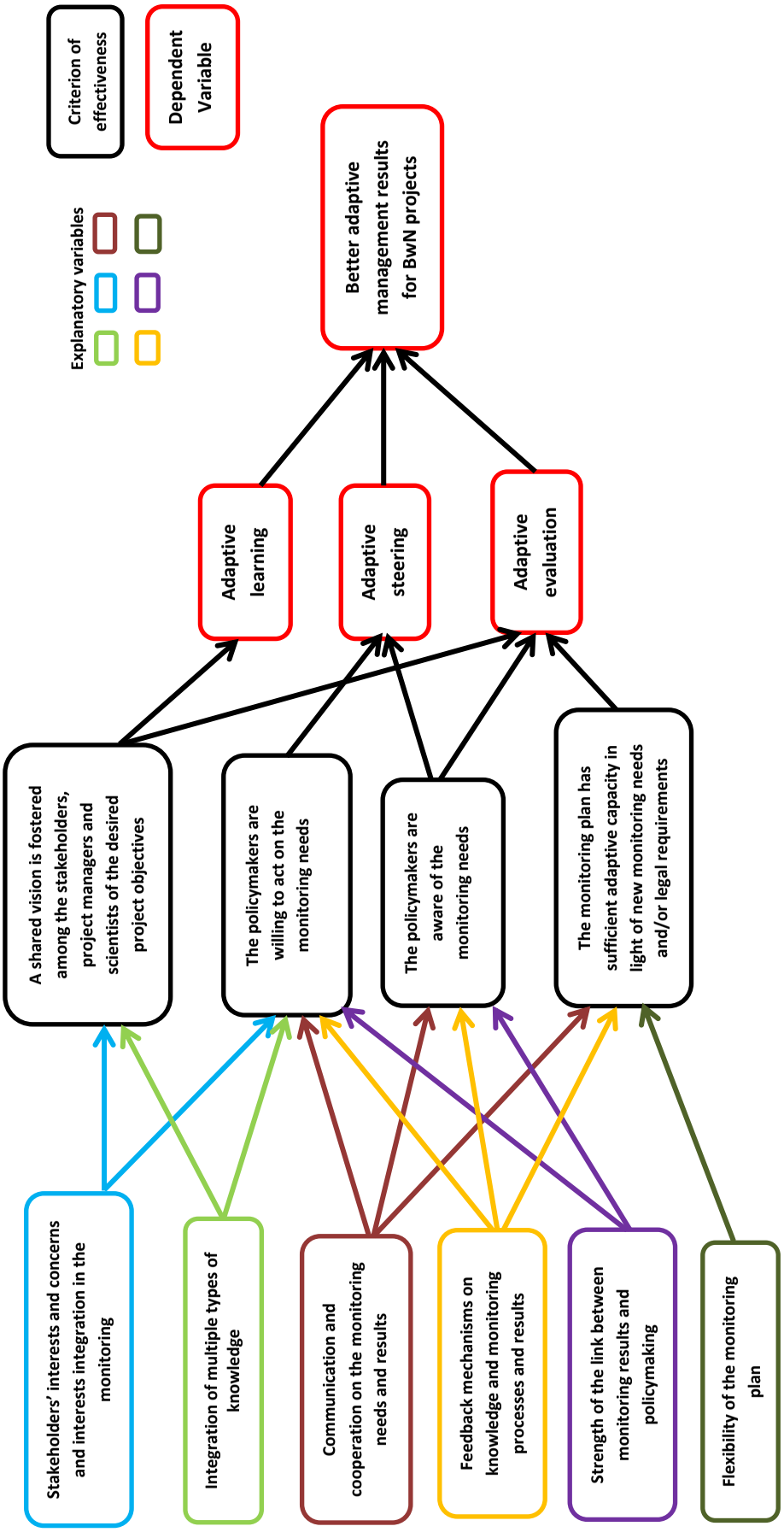

Figure 3: Conceptual framework of explanatory variables, effectiveness criteria and monitoring functions leading to adaptive management results

2.5 The relation of explanatory variables with the effectiveness criteria

The explanatory variables, already obvious by their name, are providing explanations about the occurrence of another event, issue etc. In this case, the explanatory variables are expected to affect all or some of the effectiveness criteria of this research. In addition, the explanatory variables are expected to have varying significance for the fulfillment of the effectiveness criteria (analyzed in Chapter 3). The table below shows which explanatory variables relate to each of the effectiveness criteria. Some explanatory variables relate to more than one effectiveness criteria.

Table 2: The relation of explanatory variables with the effectiveness criteria

Explanatory variable	Criterion 1: Shared Vision	Criterion 2: Awareness of the monitoring needs by policymakers	Criterion 3: Willingness of policymakers to act upon monitoring needs	Criterion 4: Adaptive capacity of the monitoring program
Stakeholders' interests and concerns integration	✓	-	✓	-
Integration of multiple types of knowledge	✓	-	✓	✓
Communication and cooperation on the monitoring needs and results	-	✓	✓	✓
Feedback mechanisms on knowledge and monitoring processes	✓	✓	✓	✓
Strength of the link between monitoring results and policymaking	-	✓	✓	✓
Flexibility of the monitoring plan	-	-	-	✓

It is important to describe at this point how the explanatory variables relate to the effectiveness criteria. By identifying and accounting for stakeholders' concerns and interests in the monitoring, a shared perception can be fostered among the project managers and scientists working on the project, and various people having a stake in the project. More specifically, considering that the interests and concerns of stakeholders are heard and discussed with the people working in the project (project managers and scientists) enhances the probability of a responsive (for stakeholders) monitoring program. In addition, considering that the stakeholders' interests and concerns are reflected in the monitoring enhances the possibility that the monitoring needs of the program are more listened and acted upon by the policymakers. This will happen as the stakeholders are groups of interest for policymakers, and the policy plans are trying to address stakeholders interests in general.

The explanatory variable of integration of multiple types of knowledge implies that knowledge from a variety of sources (including stakeholder knowledge) and disciplines was obtained and utilized. This knowledge might relate to social aspects such as what kind of implications the project might have for recreational activities, sports etc. Furthermore, the project's activities might relate to a variety of disciplines and fields, therefore those disciplines have to be addressed by the monitoring. This multidisciplinary and multi-source knowledge is important in forming a shared vision of the project's objectives among the stakeholders, project managers and scientists working on the project as these people belong to various disciplinary fields themselves, and they expect relevant knowledge that they might obtain to be utilized by the monitoring program. Policymakers can connect also to e.g. social studies relating to the positive effects of the project that have to do with the public

acceptance of the project. Therefore, they are more willing to act upon the results. In addition, multiple types of knowledge can assist in the incorporation of new needs more efficiently and effectively in the sense that they can provide useful guidelines and advice derived from more disciplines that can lead to a solution of a problem.

Communication and cooperation relates to the way in which the parties involved in monitoring cooperate and communicate on the results and needs (for the purposes of this paper those parties are the project managers, the scientists and the policymakers). The creation of communication and cooperation channels is important; in light of new information there has to be consistent and efficient interaction among all the parties. For example, there have to be consistent meetings about the monitoring results and their interpretation in order to facilitate further action. For this theoretical framework, ensuring communication and cooperation with the policymakers enhances their awareness of the monitoring needs. If there is consistent communication with them about the results (as well as honesty and openness) their willingness to act upon the results is enhanced. Finally, if the communication is ensured, the monitoring program achieves early warning on new legal requirements. In that way, the adaptive capacity of the plan is enhanced.

Feedback on the knowledge gained and on the way the various monitoring process are being carried out among the stakeholders, project managers and scientists would facilitate the creation of common perception of the monitoring needs. Even if the stakeholders do not participate in the monitoring processes per se, maintaining affiliation with their interests and concerns might result in figuring out necessary changes in the monitoring itself. In addition, getting feedback from the policymakers on the knowledge gained and on the way the project performs the various monitoring tasks, can increase their awareness of the monitoring needs. Again, creating a feeling of openness and full disclosure on the monitoring results increases their willingness to act upon the results. Furthermore, giving and receiving feedback among the involved parties is of paramount importance for the adaptive capacity of the monitoring. An example is, during the communications with policymakers the project might ensure a proactive way of learning about a new legal requirement relating to the project. As mentioned before, it is important to ensure cooperation and communication among the various parties, but it is substantial to ensure that those parties reflect and exchange feedback on the results.

The variable addressing the strength of the link between policymaking and the monitoring results relates to the way and quality the monitoring results are presented to the policymakers. Firstly, it was mentioned that communication and cooperation should be created with policymakers on the monitoring results. In addition, feedback should be exchanged with policymakers on a consistent basis. These two factors relate to the explanatory variable of enhancing the link with policymaking. In addition, the project managers (in cooperation with the scientists) have to engage in efforts of translation of the monitoring results to the policymakers. The translation increases their awareness of the results, and they are able to make informed decisions. Considering that they understand and are better aware of the monitoring needs of the project, their willingness to act upon them is enhanced.

The variable addressing flexibility of the monitoring program relates to ensuring adaptive capacity. Having arrangements ensuring eased adaptation of the monitoring in light of new monitoring needs and/or new or altered legal requirements implies arrangements ensuring adaptive capacity (or else flexibility). Flexible however does not mean loose. It is important to define and even institutionalize

the roles of the parties involved in the monitoring in order to achieve adaptive implementation of the various monitoring tasks. In this way, under new circumstances indicated by the monitoring results, each party is aware of their responsibility and confusion is avoided (about who does what etc.). Flexibility also reflects the extent to which the project has ensured the creation of efficient and effective 'funding searching' mechanisms in order to obtain the adaptive capacity to address emerging needs effectively and in timely manner. The theory chapter concludes by presenting design principles for monitoring arrangements that will facilitate the adaptive implementation of BwN projects.

2.6 Design principles for monitoring arrangements

This chapter presents a number of design principles that have to be taken into consideration when designing monitoring arrangements for BwN projects. These principles are based on the (explanatory) variables and the effectiveness criteria that have been identified by the theory and were discussed previously. For the delineation of the design principles for monitoring arrangements, ideas and elements from various monitoring frameworks have been borrowed, as described also in the previous theory sub-sections. It should be mentioned at this point that those design principles aspire to contribute to the formulation of an integrated monitoring program as an issue of social networking that relates to processes i.e. monitoring arrangements, and not to the articulation of technical or physical indicators. According to the theoretical foundation given in this paper effective monitoring arrangements:

(1) Ensure that the interests and concerns of the comprehensive list of stakeholders are taken into account and reflected in the monitoring – *Integration of stakeholders' interests and concerns in the monitoring*

The monitoring program of a BwN project needs to entail arrangements that ensure that the interests, stakes and concerns of all[2] the stakeholders[3] are identified and well-defined before setting up the monitoring program. For example, there should be exploratory research and communication with potentially interested or affected parties in order for them to be able to express their interests, and concerns. In this way, the concerns of the stakeholders will co-drive the aspects that are going to be monitored (along with technical concerns from the scientists) and the probability that the BwN project garners significant stakeholder long-term commitment and involvement is higher (Western, 2004). Furthermore, if for example stakeholders take over responsibilities relating to data collection they feel even closer to the project and its progress, and the probability that the stay engaged in the project increases. This research however does not address collaborative monitoring per se, but it illustrates the advantages of incorporating stakeholders' interests in the monitoring.

[2] All stakeholders i.e. (more accurately) a wide array of them; a comprehensive list of as many groups of people as possible potentially having a stake.

[3] Stakeholder is a person, organization or group of people, which is either influenced by or might affect a certain issue. Stakeholders usually can have two different roles with regard to monitoring an environmental project. Firstly, it is not feasible for the management of an environmental project to obtain the opinions of all local individuals that might be affected from the project activities. Therefore, certain individuals or groups can represent the interests of certain stakeholders and thus help with the identification of issues that need monitoring. The second role of stakeholders is the one of local expert. Local experts might provide the project with unique insights into the functions of the local ecosystem (either due to their profession or practical experience) that cannot be obtained otherwise (Hermans et al., 2011).

(2) Ensure that knowledge from a variety of sources and disciplines is integrated and utilized in the monitoring program –*Integration of multiple types of knowledge*

The BwN project at issue should ensure that multiple types of knowledge is obtained and used already in the design of the monitoring. This can be achieved by creating and maintain venues for knowledge input. Equally important is the effort to obtain and utilize knowledge from a variety of disciplines and sources. Therefore, the monitoring should be designed in a way that addresses aspect relevant to the various disciplines relating to the project. For example, a BwN usually relates largely to fields such as ecology, spatial planning, biodiversity, hydrology etc. Hence, the project should for example engage in research on the varying disciplines or at least in efforts obtaining relevant information; this information should be taken into account by the project and reflected in its monitoring program. Local environmental groups such as bird or fish conservation groups might obtain or be able to create and/or provide significant types of knowledge that cannot be obtained by the project otherwise.

(3) Create communication and cooperation channels among the involved in the monitoring parties on the monitoring results and needs – *Communication and cooperation on the monitoring needs and results*

For the purposes of this paper, the involved in the monitoring parties are the project managers, the scientists and the policymakers in the sense that they can affect the regulatory requirements relating to a project[4]. The project should ensure channels of communication and cooperation in a consistent, well-organized manner on the monitoring results and needs. For example, this consistent cooperation can be ensured by arranging various types of meetings such as workshops, dialogues, conference calls etc. Such meetings should be arranged according to the pace of new needs arising and according to what the results reveal. Considering that consistent and efficient communication and cooperation is ensured among all three parties, the trust among them is enhanced and therefore the chances for smoother future cooperation and longer engagement to the project (this applies mainly to the policymakers as the scientists and project managers working on a project are expected to be engaged anyway) (Cundill and Fabricius, 2009).

(4) Establish feedback mechanisms on the knowledge gained and on the unraveling of the monitoring processes – *Feedback on knowledge and monitoring processes and results*

This design principle addresses the quality of communication and cooperation on the monitoring results and needs. It relates with the previous principle but the two principles are distinct in the sense that the former indicates the need to organize consistent and efficient communication on the results and needs and this one designates the importance of feedback exchange within the communications. In other words, this design principle requires the design of arrangements that ensure that meaningful feedback exchange among all the involved groups. More specifically, there needs to be reflection on the knowledge gained among the project managers, scientists and policymakers order to achieve well-advised and well-informed further action (both within the project but also in policymaking). For example, scientific input by monitoring can be communicated to project managers or policymakers who can provide additional information about what is going on

[4] Although it is important to incorporate and address stakeholders' interests and concerns through monitoring, the communication and cooperation on the monitoring results and needs is addressed in this theoretical framework as process among the project managers, scientists and policymakers.

in their area of expertise and how further action can look like. In this way, the results are filtered and analyzed more efficiently and in an interdisciplinary way, paving the way for proactive, well-informed project decisionmaking and (regulatory) policymaking. Therefore, scientifically sound and articulate solutions that are also grounded to the specific needs of the project at issue can be found (Dyball et al., 2007).

(5) Establish a network of interests of the policymakers before the design of the monitoring program and ensure that they are presented with the monitoring results in a meaningful way – *Strength of the link between monitoring results and policymaking*

It is crucial for a BwN project to ensure that its monitoring results have a strong link to policymaking. This link can be achieved by ensuring that policymakers are aware and understand the monitoring results of a BwN project, and therefore also what the results show. Hence, there is the need to translate the monitoring results before they are presented to policymakers; the project has to ensure that the most significant points deriving from the monitoring are well presented to policymakers. In addition, there is the need for the project to present the results in a way that it is interesting and reasonable for policy change. In order for the aforementioned to happen, the project needs to engage in translation efforts and communication strategies of the results to policymakers. For example, a team can be assembled that would be responsible for the interpretation of the results in cooperation with the scientists and project managers, and that would also be responsible to present and communicate the results to policymakers. In other words, this team will contribute in the 'framing' of certain aspects (Babu and Reidhead, 2000) through a process of information 'translation' that bolsters the understanding and knowledge of policymakers.

(6) Ensure flexibility of the monitoring program in light of new monitoring needs; definition and redefinition of the roles of the stakeholders; keeping track and affinity with new legal requirements – *Flexibility of the monitoring program*

The BwN project needs to ensure that the responsibilities of the parties involved in the monitoring are clear and straightforward; they can even be institutionalized or binding if necessary. This is necessary in order for every party to know exactly their role when a new need appears and needs to be dealt with. The monitoring program's flexibility is strengthened even more if it also includes arrangements that allow for and facilitate the re-definition of roles in light of new needs.

A monitoring program should also be designed in a way that facilitates and allows for eased adaptation and integration of new legal requirements. Adaptive principles highlight the need for adaptive capacity in light of future changes in legal requirements or the introduction of completely new requirements. In other words, the monitoring program should entail arrangements that ensure that when new legal requirements appear, the process of their integration into the project and the monitoring is not complicated and obscure. For example, a specified expert team can be appointed for the task of keeping close attention to the legal obligations of the project, and for engaging in efforts to address the legal updates in monitoring. Such arrangements are preconditions and at the same time 'safety valves' for the monitoring program to have adequate and systematic control over its constant compliance with legal requirements (Arbuckle et al., 1991).

Chapter 3: Methodology

This chapter presents the methodology followed for the analysis of the two ex-post cases of the Sand Engine and South Bay Salt Pond Restoration introduced in Chapter 1 as well as the methodology for the analysis of the ex-ante case of Marker Wadden. This chapter sets out to 'measure' effectiveness of the monitoring arrangements of the ex-post cases by explaining (1) how the four criteria mentioned in Chapter 2 are going to be measured (2) by operationalizing the explanatory variables described in the Chapter 2 and by also explaining how the degree to which the explanatory variables were satisfied is assessed. Finally, the choice of the research methodology will be justified and the data collection methods will be presented and described.

3.1 The choice of the effectiveness criteria

In the previous chapter the four effectiveness criteria were presented. These are the following:

1. Stakeholders, project managers, scientists reach a ***shared vision*** with regard to the project's objectives of the project at issue;
2. The policymakers are **aware** of the monitoring needs of the project at issue;
3. The policymakers are **willing to act** on the monitoring needs of the project at issue;
4. The monitoring plan has sufficient ***adaptive capacity*** in light of ***new monitoring needs*** and ***legal requirements***

This research will analyze and assess the monitoring arrangements of the ex-post cases based on the above-mentioned four criteria; these criteria are considered sufficient to address monitoring effectiveness in terms of adaptive implementation. The assessment of the monitoring arrangements of the ex-post cases will be conducted based on the explanation of the scores for the criteria presented in the table below:

Table 3: Explanation of the scoring method for the effectiveness criteria

Score	Criterion 1: Shared Vision	Criterion 2: Awareness of the monitoring needs by policymakers	Criterion 3: Willingness of policymakers to act upon monitoring needs	Criterion 4: Adaptive capacity of the monitoring program
Effective	In order for the first criterion to be fulfilled and the arrangements to be *effective* all three groups of stakeholders, project managers and scientists working on the project have to share a common vision of the project's objectives. a shared vision of the objectives among the three groups implies that their concerns and interests have been accounted for and addressed by monitoring.	In order for the arrangements to be considered *effective* for the second criterion the policymakers have to be fully aware of the monitoring needs of the project.	The arrangements are *effective* for the third criterion when the policymakers are fully willing to act upon the monitoring needs[5]. That implies that the needs are visible to them i.e. the project was successful in getting those needs through to the policymakers. In addition, they are willing because those needs are understood and acknowledged also by stakeholders, considering that their concerns are addressed by the monitoring and they expect that the monitoring continues accounting for their interests. Thirdly, the policymakers are willing to act upon the needs because they obtain the financial resources that will allow them to act upon the monitoring needs. The needs were explained in chapter 2; they usually require policymaking action usually relating to the provision of additional funding by policymakers.	The arrangements are effective for the fourth criterion when the monitoring program entails arrangements which ensure adaptive capacity in light of new monitoring needs and new or updated legal requirements. In other words, when new needs appear (and/or new or updated legal requirements) they are incorporated and addressed efficiently and in a timely manner.

[5] A monitoring need is explained in section 2.4

Moderately effective	The arrangements pertaining to the first criterion are *moderately effective* when one of the three groups (the project managers, the scientists and the stakeholders) does not share the same vision of the project's objectives of the ecosystem and project at issue.	The arrangements pertaining to the second criterion are *moderately effective* when the policymakers are not fully aware of the monitoring needs of the project. Although they stay in touch with the project activities, its monitoring arrangements are not always clear to them.	The arrangements pertaining to the third criterion are *moderately effective* when the policymakers are mediocrely willing to take action on the monitoring needs of a project. This might relate to the fact that they are aware of the monitoring needs but they are unwilling to act upon all emerging needs due to financial constraints. On the other hand the policymakers might not be willing to attend every emerging need of the monitoring because they are not adequately aware of the every need that needs action, or because the needs are not understood and acknowledged by the stakeholders of the project, even if there are available financial resources.	The arrangements pertaining to the fourth criterion are *moderately effective* when new monitoring needs and/or new or updated legal requirements are not always incorporated efficiently and in a timely manner in the monitoring program.
Ineffective	At least two of the three groups do not agree with the others on the monitoring needs. Therefore, the arrangements relating to shaping a shared vision are *ineffective*.	The policymakers are not aware of the monitoring needs and the project struggles to achieve policymaking/regulatory action over its monitoring needs. Therefore, there are *ineffective* arrangements for the creation of awareness of the monitoring needs to the policymakers.	The arrangements pertaining to the fourth criterion are *ineffective* when the policymakers are not willing to take any action on the monitoring needs of the project at issue. This implies that they are unaware of the needs and their importance; the stakeholders do not share a common vision of the project's objectives, therefore reducing the policymakers' willingness to act upon them. Finally, there are not adequate financial resources.	The arrangements pertaining to the fourth criterion are *ineffective* when new monitoring needs and/or new or updated legal requirements are insufficiently and with significant delays addressed in the monitoring program.

The method presented in table 3 is going to be used in order to assess the degree to which the effectiveness criteria were met in each ex-post case. It is important now to continue with the explanation on how the degree to which the explanatory variables were met by the monitoring arrangements of the ex-post cases is assessed. The next section presents firstly the operationalization of the explanatory variables and then it proceeds with a table that explains how the monitoring arrangements of the ex-post cases will be assessed with regard to the explanatory variables introduced in chapter 2.

3.2 Operationalization of the explanatory variables

The explanatory variables presented in the previous chapter are the variables that are expected to affect the effectiveness of a monitoring approach according to this paper. In order to actually assess the degree to which these variables influence the fulfillment of the four effectiveness criteria the variables have been operationalized.

Table 4: Operationalization of explanatory variables

Explanatory variable	Operationalization
Integration of stakeholders' interests concerns in the monitoring	• Identification of interests and concerns of all stakeholders early on, before the design of the monitoring plan • Adequate reflection of all the stakeholders' interests and concerns identified by the monitoring
Integration of multiple types of knowledge	• Practical knowledge input e.g. from local experts, local communities, environmental groups in the monitoring • Knowledge input from various disciplines related to the project's activities e.g. spatial planning, ecology, biology etc. in the monitoring
Communication and cooperation on the monitoring needs and results	• Existence of communication and cooperation channels among all the parties involved in the monitoring • Consistent interaction and collaboration among all the involved parties through consistent meetings, conferences, emails, reports etc.
Strength of the link between monitoring results and policymaking	• 'Translation' of the monitoring results to policymakers i.e. explanation and elaboration of the significant points emerging from monitoring • Openness and disclosure about the monitoring results that might reveal either positive or negative implications caused by the project's activities

Feedback mechanisms on knowledge and monitoring processes	• Reflection and feedback exchange on the monitoring results and needs among all the involved in the monitoring parties • Feedback exchange both on the knowledge gained by the monitoring but also on the way monitoring processes are conducted
Flexibility of the monitoring program	• Clear and straightforward distinction of the roles of the involved parties; everyone knows their role in light of new monitoring needs, who communicates what and in what ways, who is taking action etc. • Efficient and effective funding mechanisms; clear and efficient appointment of the responsibility for searching of funding

After having operationalized the explanatory variables introduced in chapter 2, this section will present the scoring method for the degree to which the explanatory variables were satisfied by the monitoring arrangements of the ex-post cases. The scoring method for the explanatory variables is explained in the table below:

Table 5: Explanation of the scoring method for the explanatory variables

Explanatory Variable	Sufficient	Moderately Sufficient	Insufficient
Integration of stakeholders' interests and concerns in the monitoring	Sufficient integration of stakeholders' interests and concerns in the monitoring is considered when the interests and concerns of the comprehensive list of stakeholders were identified before the design of the monitoring program. The monitoring addresses and accounts sufficiently for those stakes and interests.	Moderately sufficient integration of stakeholders' interests and concerns in the monitoring is when stakeholders' concerns were not reflected in the monitoring sufficiently. This score is given when there are monitoring efforts relating to various stakes identified, but the efforts do not address all the stakes to a sufficient degree.	Insufficient integration of stakeholders' interests and concerns in the monitoring is considered when the process of identification of stakeholders' concerns was insufficient to reveal important stakes before the setup of the monitoring. In addition, the same score is given when the various stakes were identified but some of them were not taken into account at all in the monitoring.
Integration of multiple types of knowledge	Sufficient integration of multiple types of knowledge in the monitoring is considered when there was knowledge input from a variety of disciplines and sources. Firstly, there has to be practical knowledge input by sources such as environmental groups, local experts, sports groups (recreational groups) whose observations and expertise can provide unique insight to a project and make the need for monitoring certain aspects more evident. Furthermore, knowledge from a variety of disciplines related to the project can provide significant knowledge towards potential problem-solving. More specifically this score is given to a project that actually organized efforts to obtain and incorporate knowledge from a variety of sources and disciplines and integrated that knowledge to the monitoring.	Moderately sufficient integration of multiple types of knowledge is considered when the project used only randomly various types of knowledge. There were efforts to obtain knowledge from various sources but those efforts omitted important knowledge from certain disciplines or sources of importance for the project.	Insufficient integration of multiple types of knowledge is considered when the project did not make use of a multiplicity of types of knowledge such local expertise, knowledge by environmental or recreational groups. In other words, the project sticks to the disciplines that are absolutely necessary to the project and avoids pursuing knowledge on more disciplines or from more sources.
Communication and cooperation on the monitoring needs and results	Sufficient communication and cooperation on the monitoring needs and results is considered when there are (1) consistent communication and cooperation channels and venues among the involved (in the monitoring) groups on the results i.e. consistent, arranged meetings, regular phone conferences for consistent update on the monitoring results and therefore needs. In addition, there has to be (2) interaction among all the parties i.e. the scientists producing the results, the project managers that have the authority to act upon the results on the project level, but also the policymakers who can affect with permits and legal requirements the development of the monitoring.	Moderately sufficient communication and cooperation on the monitoring needs and results is considered when there is communication and cooperation on the results, but to a moderately consistent degree. For example, although the scientists may communicate and cooperate with the project managers consistently, communication with policymakers might be suboptimal in terms of consistency i.e. only on an ad-hoc basis etc. This might create a feeling to the policymakers that they are left out of the cooperation on the monitoring results and reduce the opportunity for the results to be acted upon on the policymaking level.	Insufficient communication and cooperation on the monitoring needs and results is considered when the communication and cooperation among managers, scientists and policymakers is inconsistent. This implies for example, that the results are not communicated consistently to the involved groups.
Strength of the link between monitoring	Sufficient link between monitoring results and policymaking is considered when the monitoring results are presented to the policymakers through	Moderately sufficient link between monitoring results and decisionmaking is considered when either there are efforts to explain and	Insufficient link between monitoring results and policymaking is considered when there are no efforts to present

results and policymaking	a process of translation in order to achieve fast turnover of data information and therefore more efficient and effective policymaking action. In addition the link is deemed sufficient when there is disclosure of and openness about the monitoring results (which might convey positive effects but also negative implications caused by the project's activities).	'translate' the monitoring results to the policymakers but those efforts are moderately adequate to create a strong connection among the project's monitoring program and policymaking. In addition, the link is weakened when there is reduced openness and disclosure about the monitoring results to the policymakers.	the policymakers with 'translated' monitoring results in order for them to connect stronger with the project's needs (by understanding better what the results convey).
Feedback mechanisms on knowledge and monitoring processes and results	Sufficient creation of feedback mechanisms is considered when there is feedback exchange among all the parties involved in the monitoring. In particular, there is feedback exchange among the project managers, the researchers, and the policymakers on the monitoring results and processes. In addition, there has to be feedback both on the knowledge gained by the monitoring but also on the way the various monitoring processes are being carried out.	Moderately sufficient creation of feedback mechanisms is considered when there is not feedback exchange among all the parties involved in the monitoring; a type of feedback is missing or is moderately adequate, e.g. from policymakers. Similarly, this score is given in the case that one type of feedback does not take place (either on the knowledge gained or on the way monitoring processes are taking place).	Insufficient creation of feedback mechanisms is considered when there is insufficient feedback among the parties involved in the monitoring. Insufficient feedback implies that there is neither feedback on the knowledge gained by monitoring nor on the way monitoring processes are occurring. That might result in ill-informed management actions with regard to monitoring are in terms of scientific guidance; scientists not being aware of management concerns relating to monitoring etc.
Flexibility of the monitoring program	Sufficient flexibility of the monitoring plan is ensured when the roles of the various involved in the monitoring parties are clearly laid out i.e. in light of new needs or conditions each party knows their responsibility. In addition, the task of finding funding has clearly and efficiently appointed. That means that it should lie with one or more agencies with available resources, and/or it should be appointed to knowledgeable people with funding acquisition skills. In this way, the changes are made and/or integrated faster as well as the necessary actions in order to address the changing conditions and introduce potentially additional monitoring.	Moderately sufficient flexibility of the monitoring plan might occur if one of the two parameters of sufficiency in terms of flexibility is not met. Firstly, the roles for the monitoring might not be clearly defined. This implies that when new needs appear, there is relative confusion as to whose responsibility is to deal with the emerging needs, and how they should be dealt with. Secondly, the project might not entail efficient and effective 'funding searching' mechanisms. In any case, one flexibility parameter is not met.	Insufficient flexibility of the monitoring plan is considered when none of the two flexibility factors mentioned in the cell addressing the 'sufficient flexibility of the monitoring plan' is met.

3.3 Assessment of the degree of influence of the explanatory variables

This section will present the scoring method for the degree of influence of the explanatory variables on monitoring effectiveness. The scoring method has three 'scales' high, medium and low. The degree of influence of the variables is a combination (1) of their scores (as explained in the previous section) and (2) of the relative importance, as interpreted by the author. Through the overall structure and development of each interview, a sufficient amount of information and insight on the importance of each explanatory variable on monitoring effectiveness, could be extracted[6]. This information and insight enabled the author to rank the variables based by applying the following scoring method.

Table 6: Influence of Explanatory Variables on Effectiveness Scores

Score	Explanation
High	The score *high* implies that this variable is believed to influence to a large degree monitoring effectiveness and/or the fulfillment of other explanatory variables. Most of the interviewees stressed the importance of this variable.
Medium	The score *medium* is given to a variable that, from the analysis, is proved to only mediocrely influence monitoring effectiveness and/or the fulfillment of other explanatory variables.

[6] During the interviews, the respondents were not specifically asked to rank the explanatory variables according to their importance on monitoring effectiveness.

Low	The score *low* is given to a variable that barely influences monitoring effectiveness and/or the fulfillment of other explanatory variables.
No score	The author did not have sufficient evidence in order to score the degree of influence of this variable.

3.4 Research method selection

The research method employed in this research is that of the comparative case study analysis. Briefly, the reasons of this choice were explained in chapter 1. This sections aims to explain and further elaborate on the methodological justification of the choice as well as how it will be used in order to transpose the conclusions drawn by the ex-post cases' analysis to the ex-ante case of Marker Wadden.

Yin (2009) defines the case study method as the study of cases in their real life, contemporary context or setting. This research employed primarily qualitative methods of data collection and analysis such as qualitative document analysis, and in depth interviews with key informants. The selection of the ex-post and ex-ante cases for this research was made by conducting a literature review in order to select cases that are as similar as possible, based on a pre-defined set of criteria. Some of the criteria are pragmatic considerations such as access to information on the cases and people with relevant knowledge to the research (Seawright and Gerring, 2008).

However, the criteria reflect also key characteristics and attributes of the ex-ante case; one of the first steps of the research was to find ex-post cases that can provide important lessons for the ex-ante case of Marker Wadden. Therefore, the research design can additionally be defined as the 'most similar' case study analysis accompanying the comparative method (as defined by Seawright and Gerring, 2008). The ex-post cases are similar across certain background and contextual circumstances that are relevant to the research objectives, but they differ in the degree to which they achieve monitoring effectiveness. By assessing those varying degrees this research will draw certain conclusions on (1) which functions monitoring should achieve (2) the conditions that have to be met, in order for those functions to be achieved and (3) factors influencing the degree to which monitoring effectiveness is achieved. By having a comprehensive overview of the aforementioned this research can delineate design principles for monitoring arrangements for BwN projects. Those principles will then be adapted to the specific characteristics of the Marker Wadden ex-ante case, and function as guidelines for future designing of Marker Wadden monitoring arrangements.

3.4.1 Selection of the ex-post and ex-ante cases

As mentioned in the first chapter the purpose of this research is to produce a set of monitoring arrangements that can facilitate the adaptive implementation of BwN projects and extract conclusions and important lessons for the ex-ante project of Marker Wadden. In that respect, BwN projects - case studies were selected based on certain criteria that constituted them adequately comparable with the Marker Wadden case. The criteria for selection of the two ex-post cases were mentioned in the first Chapter.

The first criterion for case selection was a logical choice in terms of efficiency of data collection and deduction of conclusions. In other words, access and reachability of contact persons are very significant factors as far as plurality and sufficiency of data and information are concerned. The second criterion was chosen taking into consideration the association of the Marker Wadden project

with the BwN concept; the ex-post cases had to address a BwN project. The Marker Wadden's implementation is expected to follow BwN principles as does the Sand Engine case.

The choice of the South Bay Salt pond restoration project was deliberately made as it provides a sufficiently comparable case which is also considered to provide added comparative value to this research. Although not a BwN project per se, the nature restoration project of SBSPR is a BwN-like project in the sense that the core principle of the two concepts is very similar; BwN similarly to nature restoration aims at facilitating (and if necessary also creating) the conditions for natural processes of ecosystems to be functioning undisturbed. The difference is that natural processes in a BwN context are expected to function undisturbed in a shorter period of time, while in a nature restoration context natural processes take longer to be fully restored to a 'pristine' condition (the time it takes usually depends largely on the level of nature degradation of the project area). This important similarity between the two concepts makes the analyses and comparison of the two cases appropriate for the purposes of this research. The third criterion relates to the added value an international (outside Europe) BwN project could provide implemented in a public-private setting, similar to the one in the Netherlands. The last two criteria relate to the monitoring approach of the cases that would be selected. In order for a case to be selected, some sort of a monitoring program must have been designed and already put forward; the project had to already be in the monitoring phase in order for data and information to be available.

All the aforementioned criteria were selected with the purpose of achieving plurality in information as well as sufficient comparability of the three cases. The US institutional context probably has both organizational as well as structural differences with the Dutch context. However, as already established, the cases are comparable with regard to the critical aspects; the explanatory variables presented earlier are considered to influence monitoring effectiveness similarly for the ex-post cases and are expected to do so also for the ex-ante case. In the next sub-section the level of analysis of the cases will be described.

3.5 Level of analysis

The monitoring programs of both ex-post cases will be studied and analyzed at the project level. This level of analysis means that the research is conducted by scrutinizing aspects of specific projects; in this case the monitoring arrangements of two BwN projects are analyzed in order to gain important lessons that could serve as useful guidelines for the design of monitoring arrangements for the Marker Wadden case. More specifically, the performance of the arrangements of the Sand Engine and the SBSPR projects will be assessed based on the four effectiveness criteria mentioned before. In addition there will be an assessment of the explanatory variables; this assessment will help this research to delve more into the causality of certain occurrences and conditions. In addition, the data collection method of interviews allows for input of knowledge and experiences at the project level.

One important reason for the choice of the project level is the relatively eased access to actors involved in the projects. The Sand Engine is a Dutch project and the Marker Wadden is also a project that is expected to be implemented in the Markermeer area of the Netherlands. Deltares was able to facilitate communication and the arrangement of interviews with key people of each case. Therefore, the project level analysis seemed a rational choice. Similarly, there was the possibility of communication and interaction with key people working on the SBSPR project; Deltares was involved in a doctoral research that addressed the SBSPR project. The next part of the methodology chapter will present the data collection method followed.

3.6 Data collection

3.6.1 Document analysis

South Bay Salt Pond Restoration

For the analysis of the two ex-post and the one ex-ante cases certain documents were used in order to extract useful information with regard to the effectiveness of the monitoring arrangements made. One of the most important documents for the analysis of the SBSPR case was the *South Bay Salt Ponds Final EIR/EIS*, (2007) report and especially the Appendix D, which refers to the 'adaptive management plan' of the project and provided useful information on the design and chronicle of the overall adaptive management strategy applied. In order to obtain information on the stakeholder involvement and the level of integration of their concerns and interests the document articulated during the planning phase was used: *Stakeholder and Organizational Assessment Findings and Recommendations* (2003). This report was assigned by the SBSPR project partners to a joint program of California State University Sacramento and the McGeorge School of Law (see section 5.1 for further information), to conduct a stakeholder assessment in order to "elicit issues and concerns regarding the restoration planning process" (Center for Collaborative Policy, 2003a, p. 1).

Sand Engine

A number of documents were used for the Sand Engine, a number of documents and articles were used as well. One of the core documents is: *Uitvoeringsprogramma, Monitoring en Evaluatie pilot Zandmotor (Monitoring and Evaluation Plan of the Sand Engine Pilot);* this report includes the description and explanation of the monitoring program and evaluation system for the Sand Engine project for the period 2011-2021. From that document a lot of useful information with regard to the governance of the Sand Engine's monitoring (which agency does what and why) was elicited. Another important literature source for gathering information on the Sand Engine project was the 'living'[7] document: *Case - Designing and monitoring the Sand engine*. A lot of background and descriptive knowledge both on the overall Sand Engine project (historical background, location etc.) as well as its monitoring program was used from this document.

The analysis of the aforementioned documents in combination with the interviews with key people of all the cases is expected to facilitate the extraction of important lessons with the regard to what variables are important and are believed to condition monitoring effectiveness. After obtaining that information, a set of monitoring arrangements which are considered important for the adaptive management and therefore adaptive implementation of the BwN projects (and in particular the Marker Wadden project) will be assembled.

3.6.2 Interviews

Apart from an extensive literature review on the theoretical foundation of monitoring frameworks and effectiveness as well as the on the monitoring programs of the ex-post cases, the main data collection method applied had elements of both the structured and semi-structured types of interview in qualitative research. From the structured[8] interview type the elements used were: (1) the interviewer asked each interviewee the same list of questions, (2) the method of questioning was standardized and the line-up and phrasing of the questions were kept consistent from the first

[7] A 'living' document is an online document that it can be/is continuously edited and updated.
[8] http://www.qualres.org/HomeStru-3628.html

to the last interview (3) The interviewer maintained a neutral position and did not express her opinion during the interview. From the semi-structured[9] interview type the elements used were: (1) the interviewer inquired the list of questions as described above, but was flexible to pursue topical trajectories during the discussion that might have strayed from the order of questioning when she deemed it necessary. By employing elements of both methods, the data collection gained added value. The qualitative data that were produced were consistent comparable across all interviewees. In addition, the way in which the interviews were conducted allowed interviewees to express their views on various subjects in their own terms, considering that when necessary certain subjects were further elaborated and reflected upon.

3.6.3 Quantification and measurement of interviewees' answers

For the extraction of useful conclusions with regard to the issues of research of this paper interviews were arranged with project managers, stakeholders, scientists and policymakers involved in the ex-post cases. At this point it is important to clarify how each question's answer will be quantified and measured. Some of the questions are more open than others i.e. their answers reflect more the opinion of the interviewee and less what literature and document review shows.

For example, on the one hand the question: '*Were the stakes, interests and concerns of all stakeholders taken into consideration and integrated in the design of the monitoring plan?*' addresses more the opinion of the interviewee and less the extent to which stakeholders' interests and concerns were actually incorporated in the monitoring plan or in what way. In that respect, it will be taken into account in the case analysis as an opinion; it will be used as a quote by the interviewee in support of an argument that was corroborated by the documentation and literature found. On the other hand, the answer to the question: '*Do the stakeholders have any assigned role in the monitoring program e.g. participate in the monitoring data collection (other than expressing their interests and concerns)?*' gives a more apt view of the degree to which stakeholders were involved in the monitoring program itself. Answers to such close-ended questions will be quantified according to the information stated in the score tables 4 and 5.

The next section entails a more elaborate analysis of the choice of the ex-post case and ex-ante cases.

Practical arrangements for the interviews

In order for the interviews to be arranged consistently, certain practical arrangements had to be ensured. Firstly, the respondents were approached by e-mail in order to arrange either a meeting or a Skype interview. For the Dutch case of Sand Engine it was more feasible to achieve face-to-face communication by arranging a meeting. The Sand Engine Interviews took place at the headquarters of Deltares in Delft and at the Province of South-Holland in The Hague. The communication with actors of the SBSPR project was only possible through email (i.e. online communication). Therefore, Skype interviews were arranged. For the Marker Wadden case, one interview was arranged (with one of the advisors of Deltares) which proved to be sufficient for the description of the case at the time, and for the extraction of design principles for future Marker Wadden monitoring arrangements. The project is still in the planning phase and monitoring is currently beginning to be contemplated. Below there is table presenting a list of the interviewees their role and affiliation with the two ex-post cases.

[9] http://www.qualres.org/HomeSemi-3629.html

Table 7: A list of the interviewees and their affiliation with the cases

Sand Engine		South Bay Salt Pond Restoration		Marker Wadden	
Interviewee	**Affiliation with the project**	**Interviewee**	**Affiliation with the project**	**Interviewee**	**Affiliation with the project**
Carrie de Wilde	Communication Manager at the Rijkswaterstaat for the Sand Engine project	**John Bourgeois**	Executive Project manager of the SBSPR project (California State Conservancy)	**Gerda Lenselink**	Strategic Advisor for the monitoring program of Marker Wadden (Deltares)
Lenie Dwarshuis	Former Vice-Governor of the Province of South Holland, Provincial Executive on water related issues (currently retired)	**Laura Valoppi**	Lead Scientist through the U.S. Geological Survey Western Ecological Research Center		
Koen Oome	Project manager of the Zandmotor –coast and nature development (Province of South Holland)	**Mary Selkirk**	Senior Mediator – Professional Facilitator through the Center for Collaborative Policy for the SBSPR project (currently retired)		
Arjen Boon	Project Leader Zandmotor at Deltares research institute which conducts monitoring and research for the Sand Engine	**Catherine Burns**	Executive Director at San Francisco Bay Bird Observatory (stakeholder NGO and a monitoring partner of the SBSPR project)		
Pieter Koen Tonnon	Advisor/Researcher on applied morphodynamics - involved in the design of the evaluation and monitoring plan (Deltares)	**Judy Li**	Researcher; Senior thesis on civic engagement and stakeholder participation in Alviso ponds (one of the three project areas)		
Kees den Heijer	Advisor/Researcher on Marine and Coastal Information Science and responsible for the monitoring data management of the NatureCoast research program (Deltares and TU Delft)				
Ben Girwar	Policy officer and responsible for the daily management of Zandmotor - Water management and Water safety (Province of South Holland)				

The selection of the interviewees presented in the table above was based on certain parameters and considerations. They were selected according to their involvement and knowledge on the overall project but also on the monitoring processes of the respective project. These considerations might refer for example to involvement in the design of the monitoring plan, data collection, analysis, interpretation etc. Moreover, the purpose of arranging a number of interviews is to gather information from varying perspectives and opinions. Therefore, it was deemed important that the interviews shed light to knowledge or perceptions from various stakeholders, such as people involved in policymaking, local residents.

Before the interview there were also certain arrangements agreed upon by both parties - the interviewer and the interviewee. The interviewer had permission to record the conversation, both via Skype (as a video call) and in person through a recording device. The respondents agreed to receive an interview report of 3-4 pages of the main points of their interview and send it back for verification of the results. They also agreed that they would be referenced in the thesis research paper; the points presenting their arguments and opinions are referenced accordingly. The interviews had an average duration of one hour and 15 minutes. There were no follow-up interviews arranged. There were some follow-up questions on the SBSPR project which were answered by John Bourgeois.

Chapter 4: The Sand Engine

This chapter starts by presenting background information on the BwN project of Sand Engine for coastal protection and nature development as well as clarifications on its organizational structure. Next, there will be a description of the monitoring program based on to the scope and requirements of this research. The chapter proceeds with the analysis of the case, i.e. the assessment of the monitoring arrangements of the Sand Engine based on the effectiveness criteria and the explanatory variables. The chapter is finalized with the extraction of conclusions with regard to the degree to which the explanatory variables actually influence monitoring effectiveness and a reflection on the degree to which the arrangements made in the Sand Engine project facilitate the three main monitoring functions mentioned in Chapter 2.

4.1 Background Information

Historically, the geomorphology of the country of the Netherlands required that the coastal policies focused on the important national issue of flood protection and coastal defense of the 9 million Dutch citizens living below mean sea level, protected by dikes. The Netherlands is a country that consists of many estuarine and low-lying areas that were constantly threatened by sea level rise; these phenomena were aggravated in the last 30 years due to climate change and human-induced environmental changes (Janssen et al. 2012; Gratiot et al., 2008).

Figure 4: Location of Sand Engine

During the 1980s, the coastal policies in the Netherlands started to aim at the integration of other functions of the Dutch coastal line, not to the exclusion of the historical need for flood protection and coastal defense, but in addition to it. The integration of other functions stemmed from the immense need for creation of recreational and green spaces for the ever increasing population of the various estuary areas all around the Netherlands (Dwarhuis, 2014). The Delfland coast[10] in the south-west of the Netherlands was an example of a Dutch coastal area that was in need of flood protection, as well as the use of the coast as a recreational space (see figure 4, found in Aarninkhof, 2010).

The western Dutch coast, part of which is the Delfland coast, is exposed to the North Sea. The Delfland coast which has about 15km length between the Hoek of Holland and the coastal line of the Hague is "characterized by dunes and a net northward transport of sand driven by predominantly south-westerly winds" (Aarninkhof, 2010, p.3). The construction of a dike for the flood protection of the adjacent to the coastal line areas was not feasible financially. The main method of flood protection was nourishments of the beach with sand and later foreshore nourishments, approximately every 4-5 years. Each year that passes by requires 300.000 to 500.000 m3 of sand for the Delfland coast (Aarninkhof, 2010).

[10] Delflandse kust (figure 3) translates as Delfland coast in English.

As mentioned before, climate change and anthropogenic factors have aggravated the issue of sea level rise; this is expected to have implications on the amount of sand that is going to be necessary for the long-term maintenance of the coastal line, as well as the flood protection of the western Dutch coast, including the Delfland coast. Aarninkhof (2010) argued that the demand for sand was expected to reach 20 million m^3 for the next 20 years (until 2030). This implies that the sand nourishment activities will have to take place on a more regular basis, in order to cope with the flood-threating conditions. This, however, posed ecological concerns for the local aquatic and coastal environment. The sand nourishments cause significant disturbances to the ecosystem of the Delfland foreshore; then the ecosystem needs a certain amount of time to recover and return to its former state. The small time frame between the nourishments raised serious concerns about the situation of the ecosystem after a certain number of nourishments. The need for a more ecosystem friendly approach of sand nourishment was evident (Aarninkhof, 2010).

The aforementioned concerns and the immense need for continuous replenishment of the coastal line and foreshore led to the conception of the idea of an innovative, mega-nourishment experiment for flood protection and coastal sand development - the Sand Engine (Zandmotor in Dutch). The Sand Engine is a man-made, hook-shaped sand peninsula created in the area of Ter Heijde (Delfland coast) and was designed to serve recreational, public access and nature development objectives apart from the primary one of flood protection (Rijkswaterstaat, 2013). The Sand Engine construction entailed the deposition of 21.5 million m^3 of sand on the foreshore. Briefly, the goal was to make use of the south-westerly winds and waves (transferring sand to the north) in order to distribute the sand along the coastal line. In this way, the gradual distribution of sand along the Delfland coast will enhance flood protection in a horizon of 20 years, by making use of certain natural processes and ecosystem functionalities, as the core of BwN prescribes (Aarninkhof, 2010). The Sand Engine is a benchmark project of the BwN concept (for the Netherlands).

In April 2008, the governmental authorities of the Ministry of Infrastructure and the Environment (whose executive branch is Rijkswaterstaat, hereafter RWS) and the Province of South Holland signed an agreement for the expansion of the Delfland coast seawards according to the principle BwN[11]. The province of South Holland was in charge of the design phase (2008-2009), during which time the Environmental Impact Assessment Requirement was attended (Pekkeriet, 2010). The Province of South-Holland was the authority that initiated the dialogues for the Delfland Sand Engine (Dwarshuis, 2014), mainly due to the pressing issue of recreational and green space mentioned above and cooperated with various parties, such as RWS, the Water Board of Delfland (responsible for flood defense system maintenance), the municipality of Westland, the municipalities of the Hague and Rotterdam, the Environmental federation of the South Holland (Milieufederatie Zuid Holland) [12], the World Wildlife Fund and Ecoshape (Aarninkhof, 2010). EcoShape[13] is an association of a variety of organizations and parties from the private sector such as dredging contractors, equipment suppliers and engineering consultants and the public sector such as government agencies and municipalities, research institutes, universities and non-profit organizations. The Ecoshape initiators were two dredging companies Van Oord and Boskalis and the research institute of Deltares.

[11] BwN is a concept promoted by Ecoshape. Ecoshape is largely involved in the Sand Engine project (the Sand Engine is a BwN project).

[12] The Federation of Nature and Environment of South Holland (Milieufederatie Zuid Holland) is an independent, private organization that works with residents, businesses and the Government towards the sustainable development of the province, (http://milieufederatie.nl/).

[13] http://www.ecoshape.nl/en_GB/about-ecoshape.html.

As mentioned before, during the planning phase of the Sand Engine an Environmental impact assessment was carried out. The next sub-section will focus on this legal requirement with the aim to introduce the need and logic behind the monitoring program of the project.

4.2 The planning phase of the Sand Engine

All the European projects that are likely to have significant effects on the environment by virtue, inter alia, of their nature, size or location", are obliged by the European directive to draft a report presenting the expected effects, the 'Environmental Impact Assessment' (EIA hereafter), before the development of the project is permitted (European Commission, 2013, p.3).

Accordingly, for the development of the Sand Engine a Strategic Impact Assessment (SIA hereafter) (Grontmij, 2008) and an EIA were conducted. During the planning phase, and within the framework of the EIA, various alternative designs of a Sand Engine were studied in order for the configuration of a Sand Engine project scenario that would provide the most sustainable nourishment strategy with the least long-term burden on the ecosystem (Mulder et al., 2010). In addition, there were national legal requirements (e.g. from Nature Conservation Authority) for which the project's planning needed to account (Deltares and Imares, 2011). The EIA report was based on a model that focused on the morphological development of the Sand Engine; after the EIA process was through new concerns arose such as swimmer safety, effects of storms etc. (Pekkeriet, 2010). These issues had to be addressed later on in the project, and it was evident that this had to be done through the adaptive management of the project as well through monitoring the effects of the project on all the relevant aspects identified. For the purposes of this paper, the monitoring program of the Sand Engine has to be explained in more detail: what is monitored, who is involved etc. Before going into the specifics of the monitoring program, the next section will present and describe firstly the organizational structure of the Sand Engine, in order for the reader to have a complete overview of the hierarchy of the main actors involved and where monitoring lies in this structure.

4.3 The organizational structure of the Sand Engine

The diagram below presents the main groups of actors involved in the Sand Engine project, in order for the reader to obtain the comprehensive overview of the hierarchical 'position' of the actors as well as to comprehend where the monitoring lies within this picture.

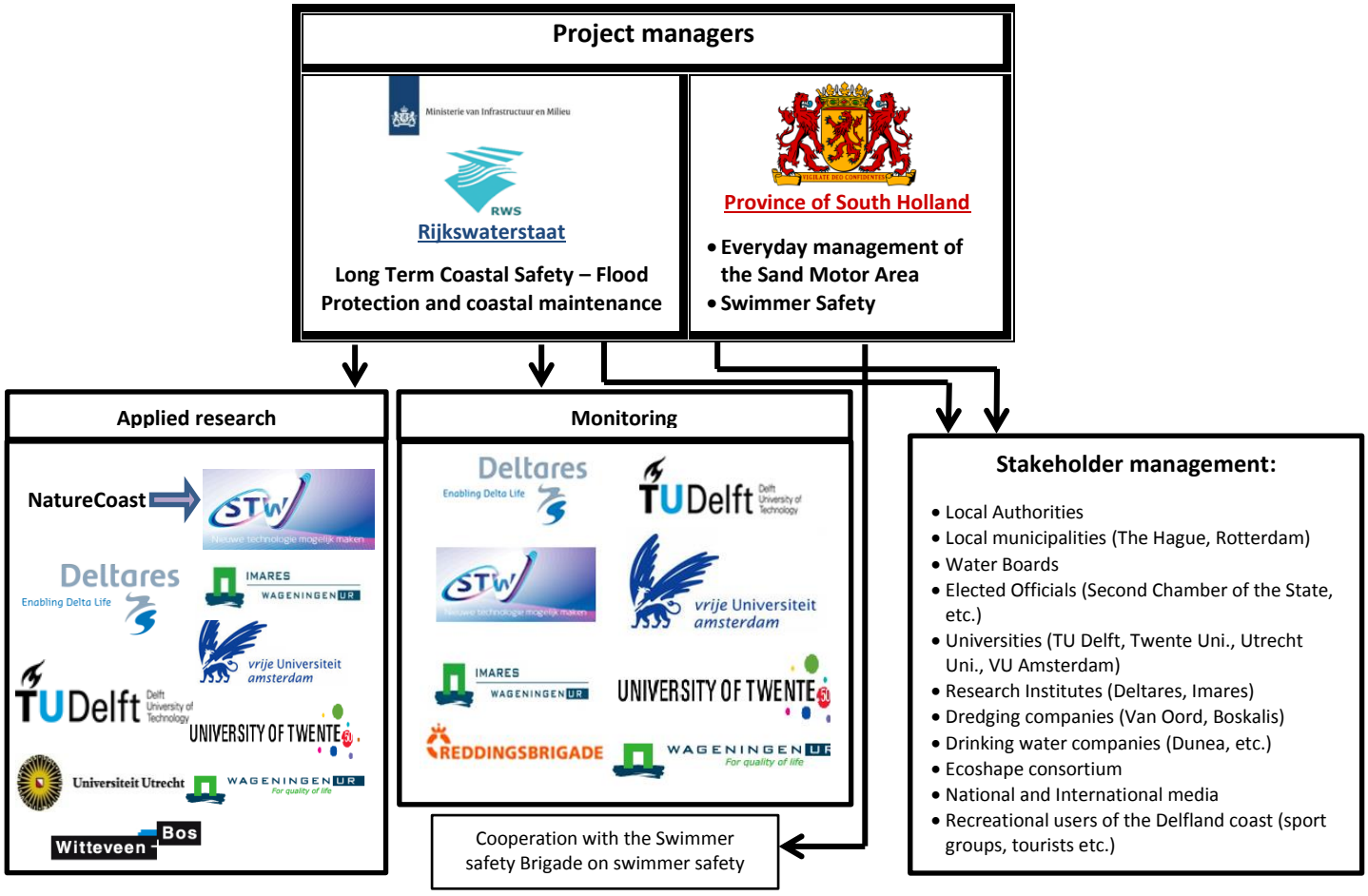

Figure 5: Sand Engine project actors' structure

According to the diagram the overall organizational structure of the Sand Engine project starts on the top with the two governmental agencies of RWS and the Province of South Holland who are also the initiators of the project. The responsibilities of the two governmental agencies - project partners with regard to the project follow naturally from their general responsibilities set by the Dutch Law; as far as the water sector is concerned (more specifically coastal defense, flood protection, environmental protection) the RWS is "responsible for long-term coastal safety by maintaining the coast line and the sediment volume of the coastal foundation" (Aarninkhof, 2010, p.3) and the Province of South Holland is responsible for the day-to-day management of the coastal line (Rijkswaterstaat, 2013). The RWS is in charge of the higher level coordination of the 'Monitoring and Evaluation Program' of the Sand Engine. Various private enterprises and academic institutes are involved in the knowledge development i.e. in the applied research activities for the Sand Engine (see figure 5). Furthermore, the Sand Engine is a project that affects a variety of stakeholders listed in figure 5. The management and the communication with the stakeholders is a joint responsibility of the initiating and leading authorities of RWS and the Province of South Holland (the arrows connecting the RWS and the Province with the stakeholder management).

It is important to delve into the monitoring part of the project before its arrangements are assessed in terms of the degree they facilitate the adaptive implementation of the project. In the next sub-section a description of the monitoring program of the Sand Engine is provided.

4.4 The monitoring program of the Sand Engine

As required by the EIA process but also for the reasons an environmental project need to be monitored (see Chapter 1), an extensive monitoring program was designed for the Sand Engine under the guidance of the RWS and the EcoShape consortium; the program is funded by the RWS and the European Fund for Regional Development (EFRO) (Aarninkhof et al., 2012). The RWS assigned the research institutes of Deltares and Imares with the task to articulate a 'Monitoring and Evaluation Program'. The program was co-designed by the aforementioned research institutes in collaboration with Vertegaal Ecologisch Advies - an ecology consultant firm and Arens Bureau voor Strand- en Duinonderzoek (Deltares and Imares, 2011).

The picture below shows the research themes that relate to the Sand Engine (Rijkswaterstaat, 2013). Aspects of these thematic categories are being monitored within the Sand Engine monitoring program. Groundwater monitoring data are provided by another pilot project, the 'Zandmotor/Solleveld' and used in the research activities of the Sand Engine. This happens in order to avoid measuring the same aspects twice as both projects need the same types of groundwater data. The monitoring of recreational aspects and swimmer safety falls under the jurisdiction of the Province of South Holland; the province in close collaboration with the Swimmer Safety Association (Reddingsbrigade) is in charge for the on-site monitoring efforts of the aforementioned two aspects. The remaining aspects, as presented in figure 6, belong to the monitoring program of the Sand Engine, led by the RWS (Deltares and Imares, 2011).

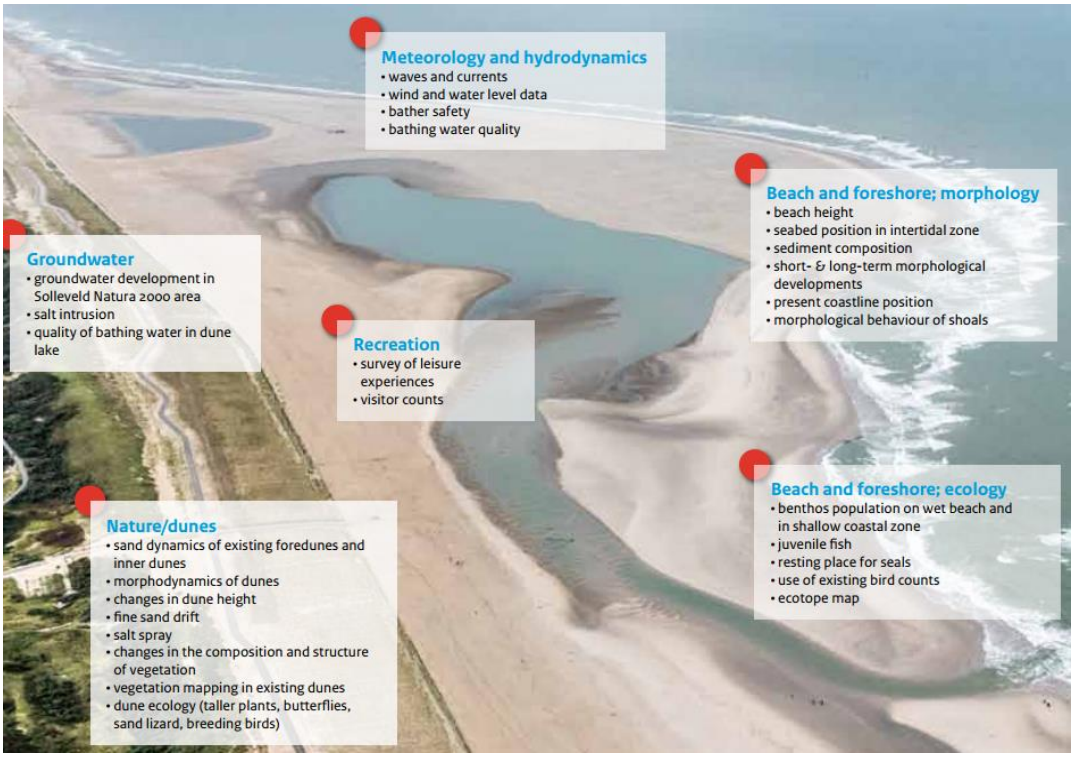

Figure 6: Research and monitoring themes for the Sand Engine

The monitoring program of the Sand Engine entails the production of an extensive amount of data; the availability of monitoring data triggered the setup of the research program called NatureCoast (see figure 5) that entails research on all relevant to the Sand Engine's objectives aspects: physical,

ecological and social (Aarninkhof et al., 2012). The first official results will become publicly available in 2016, due to the need to protect[14] the publication rights of the researchers (Rijkswaterstaat, 2013).

Next, there will be an assessment of the monitoring arrangements based on effectiveness criteria explained in table 3. Following, an evaluation will be made based on the degree to which the arrangements fulfill the six explanatory variables. The assessment will be based on the explanatory variables as presented in table 5 in the methodology chapter.

4.5 Assessment of the monitoring program based on the effectiveness criteria

This part will address the degree to which the monitoring effectiveness criteria are satisfied. In other words, the monitoring arrangements will be scored based on the degree to which they fulfill the effectiveness criteria. The scoring explanation for the effectiveness criteria can be found in Chapter 3 (table 3) and the explanation of the relation between the effectiveness criteria and the explanatory variables is explained in Chapter 2 (table 2).

Criterion 1: Shared Vision

The first criterion illustrates the degree to which the monitoring arrangements facilitate the creation of a shared vision among scientists, managers and the stakeholders of the Sand Engine with regard to the project's objectives. Although a stakeholder analysis was conducted in the beginning of the project, which revealed the variety of potential stakes and concerns of the affected groups, not all concerns were reflected in the monitoring program (den Heijer; Tonnon, 2014). The scientific and technical concerns relating to the Sand Engine were fully addressed, but the same did not happen for the issues of concern of recreational users (the issue of stakeholders' concern integration will be further elaborated later in the chapter). That resulted in the creation of scepticism among the recreational users of the Sand Engine area and also among the residents and tourists who were concerned with swimming safety (mainly in 2012). Those stakeholders could not understand what the construction of the Sand Engine meant for them, how it would affect their use of the area. Safety issues were better account for in monitoring later in the course of the project, after that criticism. The overall assessment is that certain stakeholders did not share a common vision with regard to the project's objectives, mainly in the first two years after the construction of the Sand Engine (den Heijer, 2014; Tonnon, 2014). They expected their concerns to be better addressed by the project. Although there have been efforts to account for safety issues more and incorporate them in the monitoring, recreational implications are under-investigated in the monitoring part. Therefore, the arrangements relating to the first effectiveness criterion are *moderately effective*.

Criterion 2: Awareness of the monitoring needs by policymakers

This criterion aims to illustrate the degree to which the monitoring needs and results 'reach the ears' of the (regulators and) policymakers who can influence, facilitate or allow for the fulfillment of those needs. For the case of the Sand Engine, the responsible higher-level policymaking authority is the Ministry of Infrastructure and the Environment. As already mentioned, the delegate of the Ministry for water related issues in the country is the RWS; the RWS is one of the initiators and leading authority of the monitoring program of the Sand Engine. All the entities assigned with monitoring responsibilities by the RWS are communicating with and reporting to the RWS on a quarterly and

[14] The dissemination of monitoring results is subject to certain rules defined in the document: 'House Rules for the Storage, Use and Publication of the Sand Motor Monitoring Data' (2013).

yearly basis to on the monitoring results (Boon, 2014). More specifically, they report on e.g. what certain results show and what does that mean for the continuation of monitoring. Those results might reveal the need for additional monitoring i.e. a new monitoring need, as described in section 2.4. In addition, the fact that the RWS performs monitoring on the Sand Engine implies that it is largely involved and aware of at least the needs stemming from the RWS monitoring (Boon, 2014; den Heijer, 2014). Their awareness on the monitoring results and updates is enhanced by the input of the entities performing the other monitoring tasks. Den Heijer (2014) argues that the RWS employs people who are very experienced on how to present monitoring needs to higher level policymakers. Therefore, if the needs require action by higher-level policymaking, the RWS presents the situation to the Ministry. As a conclusion, there are *effective* arrangements ensuring the fulfilment of the second criterion.

Criterion 3: Willingness of policymakers to act upon the monitoring needs

The third criterion shows the degree to which the policymakers are willing to act upon the monitoring results. As already described above, the monitoring needs are sufficiently visible to the policymakers; den Heijer (2014) mentioned that the project is successful in ensuring that the needs and the links between the different types of monitoring are known to high levels of authority (the Ministry); when a monitoring need comes up (usually evident by the monitoring results) the RWS is alerted immediately. However, den Heijer (2014) mentioned that there is a tendency of the policymakers to try to stick to the monitoring activities that are already running, due to financial constraints. This however, does not facilitate the eased satisfaction of all the monitoring needs of the project. Certain needs might be considered necessary and/or urgent by the scientists working on the project, but not by the RWS. The explanation for this discrepancy is that the financial constraints faced by the RWS imply that the allocation of funds does not allow for satisfaction of every emerging need. Unavailable or limited financial resources have negative implications on the effectiveness of the project. Unavailability of financial resources of the policymakers to support monitoring needs is not a 'failure' of the monitoring arrangements of the Sand Engine; yet the arrangements are still scored as *moderately effective,* because they do not facilitate the creation of a common vision among all stakeholders of the project's objectives, which would enhance the policymakers' willingness to act upon the results, according to the theory of this research.

Criterion 4: Adaptive capacity of the monitoring program

The fourth criterion shows the degree to which the monitoring program has adaptive capacity in light of new monitoring needs and/or new or revised legal requirements. The procedure followed when new needs appear is already mentioned above. The RWS being the leading authority of the monitoring program of the Sand Engine, is alerted about new monitoring needs. However, a considerably smaller fraction of new needs that might appear has proven to be able to create confusion within the Sand Engine project, due to jurisdictional overlaps. New needs cannot always be addressed efficiently and in a timely manner because incidents might seemingly fall under the authority of both RWS and the Province (explained in Chapter 6 in more detail). Although there have been efforts to clarify and distinct these areas of authority and responsibility in a more clear way, there are still problems with regard to the ability to address needs efficiently and in a timely manner (Boon, 2014).

The adaptation of the project to new or updated legal requirements is taking place as follows: the RWS, as a governmental branch, has a department working on new legal requirements and permits

that need to be issued, also relating to the Sand Motor. Some of these people might also be involved in the monitoring program of the Sand Motor itself; in any case there is the opportunity within the Rijkswaterstaat for more direct communications among colleagues about the (new) legal requirements and their implications for the monitoring of the Sand Motor (Boon, 2014). Therefore, the adaptation and modification of the monitoring plan according to new legal requirements is facilitated. The conclusion is that the arrangements relating to the fulfilment of the criterion addressing the adaptive capacity of the plan with regard to the incorporation of new needs and/or legal requirements are *moderately effective*.

The next section will present a reflection on the degree to which the monitoring arrangements of the Sand Engine seem to facilitate the fulfilment of the monitoring functions identified by this research.

4.6 Degree of fulfillment of monitoring functions – Sand Engine

This part of the chapter includes a reflection on the degree to which the monitoring functions identified in the theory chapter of this paper were facilitated by the monitoring arrangements of the Sand Engine. Firstly, the learning function of monitoring, which according to the theory entails the promotion of collaborative learning processes among the parties involved, namely stakeholders, scientists, project managers and policymakers, is not achieved to a high degree by the Sand Engine. There are actually learning processes with regard to monitoring among the scientists working on the project, the project managers who in this case almost coincide with the policymaking authorities but not with all main types of stakeholders identified. There are important learning processes with technical stakeholders (e.g. dredging companies), mainly because the monitoring program was set up to address, at least initially, technical concerns. Recreational stakeholders (e.g. hikers, kite surfers) have not participated in the knowledge production for the monitoring except for certain occasions in the planning phase and recent efforts by the project managers to include them more in the project's activities. The learning function is enhanced, as the arrangements are effective in terms of creating awareness among policymakers. However, the learning function appears not to be achieved in a high degree as the project's monitoring arrangements are moderately effective in creating a shared vision among the project managers, scientists and stakeholders.

The second monitoring function of evaluation according to the theory entails evaluation processes among the parties involved in monitoring (for this research, scientists, project managers and policymakers). These processes relate to evaluating the knowledge gained by monitoring, as well as evaluating the way the monitoring processes are taking place e.g. if there is a need for changes on 'how' processes are carried out. In addition, the evaluation function aims at assessing the degree to which a project can understand through monitoring whether it progresses towards the achievement of its objectives but also whether it accounts for the stakes of people affected. The Sand Engine monitoring arrangements seem to facilitate the evaluation function to a mediocre degree. There are indeed arrangements ensuring the evaluation of the knowledge gained by monitoring and on the way tasks are carried out monitoring among project managers, policymakers, scientists, creating for awareness among policymakers and enhancing their willingness to act upon the monitoring needs. However, the arrangements fail to provide ground for evaluation of the degree to which the project accounts for certain stakes, because those stakes are underrepresented in monitoring (not so much incorporated); this failure relates to the score of the arrangements (moderately effective) with regard to the creation of a shared vision among the project managers, stakeholders and scientists.

The third monitoring function of steering is the one that the Sand Engine seems to fulfil to a relatively sufficient degree. The monitoring arrangements of the Sand Engine seem to facilitate this monitoring function, as indeed monitoring functions as a steering mechanism for policymaking. The respondents stressed that the project has achieved to translate the monitoring results if and when necessary to policymakers, and that the presentation of the results are decisionmaking supportive for the RWS and policymaking supportive for higher level policymaking (by the Ministry). That relates to the fact that the monitoring arrangements are effective in term of creating awareness among policymakers, but still moderately effective to enhance their willingness to act on the monitoring needs.

One function that the theory has not incorporated but is prominent through the case analysis of the Sand Engine is that monitoring should function as a mechanism to garner stakeholder support. More specifically, the project managers along with the scientists can ensure that stakeholders concerns are addressed by monitoring and that this process is evident to the stakeholders. It is a proof mechanism that the project has taken the various stakes into consideration and has actively taken action upon them through its monitoring program. In that way a shared vision of the project's objectives among the project managers, scientists and stakeholders is enhanced. The Sand Engine's monitoring arrangements has not achieved this additional function.

The next section presents the assessment of the monitoring arrangements based on the explanatory variables, according to table 5 (Chapter 3).

4.7 Monitoring arrangements' assessment based on explanatory variables

a) Integration of stakeholders' interests and concerns in the monitoring

This explanatory variable is going to address the degree to which the stakeholders' interests and concerns were integrated in the monitoring program of the project (as well as the form of their involvement). Before the arrangements for this variable are assessed, it is also important to briefly explain the stakeholders' overall role and involvement in the project.

As mentioned before, the main government stakeholders and project managers of the project are the RWS and the Province of South Holland. The interests and stakes of the RWS (mainly technical/scientific) were incorporated in the project's plan that went through the EIA process. The concerns of the Province (about safety) were partially attended (explained below). Furthermore, during the planning phase there were efforts to approach and include a wide range of groups of people potentially having an interest in the project (stakeholders) (see figure 5 for the list of stakeholders). The general public was also invited in various meetings (mainly between 2009-2011) in order to reflect upon the Sand Engine plans in the planning phase; in the Netherlands official public comment is sought for projects that have to go through the EIA process (van Slobbe and Lulofs, 2011).

For the comprehensive identification of as many stakeholders as possible, a stakeholder management analysis was carried out by the Province of South Holland in cooperation with the RWS. This analysis aimed at identifying the spectrum of stakeholders as well as their associated stakes and possible concerns about the project. During the planning phase there were meetings arranged with the public, local sports groups, environmental groups etc., in order for them to be able to bring their thoughts and questions to the table (de Wilde, 2014). The Province of South Holland was (and is) primarily in charge of the communications with local stakeholders (e.g. residents, local sports groups)

considering that it is the most prominent local authority related to the Sand Engine. In addition, there was a stakeholder platform through which everybody could pose questions (e.g. interested members of the public such as residents). This platform is no longer available. However, in May 2014 there was a meeting where a wide range of stakeholders as well the general public were invited, in order to rejuvenate public engagement and interest for the project (de Wilde, 2014). In addition, there is another stakeholder platform which is accessible to local authorities and other parties currently involved in the project e.g. the Swimmer safety Brigade, the adjacent municipalities etc. (not publicly accessible) (Girwar, 2014).

When the RWS initiated the design of a monitoring plan, mainly technical stakeholders participated in the identification of the monitoring needs (e.g. the Ecoshape consortium of dredging companies, research institutes and universities). De Wilde (2014) mentioned that when the permission for the construction of the Sand Engine was given and a monitoring program had to be designed there was not enough time to actually account for all interests and concerns. Later in the course of the project more stakes and interests were addressed by the project. All in all, the participation of technical stakeholders resulted in the consideration of a wide variety of mainly technical and scientific aspects in the monitoring design. In other words, the interests of stakeholders with technical affiliation with the project were attended to a sufficient degree (Boon, 2014; Tonnon, 2014).

However, concerns had arisen about swimmer safety and potential implications from and for the recreational use of the Sand Engine area during the construction of the project. Safety issues have been addressed by the monitoring program of the Sand Engine with relative delay. Recreational aspects are still not fully addressed by the monitoring. Despite the fact that certain aspects relating to recreation (e.g. observations of currents potentially dangerous for some activities at certain times) are monitored, the broad spectrum of issues of concern on the recreational use of the Sand Engine is not monitored with the adequate scientific rigor (de Wilde, 2014). Considering that recreation is of great importance and a stated objective of the project, it should have been incorporated in a more adequate way in the monitoring earlier on. As a conclusion, the integration of stakeholders' interests and concerns in the monitoring program is considered *moderately sufficient*.

b) Communication and cooperation on the monitoring needs and results

This variable will address the consistency of the communications and cooperation among the involved parties on the monitoring results. In other words, the variable examines whether there are consistent communication channels and venues. It is important to clarify that the parties communicating and cooperating on the monitoring results and needs are the RWS, which leads the Monitoring and Evaluation program of the Sand Engine, the research institutes, the universities and the NatureCoast research program.

Every two months there are meetings for the Sand Motor in general, not specifically on the monitoring. If an urgent matter that relates to the monitoring comes up, then it is discussed during those meetings. The meetings occurring every two months (about the overall progress of the project) are among the most closely involved parties of the RWS, the Province, Ecoshape and the NatureCoast research project. In this way, the main actors stay engaged to the progress of the project and are consistently updated. There are also meetings among the research institutes (Deltares and Imares) and the RWS every six months, where science updates are discussed and presented to the RWS, by the research institutes. The research institutes (along with the other entities involved in the monitoring program) send an annual evaluation report (also on the

monitoring results) to the RWS. Those reports entail information mostly on the technical processes and on the activities of the parties involved; what has been done and what is planned to happen next. This report is not publicly available (Boon, 2014; den Heijer 2014). In 2012, a steering group was assembled with the purpose to define the communication and cooperation venues among the main involved parties more clearly, as well as the time and manner in which the communications would occur. This steering group was assembled quite late in the project mainly due to certain incidents that were not exactly foreseen but there are no significant communication problems ever since (Dwarshuis, 2014). Those incidents pertain to jurisdictional overlap among the involved parties and are explained in Chapter 6 in more detail.

More specifically about the monitoring, needs are discussed among the entities conducting the monitoring and the RWS. If an urgent matter comes up, the communications are immediate i.e. through phone calls and/or emails in order for the RWS to make a decision about a solution. The monitoring program's updates are presented by the entities conducting the monitoring during the meetings every six months, and then decided upon by the RWS. If an issue comes up through the monitoring and it is really evident and self-explanatory, then it is usually immediately understood also by the RWS. As mentioned before, the RWS conducts on and off shore monitoring in the Delfland coastal area (Boon, 2014).

It is important to clarify that the Province of South Holland does not participate in the official Monitoring and Evaluation program of the Sand Engine. The Province is informed through meetings (every two months) about the progress of the monitoring and through the official annuals reports. The Province is not included in the communications on the monitoring needs of the official program, but only on certain monitoring efforts relating to swimmers' safety. The Province cooperates and communicates with the Swimmer Safety Association for the monitoring of swimmer safety aspects. The Province passes on the monitoring needs of swimmer safety issues to the RWS when necessary. Furthermore, communications of the issues requiring attention for the project with higher level policymaking, i.e. the Ministry of Infrastructure and the Environment, is done by the RWS. The decisions however for the monitoring are mainly taken by the RWS (as both a policymaking agency and the project manager of the Sand Engine) (den Heijer, 2014).

Based on the facts mentioned above, the conclusion is that there is consistent communication and cooperation on the monitoring results within the monitoring program of the Sand Engine. The scientists are communicating consistently the needs and results of the monitoring and the RWS is acting upon them accordingly and if necessary communicates with the higher level policymakers. Therefore, the communication and cooperation on the monitoring results and needs of the Sand Engine is scored as *sufficient*.

c) Integration of multiple types of knowledge

This variable addresses the degree to which the project arranged efforts for the integration of knowledge from a variety of disciplines and sources in its monitoring program.

The knowledge input for the monitoring program of the Sand Engine originates largely from the research institutes, universities and consultancy firms that were assigned with research and monitoring. These entities have been brought in by the RWS to assist in the knowledge creation and input for the project. Both in the planning phase and to this day, there were efforts to obtain knowledge from a variety of (mainly) technical/scientific disciplines relevant to the project activities;

that knowledge was also utilized for the design of the monitoring program. Those disciplines were, among others, hydrology, morphology, ecology etc. In addition, the NatureCoast research program was initiated for the production of further research and additional monitoring for other aspects relating of the project, e.g. governance (den Heijer, 2014). Boon (2014) argued that the utilization of knowledge by the aforementioned disciplines has proven to work well for the project in terms of sufficient input of knowledge for the continuation of mostly technical aspects of the project. The knowledge provided is supportive of further project actions among the project managers (RWS, Province).

However, practical knowledge from e.g. local residents, recreational or sports groups, environmental organizational groups is not sought by the project. There are no official venues for knowledge input from the aforementioned types of stakeholders. Boon (2014) argued that neither individuals from the communities nor environmental organizations are hired to monitor, nor are they asked. Such input is on a voluntary basis. There is a platform where such observations can be reported. This platform is independent of anything official monitoring for Sand Engine. In addition, Boon (2014) believes that for a proper research on birds and marine mammals a lot more need to be done in terms of monitoring; these aspects are not emphasized within the monitoring program.

Based on the above facts, the conclusion is that the project made efforts for the integration of knowledge from the beginning of the project, but mainly from certain technical and scientific disciplines. This knowledge was utilized and reflected in the monitoring. However, there was not practical knowledge input from e.g. local residents or experts, environmental groups, sports' groups etc., which could have indicated aspects that should be monitored. The score for this variable for the monitoring program of the Sand Engine is *moderately sufficient.*

d) Feedback mechanisms on knowledge and monitoring results

This variable addresses the degree to and manner in which the actors involved in the monitoring of the Sand Engine project have the opportunity and venues to receive from and give feedback to one another. In other words, the variable describes the degree to which there was feedback among all the involved in the monitoring parties on the monitoring results, needs and on the way the monitoring processes are being carried out.

In the part where the 'communication and cooperation' variable was described, certain ways and channels of communication and cooperation were described. Some of those were the meetings among the RWS, the Province, Ecoshape and NatureCoast (once every two months), the meetings among the RWS and the research institutes (every six months) etc. The essence is that there is feedback exchange among the involved parties on the monitoring results (what is there to learn from the monitoring) as well as on the way the monitoring processes take place. The latter aspect i.e. the way the processes take place will be explained by a hypothetical example (den Heijer, 2014). One of the research institutes realizes that there is the need to make a change in the list of data collected or the respective indicators. Then, this incident is communicated to the RWS and the other involved in the monitoring parties Then, it is the RWS's and the other parties' turn, after receiving feedback on this incident, to provide feedback on what can be done to deal with this (hypothetical) matter that requires attention. In addition to exchanging feedback on the knowledge gained by the monitoring, there is feedback and discussion with regard to how the monitoring processes are being carried out. For example, whether there is problem in e.g. data collection that requires attention (Boon, 2014).

All in all, the creation of feedback mechanisms for the Sand Engine project is considered *sufficient*. The parties involved in the monitoring have the opportunity to receive from and give feedback to the other parties both on the knowledge gained by the monitoring and on the way the monitoring tasks are taking place.

e) Strength of the link between monitoring results and policymaking

This variable addresses the strength of the link between the monitoring results of the project linked to the (regulatory) policymaking. In other words, this variable will describe how good and strong the connection is between the monitoring results (that can reveal further needs) and the (regulatory) policymaking (which can facilitate or allow for the needs revealed to be satisfied). This strong connection achieved by 'translating' the monitoring results for the policymakers and ensuring that there is openness and disclosure about what the results are showing.

In the case of Sand Engine the policymakers and the project have a 'special' association. One of the project managers - the RWS, (as already stated) is the executive branch of the Ministry of Infrastructure and the Environment. The Ministry of Infrastructure and the Environment is the highest level of policymaking in the Netherlands with regard to certain aspects relating to the project e.g. coastal maintenance, flood protection, water management etc. The RWS employs water management and other experts who are capable, when confronted with the monitoring results of the Sand Engine of understanding and figuring out what is the best and most feasible next step for the monitoring (those people are always consulted by the entities involved in the monitoring). The need for translation of the results is not so immense in the Sand Engine case; the policymakers are able to interpret the results to a sufficient degree, as they are scientists and experts themselves in the respective fields (Boon, 2014; Tonnon, 2014; den Heijer, 2014). In addition, the RWS can translate the monitoring results by presenting the highlights of reports (submitted by the monitoring parties) to describe the progress to higher levels of policymaking i.e. the Ministry. For example, the RWS presents the Ministry with summaries or key figures that require attention in order to steer higher level decisionmaking towards a more desirable for the project path (den Heijer, 2014). Finally, the issue of openness and disclosure regarding to what the results are showing, is also not entirely applicable. The RWS, as a project partner, is able to obtain all the monitoring results for the Sand Engine. It is also able to interpret them sufficiently, with the help of the other monitoring parties. As the delegate of the highest policymaking authority, it is only reasonable that the RWS is interested in the 'real' results conveying the 'real' effects of the project, both positive and negative. Based on the aforementioned, the strength of the link between the monitoring results of the Sand Engine is considered *sufficient*. The need for translation of the monitoring results is satisfied, and there is openness and disclosure about the monitoring results with the policymakers.

f) Flexibility of the monitoring program

This variable will address the degree to which the roles and responsibilities of the parties involved in the monitoring program, are clearly laid out and understood. Furthermore, this part will describe the degree to which the monitoring program stays updated with the new or revised legal requirements. Finally, the existence of efficient and effective 'funding searching' mechanisms will be analyzed.

As mentioned before, the RWS is the initiator and the leading authority for the monitoring program. When the decision for the development of a monitoring program for the Sand Engine was made, the RWS hired a number of institutes and consultancy firms to start designing a monitoring plan. The entities that were hired signed a contract with the RWS which explained their rights and

responsibilities with regard to the necessary research as well as monitoring (Boon, 2014; den Heijer 2014; Tonnon, 2014). Therefore, each one of these entities is familiar with and has clear understanding of their role and responsibility in the monitoring of the Sand Engine. The general responsibilities of the project managers (RWS, Province) relating to the Sand Engine (i.e. the two main authorities) have been established and are subject to the Dutch law, long before the initiation of the Sand Engine. In other words, their regular (lawful) responsibilities formulated their role with regard to monitoring. Almost the entire monitoring responsibility lies with the RWS, except some decisions that are taken by the Province on monitoring efforts for swimmer safety (den Heijer, 2014). However, despite the fact that the responsibilities of the two leading authorities are in general clear to them, when new monitoring needs emerged at certain times during the course of the project, it is not clear who was responsible to take care of them. That relates to the fact that although the responsibilities for the biggest part of the monitoring program are well-defined, the jurisdictional overlap pertaining to certain incidents between the RWS and the Province complicate the responsibility of incorporating new needs, therefore inflicting the flexibility of the project. Boon (2014) mentioned that for example the swimmer safety monitoring pilot was finished in 2013. If the Province does not find money to prolong the aforementioned pilot, it is unclear who is going to fund it. This confusion is created because the responsibility for swimmer safety in the area lies with the province. Based on the aforementioned, the flexibility of the monitoring program of the Sand Engine is considered *moderately sufficient*.

The next section includes a brief conclusion of the knowledge gained and information obtained by the analysis of the case of Sand Engine based on the theory and methodology of this research. The table illustrates the score of each of the six explanatory variables i.e. how do the monitoring arrangement score for the variables:

Table 8: Scoring of the explanatory variables for the Sand Engine

Explanatory Variable	Score
Stakeholders' interests and concerns and integration	Moderately Sufficient
Integration of multiple types of knowledge	Moderately Sufficient
Communication and cooperation on the monitoring needs and results	Sufficient
Strength of the link between monitoring results and policymaking	Sufficient
Feedback mechanisms on knowledge and monitoring results	Sufficient
Flexibility of the monitoring program	Moderately Sufficient

4.8 Conclusions

The aim of the final section of this chapter is to provide a reflection on the degree to which the monitoring arrangements of the Sand Engine facilitate monitoring effectiveness. In addition, there will be an assessment of the degree to which the explanatory variables are actually believed to influence monitoring effectiveness, after being practically tested.

4.8.1 Effectiveness of the monitoring arrangements of the Sand Engine

The monitoring arrangements of the Sand Engine were assessed based on the four criteria for monitoring effectiveness presented in Chapter 2. They will be briefly discussed in this sub-section, in order to provide some concluding arguments for the monitoring arrangements of the Sand Engine.

The monitoring arrangements of the Sand Engine have been scored as *moderately effective* in terms of the degree to which they facilitate the forming of a *shared vision* of the project's objectives among the project managers, the scientists working on the project and the relevant stakeholders. From the very beginning of the monitoring program of the Sand Engine not all types of stakes were accounted for. More specifically, swimmer safety and recreation fall under the jurisdiction of the Province. Therefore, they were not initially addressed by the official monitoring (led by the RWS). After the emergence of incidents causing those stakeholders to demand action (because they were not seeing their interests addressed by the monitoring) the issue of safety was better attended. The recreational concerns are still under-investigated by monitoring. In other words, there are *moderately effective* arrangements with regard to facilitating a common vision of the project's objectives, as there are stakeholders who have not seen their interests addressed by monitoring to a sufficient degree.

In the Sand Engine case there are also arrangements in place, which ensure that the monitoring needs are listened to and acknowledged by the policymakers. As extensively described before, the Sand Engine has the particularity that one of the project managers is also a governmental branch which communicates directly with the higher level policymaking. Therefore, the policymakers are fully aware of the monitoring needs. However, this does not constitute an adequate condition for them to also be willing to act upon them. Limited available resources are the main constraining factor that prevents policymakers to be willing to act upon all the monitoring needs of the Sand Engine. The adaptive capacity of the monitoring program of the Sand Engine is also inflicted by *moderately effective* monitoring arrangements. The jurisdictional hurdles among the Province and the RWS have implications also on the 'who is going to do what, and in what way' with regard to the emerging monitoring needs of the Sand Engine.

The degree of effectiveness of the monitoring arrangements for the first criterion plays an important role in the fulfillment of the learning function. The moderately effective arrangements in creating a common vision of the project's objectives, explain to a large extent why the learning function seems not to be achieved to a high degree. Similarly, the fact that the evaluation function of monitoring is achieved to a moderate degree largely depends upon the fact that the arrangements did not succeed in creating a common vision. Finally, the fact that the steering function is achieved to a sufficient degree is largely dependent on the effectiveness of the arrangements aiming at creating awareness among policymakers.

The next section presents the degrees of influence of the explanatory variables according to the findings of this research and the answers given by the interviewees for the Sand Engine case.

4.8.2 Degree of influence of explanatory variables on effectiveness - Sand Engine

This sub-section entails a reflection upon the degree of influence of the explanatory variables on the monitoring effectiveness of the Sand Engine. In this way, the chapter will be finalized by identifying which explanatory variables seem to condition, to a larger extent, monitoring effectiveness in the Sand Engine case.

The first explanatory variable, the integration of interests and concerns of the broad spectrum of stakeholders has a high importance on monitoring effectiveness. This was evident from the responses of most interviewees, who supported that the creation of a shared vision of the project's objectives is a very strong criterion of effectiveness for the Sand Engine case. However, the fact that

certain interests and concerns were not fully addressed by monitoring did not allow for a common vision to be created among project managers, scientists and stakeholders.

The integration of multiple types of knowledge appears, according to the responses of most interviewees, to have a medium effect on monitoring effectiveness. This research's theory supported that the monitoring program would have benefited by knowledge from more sources and disciplines, but not all the types of knowledge defined by this research were integrated in the case of the Sand Engine. However, according to the majority of respondents the monitoring obtained the necessary knowledge, in order to address the objectives it was designed to address (technical concerns). Thus, the integration of multiple types of knowledge, as defined by this research, was of medium importance for the monitoring effectiveness of the arrangements of the Sand Engine.

The explanatory variable of communication and cooperation is of paramount importance with regard to monitoring effectiveness. It is a core process that ensures that these needs are communicated to the policymakers (i.e. RWS and then the Ministry) and it increases the possibility of these needs to be acted upon by the policymakers. In addition, communication and cooperation seem to enhance also the adaptive capacity of the monitoring as considering that sufficient venues of communication and cooperation facilitate the integration of new needs and/or legal requirements. The variable of feedback mechanisms also influences to a high degree monitoring effectiveness. It has an evident correlation with the variable of communication and cooperation, and it is equally significant. Ensuring communication does not necessarily means that feedback is exchanged among the project managers, scientists and policymakers. There has to be an interaction and opinion exchange that will assist the various groups involved in figuring out a solution for (more) appropriate further action. All the respondents stressed explicitly that communication and cooperation on the results and knowledge gained, as well as meaningful feedback exchange are key to monitoring effectiveness.

Although all respondents supported that the link between policymaking and monitoring needs to be strong, the variable as addressed by this research is of low importance. The translation of the results (if necessary) to policymakers is crucial in general, as well as the openness and disclosure with regard to the effects of the project (shown by the monitoring). However, as described earlier in the chapter, the monitoring results of the Sand Engine are immediately known by RWS i.e. executive branch of the policymaking authority. There is no particular need for translation to RWS, and openness is not applicable, because monitoring is organized in a way that allows RWS for direct awareness of all the effects of the Sand Engine, shown by monitoring. The final variable is the one of flexibility of the monitoring plan. This variable was in general pointed out as important. However, due to the particularity that the funding for the monitoring comes almost entirely from the RWS, the creation of 'funding searching' mechanisms is not entirely applicable to this case. This variable reflects also the degree to which the various involved in the monitoring parties are fully aware of their responsibilities, which was pointed out as important by the interviewees. Therefore, the overall degree of influence of this variable on the monitoring effectiveness of the Sand Engine is considered to be high.

Below, there is a table presenting the degrees of influence of the explanatory variables on the effectiveness of the Sand Engine's monitoring arrangements. The degrees of influence of the explanatory variables are the same on the effectiveness criteria they relate to according to Table 2, in section 2.5.

Table 9: Degree of influence of the explanatory variables for the Sand Engine's monitoring arrangements

Explanatory variables	Degree of influence
1. Stakeholders' interests and concerns integration	High
2. Integration of multiple types of knowledge	Medium
3. Communication and cooperation on the monitoring needs and results	High
4. Feedback mechanisms on knowledge and monitoring results	High
5. Strength of the link between monitoring results and policymaking	Low
6. Flexibility of the monitoring program	High
Additional explanatory variables	
7. Start of the monitoring program	High
8. Visibility of consideration of stakeholders' concerns	High
9. Hurdles with legal requirements	Medium
10. Distinction of jurisdictions of the parties involved	High
11. Financial constraints of the policymaking authorities	High

4.8.3 Additional explanatory variables

Apart from the explanatory variables studied, there were certain additional variables that appear to influence effectiveness, deriving from the interviews themselves in combination with the interpretation of the author. Firstly, the interviewees with a scientific background and association with the Sand Engine, supported that it was substantial for the monitoring program to have been designed and put forward earlier (i.e. before the start of the project's implementation). The variable of *start of the monitoring* has a high degree of influence effect for the Sand Engine. That resulted in certain aspects and concerns being only later incorporated in monitoring, and others being under-investigated during the whole course of the project, to this day. Furthermore, the fact that there was not strong connection between the various stakes related to the project and monitoring resulted in reactions and resistance of certain stakeholders to the project's realization. The variable of *visibility of consideration of stakeholders' concerns requirements* has a high effect for the Sand Engine. Only two of the interviewees with a scientific association with the project (from Deltares) argued that the Sand Engine has encountered some difficulties with legal obligations that indicated compliance with opposing requirements. This incident related to opposing environmental goals of the two main Ministries involved, which were reflected in the respective legal requirements. Those requirements had to be incorporated in the monitoring program as well; however, they did not seemingly inflict monitoring effectiveness. The variable of *hurdles with legal requirements* has a medium effect for the Sand Engine. Another issue that appears to be of great influence on monitoring effectiveness is the jurisdictional issues among the Province and the RWS. Certain incidents have proven that the responsibilities with regard to monitoring have to be revisited and reappointed among the two authorities (*Distinction of jurisdictions of the parties involved)*. Finally, the last explanatory variable designated as of great importance by the interviews, is the availability of financial resources of policymakers. This variable seems rather important in the Sand Engine case, as all interviewees argued that the satisfaction of the monitoring needs depends almost always on the *availability of resources of the policymakers* (in this case closely related to project managers i.e. leading project manager acts under the guidance and funding of the policymaking authority of a Ministry).

Chapter 5: South Bay Salt Pond Restoration

This chapter entails the analysis of the SBSPR project. Firstly, background information on the situation of the South Bay of California that resulted in the realization of this project is presented; in addition, information on the organizational structure of the involved actors in the SBSPR project is given. The chapter continues by providing a description of the monitoring program of the SBSPR project according to needs of this thesis i.e. scope and aspects under research. The case analysis entails the assessment of the monitoring arrangements of the Sand Engine based on the effectiveness criteria and the explanatory variables. There is also reflection on the extent to which the main monitoring functions are achieved in this case. The chapter is finalized with conclusions deriving from the analysis.

5.1 Background Information

Already from the mid-1800s the wetlands that existed in the South Bay area of San Francisco, California began to disappear due to the construction of dikes (Siegel and Bachand, 2002) or being turned into diminished habitat for indigenous marsh species (Goals Project, 1999). That was also the time when San Francisco Estuary's ponds and sloughs began to transform into commercial salt production ponds (Josselyn, 1983). More specifically, the aforementioned milestones in the San Francisco Estuary's history led to significant changes in the Bay's environment, largely negative ones. The main reasons why the idea of South Bay Salt Pond Restoration was conceived in the first place are the negative impacts imposed to the ecosystem of South San Francisco Bay by the encroachment of urbanization, the levees that have been built and the long term salt production in the area. These activities resulted in a number of implications according to SBSP Final EIR/EIS (2007, Appendix D, p.1-2): the loss of more than 85% of historical tidal wetlands, most of which has been turned into commercial salt ponds (see figure 7, found in Josselyn, 1983); important alterations in sediment dynamics; modifications in freshwater flows; appearance of pollutants, especially mercury due to traditional mining activities; changes in species composition and distribution, and substantial population fluctuations for a number of key indigenous species.

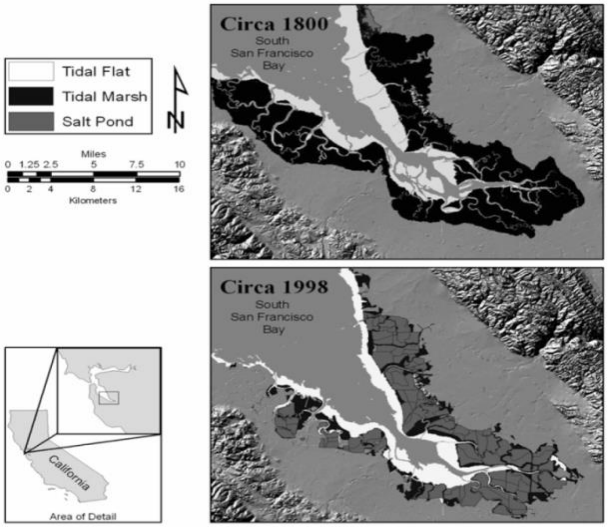

Figure 7: The significant loss of tidal land in the South San Francisco Bay

The need and willingness to protect the biotic and abiotic life of the South Bay began already in the 1960s, when insufficient treatment of sewage led to gradual fish kills. There was the acknowledgement that the vicinal estuarine ecosystems must be restored; in the 1990s that resulted in the convention of a group of government agencies, non-governmental organizations, scientists, and citizens cooperating on the Bay Area Wetlands Ecosystem Goals Project. The purpose of the project was to identify the "kinds, amounts, and distribution of wetlands and related habitats that are needed to sustain diverse and healthy communities of fish and wildlife resources in the San

Francisco Bay Area" (Goals Project 1999, p. S1). The publication of the Bay Area Wetlands Ecosystem Goals boosted the interest and attention on wetlands restoration in general (Goals Project, 1999).

The South Bay Salt Pond Restoration (SBSPR hereafter) project was initiated in March 2003 when more than 6000 hectares of ponds which had been producing commercial salt, using the method of evaporization in South San Francisco Bay were sold by Cargill, Inc. (a company that produces food ingredients and trades agricultural products[15]) to the California Department of Fish Game (CDFG)[16] and the United States Fish and Wildlife Service (USFWS)[17]. Those salt ponds constitute the main components of the SBSPR project. The SBSPR project is one of the largest wetlands restoration projects in U.S. history and the largest restoration effort in the West Coast of the U.S. It is being applied in a heavily urbanized estuary and has a wide array of interested communities and user groups, non-governmental organizations, academic institutions, and federal, state, and local governments (Center for Collaborative Policy, 2003a).

Project's Location and Areas

The SBSPR project is located in South San Francisco Bay in northern California. As figure 8 (found in SBSPR Final EIR/EIS, 2007, Appendix D, p.4) depicts the project is applied in three different region complexes. The northern blue ponds are called the '*Eden Landing*' complex and belong to the CDFG; the USFWS owns the southern green ponds from Mountain View to Fremont - the '*Alviso*' complex. The ponds in Menlo Park are known as the '*Ravenswood*' complex. Cargill, Inc. holds ownership and management of the western pink ponds of the map. Although USFWS is the main owner of the orange ponds, Cargill still produces salt there under an easement agreement. This happens due to the fact that artificial salt evaporation pond ecosystems play a vital part in the preservation of wildlife in the estuary by hosting large, diversified and rare communities of migratory species. The two yellow ponds of Sunnyvale and Milpitas in the south belong to local government agencies.

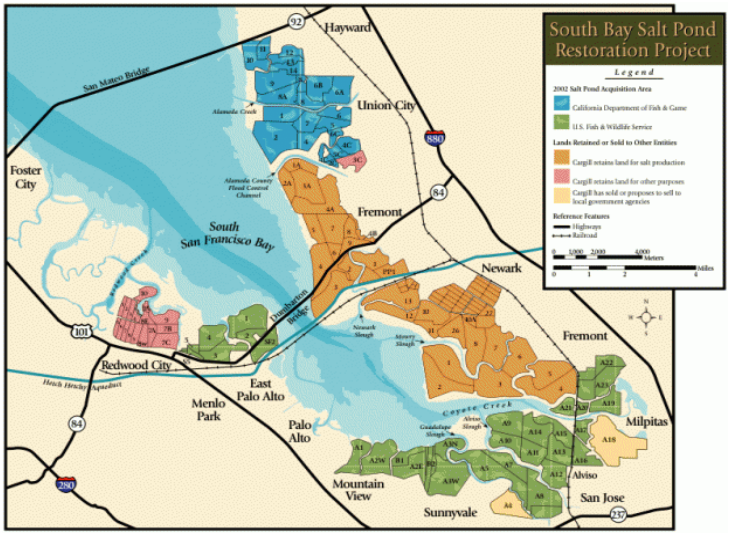

Figure 8: Map of region complexes of the SBSR project

The next section will confront the core concept of the SBSPR project, nature restoration, with the core concept of this research, BwN.

[15] http://www.cargill.nl/en/about/index.jsp

[16] CDFG is a department of the Government of California with the mission to protect and manage the state's fisheries, wildlife and natural habitats (http://www.dfg.ca.gov/)

[17] USFWS is a department of the federal Government of the US with the mission to protect and manage the fisheries, wildlife and natural habitats of the United States (http://www.fws.gov/)

5.2 Confrontation of the SBSPR project's key concept with BwN

Already obvious by the title, this research addresses monitoring arrangements for the adaptive implementation of BwN projects. The case of the SBSPR is strongly considered a BwN-like case as the core principle of both projects is the achievement of flood protection and nature development goals by allowing natural processes of ecosystems to function undisturbed of technological and/or human interventions. Nature restoration is the process of repairing the damage incurred by humans on the dynamics and natural process of indigenous ecosystems (Jackson et al., 1995). BwN supports and promotes working with the natural process and dynamics of ecosystems (see Chapter 1). The goals of these approaches are convergent: on the one hand nature restoration (and in this case wetland restoration) promotes the restoration of a natural ecosystem in its pristine situation to the greatest possible degree in terms of processes and dynamics etc.; on the other hand BwN promotes the use of the natural processes and dynamics of an ecosystem in order to create/build projects both serving the humans, and at the same time not disturbing nature but cooperating with it.

The next section will briefly describe the planning phase of the SBSPR project in order to explain and set the basis to introduce the organizational structure of the project (within which there are certain actors involved in the monitoring).

5.3 The planning phase of the SBSPR project

The two land owning agencies of certain project areas (USFWS and CDFG) mentioned previously, initiated in the same year of the acquisition of the ponds (2003) the first plan towards the restoration of the ponds into tidal marsh. That was the Initial Stewardship Plan (ISP), a strategy to seize salt production activities in the ponds and prepare them for the next step to come, the restoration plan. Within a short period of time the aforementioned two agencies of CDFG and USFWS along with the (California) State Coastal Conservancy (SCC)[18] initiated a four-year planning phase for the articulation of a restoration plan for the ponds (the three agencies are going to be hereafter referred to as project partners). During those four years the people involved in the project had the tasks to: develop the project's objectives and the scientific foundation to achieve them, initiate an extensive public engagement and involvement process, coordinate with the Army Corps of Engineers (ACOE) on the South San Francisco Bay Shoreline Study (a Congressionally authorized largely related study that includes the SBSPR Project area); and prepare an EIS/EIR to assess the project's expected (environmental) outcomes as a whole.

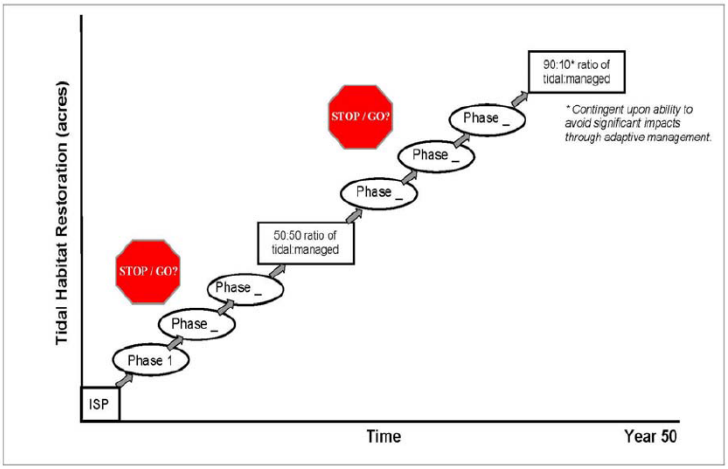

Figure 9: Adaptive Management Staircase for Tidal Habitat Restoration

The SBSPR is a long term project with a 50 year horizon. Phase 1 of the project entailed initial actions which would be implemented by the project management team or project managers (PMT hereafter,

[18] The California State Coastal Conservancy is "a state agency that uses entrepreneurial techniques to purchase, protect, restore, and enhance coastal resources, and to provide access to the shore" (http://scc.ca.gov/about/).

see Fig. 4 for PMT members) as the first part of the 50-year program. Figure 9 on shows the expected development of the project in terms of phases (SBSPR Final EIR/EIS, 2007, Appendix D, p.8). The table below (found in SBSPR Final EIR/EIS, 2007, Appendix D, p.3-4) presents the project objectives (as mentioned before, the project's objectives were agreed upon the project managers, scientists, stakeholders and regulators/policymakers):

Table 10: South Bay Salt Pond Restoration Project Objectives

Objective 1. Create, restore, or enhance habitats of sufficient size, function, and appropriate structure to: A. Promote restoration of native special-status plants and animals that depend on South San Francisco Bay habitat for all or part of their life cycles. B. Maintain current migratory bird species that utilize existing salt ponds and associated structures such as levees. C. Support increased abundance and diversity of native species in various South San Francisco Bay aquatic and terrestrial ecosystem components, including plants, invertebrates, fish, mammals, birds, reptiles and amphibians.
Objective 2. Maintain or improve existing levels of flood protection in the South Bay area.
Objective 3. Provide public access opportunities compatible with wildlife and habitat goals.
Objective 4. Protect or improve existing levels of water and sediment quality in the South Bay and take into account ecological risks caused by restoration.
Objective 5. Implement design and management measures to maintain or improve current levels of vector management, control predation on special status species and manage the spread of non-native invasive species.
Objective 6. Protect the services provided by existing infrastructure (e.g. power lines).

Similarly to the legal obligation of European projects to conduct a research before their official start with regard to potential effects, the SBSPR project is subject to both the State law of California Environmental Quality Act (CEQA), and the federal law of National Environmental Protection Act (NEPA). Both these laws require the assessment of projects for their potential impacts on the environment.

In that respect, the land owning agency of USFWS which was (and still is) the leading agency under the NEPA (as a federal agency) and the CDFG[19] (as a state agency) which was the leading agency under the CEQA, partnering with the SCC, US Army Corps of Engineers (ACOE), Santa Clara Valley Water District (SCVWD), and the Alameda County Flood Control and Water Conservation District (ACFCWCD) prepared an Environmental Impact Statement/Environmental Impact Report (EIS/EIR) for the satisfaction of the two laws. This overarching document entailed the analysis and evaluation of the potential environmental impacts of the proposed SBSPR project. It was submitted to the public and the relevant regulatory agencies for review and adjustments were made before the EIS/EIR for the SBSPR project was finalized (SBSP Final EIR/EIS, 2007).

As mentioned before, the SBSPR project will be implemented in phases over the decades to come. Currently, the first phase of the project's implementation is being finalized (Valoppi, 2014). In order for the PMT to be able to keep track of and account for the various scientific and social uncertainties with regard to achieving the project objectives, the PMT had to figure out a way to learn, be proactive and adapt appropriately from phase to phase. The overarching document that encompasses and reflects this rationale is the Adaptive Management Plan (AMP hereafter). Monitoring is a crucial part of the AMP (along with the applied studies) and it will be presented after the overall structure of the SBSPR project is described, for the sake of clarity.

[19] The California Department of Fish and Game (CDFG) is renamed as California Department of Fish and Wildlife (CDFW). This state department will be hereafter referred to by its current name - CDFW.

5.4 The organizational structure of the SBSPR project

The diagram below presents the organizational structure of the main groups of actors involved in the SBSPR project, in order for the reader to be able to visualize the overall actors' hierarchy and locate where the monitoring lies within this structure.

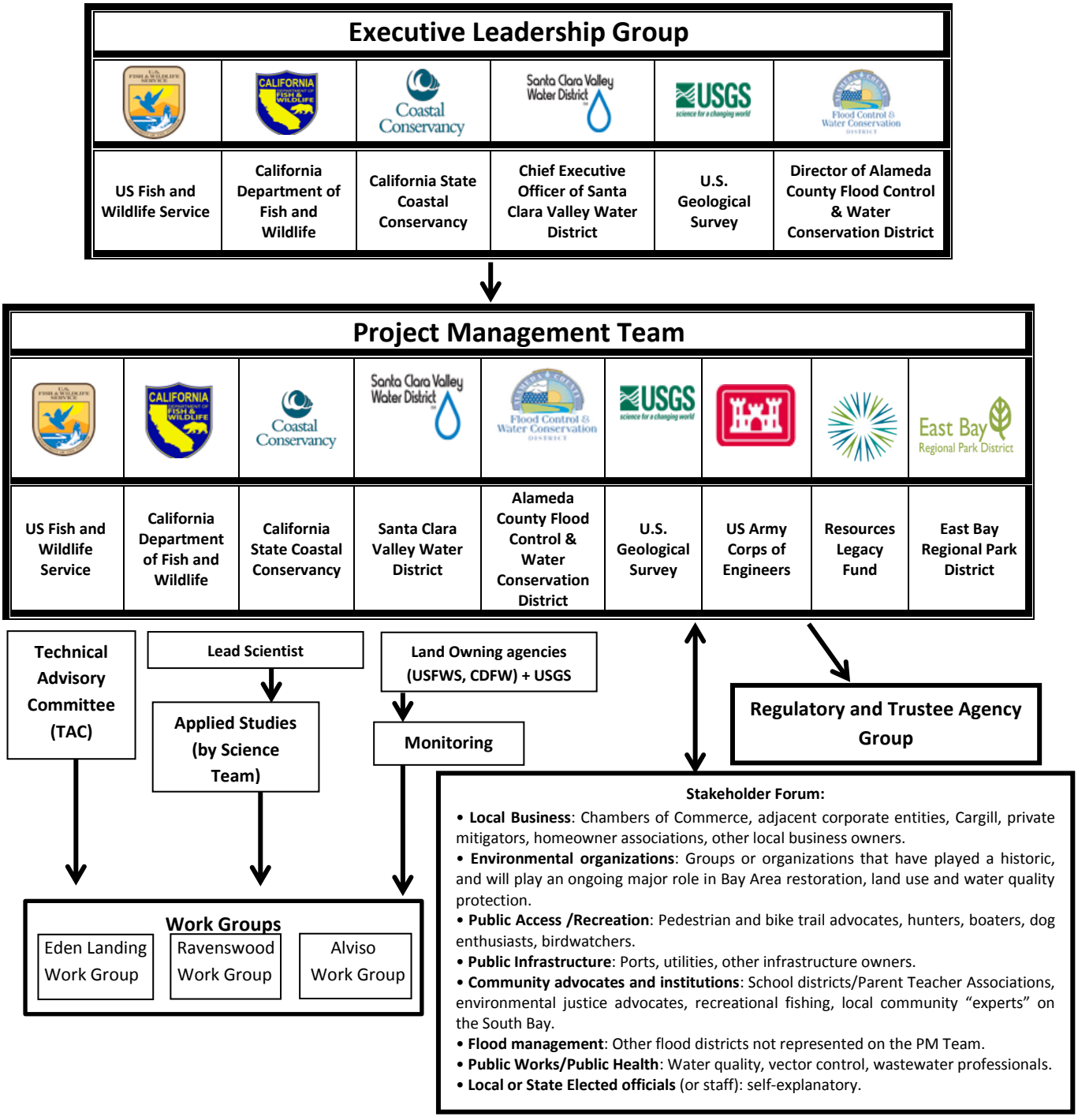

Figure 10: SBSPR project actors' structure

According to the diagram in the previous page the general organizational structure of the SBSPR project starts on the top with the Executive Leadership Group followed by the PMT which is

responsible for project decision-making and taking action on those decisions. A member of the PMT supervises the Science Program (the Lead Scientist, currently Laura Valoppi). The Science Program produces data through the applied studies and the monitoring program. The Stakeholder Forum and the Local Working Groups provide perspectives from the public and refine scientific and managerial deliberations, and finally the Regulatory and Trustee group consists of staff of the various regulatory agencies with permitting authority for the SBSPR project (Center for Collaborative Policy, 2003a).

The interplay and interconnections among the various actors formulate, steer and affect the arrangements made around the monitoring part of the SBSPR project. The structure of the hierarchy and interrelations was given in order for the reader to have in mind where the actors are in the 'hierarchy' and with which other groups they interact. The next section will delve into the monitoring program of the SBSPR project in order to explain and describe how it is organized and which actors and/or agencies are involved.

5.5 The monitoring program of the SBSPR project

For the sake of clarity and precision, a zoom-in diagram is presented below, referring to the applied studies and monitoring part of the Science program.

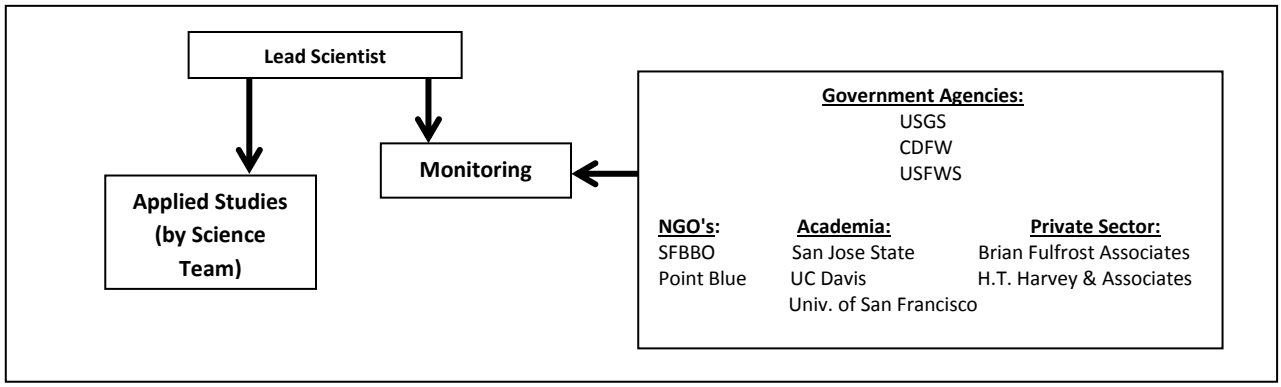

Figure 11: SBSPR applied studies structure and agencies performing monitoring

In the beginning of the project, during the planning phase, there was a call for proposals arranged by the PMT with regard to what kind of scientific studies the project needed to conduct in order to address the major challenges, questions and objectives of the project. Then, the PMT would decide what monitoring, applied studies, and modeling to fund depending on the necessity and comprehensiveness of the proposal submitted by the independent researchers. Monitoring began in 2003 and was assigned to USGS; monitoring in the early days ensured that baseline conditions and data were collected for all 54 ponds (and the related sloughs). That baseline monitoring aimed at giving a general picture of the condition of the Bay before and after the ISP. The initial monitoring program entailed not only baseline information for the ponds but also compliance monitoring processes phases (SBSPR Final EIR/EIS, 2007, Appendix D).

The researchers whose proposals were funded by the PMT would constitute the Science team of the project to this day (although there were changes from time to time within the Science Team). The Science team is responsible for conducting the scientific research for the project as well as for the collection, analysis and interpretation of the respective monitoring data. Then, the Lead Scientist would contemplate on the results of the studies and monitoring, prioritize further monitoring and research, and provide the PMT with recommendations for further actions with regard to current

project phases as well as the planning of next ones. As presented in the diagram, monitoring is being funded and organized mainly by the three Government agencies of USGS, CDFW, and USFWS. It is actually carried out (conducted) by the Science Team but monitoring processes have also been assigned to NGOs, Universities and private sector enterprises. There are various aspects that need to be monitored in order to keep track and comprehensively assess the project's progress towards its initial objectives. The general categories of the aspects monitored are: public access, public health, flood control, and habitat (species abundance, sediments etc.) (SBSPR Final EIR/EIS, 2007, Appendix D).

This chapter continues with the analysis of the case based on the explanatory variables (see scoring in table 5). More specifically the 'sufficiency' of the monitoring arrangements of this case (in terms of the degree to which they facilitate the adaptive implementation of the project) will be assessed based on the six explanatory variables. After this assessment, there will be an evaluation of the whole monitoring program in terms of the degree of monitoring effectiveness, based on the effectiveness criteria scoring presented in table 3 of the methodology chapter.

5.6 Assessment of the monitoring program based on the effectiveness criteria

At this point the overall effectiveness of the monitoring arrangements will be assessed by using the help of the four effectiveness criteria.

Criterion 1: Shared Vision

The first criterion for effectiveness indicates the need for the groups of the project managers, stakeholders and scientists of a project to form a shared vision with regard to what the project needs to monitor. In the case of the SBSPR project public and stakeholder input was evident from the beginning of the project i.e. the planning phase. As Burns (2014) and Selkirk (2014) specifically argue, the PMT of the SBSPR went to great lengths to seek and obtain stakeholder and public comment on the plans of the project in order to ensure that the major questions that the project would address would also reflect issues of concern for the stakeholders and the public. Bourgeois (2014) mention that although there are diverging opinions on the degree to which certain areas should be put through the restoration process, the project has managed to gain a considerable amount of support in all 3 project complexes. That achievement relates to the fact that the inclusion and participation of the stakeholders and the public are evident already from the project's planning phase. There are consistent biannual meetings where stakeholders and the general public are invited. Workshops are also held in all three project areas, where monitoring is addressed as well, and knowledge from expert members of the public is obtained. Valoppi (2014) and Bourgeois (2014) also describe the internal interactions among the scientists and project managers which are regular and address all the managerial or scientific issues arising. Due to the aforementioned facts this research supports that there are *effective* monitoring arrangements that facilitate the creation of a shared vision among the stakeholders, project managers and scientists with regard to the project's objectives of the SBSPR project.

Criterion 2: Awareness of the monitoring needs by policymakers

The second criterion illustrates the degree to which the monitoring needs of the SBSPR project are known by policymakers. The policymakers for the SBSPR project are the either federal or state regulatory agencies that issue permits and instruct legal requirements that the project has to follow.

The policymakers are aware of the monitoring needs of the SPSPR project, meaning that there are arrangements in place fulfilling the second criterion. The monitoring needs and results are constantly communicated to the policymakers, from whom feedback is sought on for example further action (Bourgeois, 2014; Valoppi, 2014; Selkirk, 2014). There is regular interaction between the project and the policymakers, through various communication venues (e.g. emails, phone calls, newsletter, and the annual official meetings). The facts mentioned are considered to ensure policymakers' awareness and visibility of the monitoring needs of the SBSPR project. Based on scoring table 3 in Chapter 3 the score for the arrangements of the SBPR project relating to the second effectiveness criterion are *effective*.

Criterion 3: Willingness of policymakers to act upon the monitoring needs

The third criterion illustrates the degree to which the policymakers are willing to act upon the monitoring needs of the SBSPR project. There are three parameters that the theory has indicated to facilitate the fulfilment of the third criterion. Firstly, there are constant communications with the policymakers on the monitoring results (through phone calls, newsletters) which ensure that the monitoring needs of the project are visible to the policymakers. The stakeholders of the project share a common vision with regard to the monitoring needs of the project; that implies policymakers' willingness to act upon the results is increased. However, the policymakers are not always willing to address every emerging need because there is not enough funding to do support such an action. As mentioned before, the project also depends on certain regulatory agencies to provide (part of) the funding for additional monitoring activities. Some of those agencies face serious financial constraints, therefore being unable to weigh in and assist the project with funding to satisfy every emerging need (Bourgeois, 2014). The fact that the regulatory agencies face financial constraints which reduces their willingness to act on the needs, does not relate to the effectiveness the arrangements. The monitoring arrangements of the SBSPR are considered *effective* for the fulfilment of the third effectiveness criterion.

Criterion 4: Adaptive capacity of the monitoring program

The fourth criterion illustrates the level of adaptive capacity of the SBSPR project's monitoring program in light of new monitoring needs and/or new or updated legal requirements. The arrangements of the SBSPR project for the fourth criterion are *moderately effective*. That means that new monitoring needs are not always addressed and incorporated in an efficient way and timely manner in the monitoring program of the SBSPR. That relates to the fact that although the project has laid out the roles of the various parties involved in the overall organizational structure of the project, the responsibilities about monitoring are still not appropriately appointed, therefore there is sometimes confusion which does not allow for efficient and timely integration of needs. This confusion relates to jurisdictional overlaps among certain State and Federal agencies involved in the project. In addition, the adaptive capacity of the program to integrate new needs is also impaired due to the difficulty in obtaining the necessary funding for emerging monitoring needs (Valoppi, 2014; Bourgeois, 2014; Selkirk, 2014; Burns, 2014).

The next section continues by presenting the assessment of the monitoring arrangements of the SBSPR project based on the degree to which they satisfied the variables explaining monitoring effectiveness.

5.7 Degree of fulfillment of monitoring functions – SBSPR

This section includes a reflection on the degree to which the monitoring arrangements of the SBSPR project are believed to facilitate the fulfilment of the monitoring functions identified by the theory of this research. Firstly, the monitoring arrangements of this project are considered to facilitate the learning function. Learning processes with regard to monitoring take place among the scientists working on the project, the project managers, the policymakers and the stakeholders. All the aforementioned groups have opportunities to interact with one another and exchange knowledge and experiences during the annual meetings and regional workshops. In addition, there are also meetings among the various stakeholders themselves where the various people or groups of people being affected can exchange among each other useful deliberations and ideas on the course of the project and on the degree to which the various stakeholder interests are addressed. The achievement of the learning function is largely related with the fact that the arrangements score as effective in terms of creation of a shared vision among project managers, scientists and stakeholders as well as the creation of awareness among policymakers (about the monitoring needs).

The SBSPR monitoring arrangements seem to facilitate the evaluation function to a sufficient degree. There are indeed arrangements in place facilitating the evaluation of the knowledge gained by monitoring and on the manner monitoring processes are carried out among the parties involved. Moreover, there are arrangements that promote and enable the evaluation of the extent to which the project achieves consideration of stakeholders' interests and concerns. The achievement of this function is largely connected to the fact that the arrangements score as effective in certain related criteria. More specifically, the SBSPR monitoring arrangements score as effective in terms of the creation of a shared vision, important for the evaluation function, as it implies that the project activities have gone through evaluation of the three groups of project managers, scientists, and stakeholders and they have reached a shared vision. Furthermore, the project's arrangements facilitate evaluation processes including policymakers (the arrangements score as effective in terms of creating awareness among policymakers). However, the arrangements score as moderately effective in terms of ensuring adaptive capacity of the project; this reduces the degree to which the evaluation function is achieved.

The monitoring function of steering appears to be facilitated by the monitoring arrangements of the SBSPR project. The project has achieved making arrangements with regard to monitoring that facilitate its function as a steering mechanism. Through constant communications and consistent feed of important monitoring updates and potentially indication of additional needs, the SBSPR has managed to set up a robust link between policymaking and its monitoring program. The project translates the monitoring results, and makes sure that the key points are evident to policymakers, avoiding confusing them with crude numbers. This allows for and facilitates the use and consideration of these data for future policymaking (by the regulatory agencies for example). Based on the aforementioned, the arrangements of the SBSPR project are effective in creating of awareness among policymakers, and in enhancing their willingness to act on the results.

An additional function, not identified in the theory, but revealed by the analysis of the SBSPR case, is the one designating the importance of monitoring to function as a mechanism of proof to the stakeholders, that the project has taken active consideration of their concerns and interests. Therefore, this process relies heavily on the precondition that the broad spectrum of stakes has been identified. In other words, it is substantial to facilitate and promote monitoring as a mechanism

proving that the project is interested in accounting for the various stakes and has actively taken action on these stakes through its monitoring program. From the interviewees' responses it appears that this function is achieved to a moderate extent in the case of the SBSPR.

The next section presents the assessment of the monitoring arrangements based on the explanatory variables, according to the table 5 (Chapter 3).

5.8 Monitoring arrangements' assessment based on explanatory variables

a) Integration of stakeholders' interests and concerns in the monitoring

The explanatory variable addresses the degree to which stakeholders' interests were integrated into the monitoring program of the SBSPR project. Firstly, and in order to adequately assess the efforts to integrate stakeholders' interests and concerns in the monitoring, there will be an explanation of their role already from the planning phase of the project, and how it evolved to this day. For the sake of clarity it is important to describe the overall stakeholder participation in the project in order to explain their role in the monitoring.

It was clear and straightforward from the beginning of the planning of the SBSPR project that there would be a serious effort to include any group of people that might have a stake and/or interest in the project (Selkirk, 2014). In order to achieve an inclusive and integrative approach the project partners assigned the Center for Collaborative Policy (a joint program of California State University Sacramento and the McGeorge School of Law) with the task to conduct an extensive stakeholder assessment for the SBSPR project. This assessment aspired to not only identify as comprehensively as possible the broad spectrum of stakeholders, but also to give an overarching overview of their concerns and interests during the planning of the SBSPR project. The assessment provided the project partners with recommendations with regard to the core forms that public participation should take within the SBSPR project; these recommendations were adopted by the project partners and set in motion.

Firstly, a Stakeholder Forum was launched consisting of various types of stakeholders (see Figure 10) which would meet regularly and discuss concerns, interests and updates of the project. Secondly, Stakeholder Forum Work Groups were organized for each one of the three project areas (Eden Landing, Alviso, Ravenswood), where knowledgeable stakeholders were invited to provide input to scientific deliberations (Selkirk, 2014). Finally, general public participation and outreach activities were arranged. An additional document was produced – the Public Outreach Strategy - which described in detail the ways in which the general public should be involved and how media outreach should be conducted (Center for Collaborative Policy, 2003b). All these types of public participation in the SBSPR project continue to this day.

All the interviewees mentioned that there was persistent and rigorous effort to include and give a voice to any potential group with an interest or a stake in the SBSPR project (Selkirk, 2014; Bourgeois, 2014; Valoppi, 2014; Burns, 2014). However, they added that there might be some stakeholder groups that the PMT has not yet considered. Selkirk (2014) mentions that the local poor communities of the South Bay that are most vulnerable to flooding as well as the recreation group of bicyclists were not so well represented. In addition, there could have been more formal input by the various hunting groups in the Bay area. The executive project manager John Bourgeois, who is the main responsible person to make efforts to bring various people to the table, argued that certain

major companies' headquarters such as Google, Facebook and Yahoo are literally adjacent to the project area. This implies that there is the danger of flooding for the headquarters' buildings, due to sea level rise. Therefore, these companies are directly affected by the SBSPR project. Bourgeois (2014) mentions that although it took some time and effort to get them involved, the project has attracted their attention and they are starting now to become engaged.

The stakeholders did not participate in the design of the monitoring plan per se (Selkirk, 2014; Bourgeois, 2014; Valoppi, 2014). In other words, they did not participate in the various monitoring processes such as data collection, data analysis etc. However, especially in the planning phase, there was a lot of public and stakeholder input that guided the identification of the major questions and challenges that had to be addressed by the project; those questions steered to a great extent the monitoring needs of the project. In that sense, the stakeholders participated indirectly in the identification of the monitoring needs.

The integration of stakeholders' interests and concerns in the monitoring of the SBSPR project is considered *sufficient* (see the scoring in table 5, Chapter 3). This score is appointed as during the planning phase of the project, when also the monitoring needs were being identified, there was a lot public and stakeholder input, therefore the interests and concerns of the broad spectrum of stakeholders were identified by the project. Stakeholders and the public were specifically asked their opinion about the major issues the project had to address (Bourgeois, 2014); those issues were addressed explicitly in the monitoring program as well. By stating their opinion about what they regard as important issues that needs to be addressed by the overall project, they influenced the major questions addressed that were also reflected in the aspects that were going to be monitored.

b) Communication and cooperation on the monitoring needs and results

This explanatory variable addresses the manner in which the groups are communicating and cooperating on the monitoring results. In other words, the variable examines whether there is sufficient communication and cooperation on the monitoring results.

The groups involved in the monitoring in this case are the PMT, as they have the authority to pursue action on the monitoring results, the researchers[20] producing the monitoring results and the policymakers who can support additional monitoring financially or have the authority to issue permits and legal requirements affecting the monitoring program of the project. In the SBSPR project there are various communication and cooperation channels on the monitoring results. The researchers collecting monitoring data are communicating with the PMT through the Lead Scientist of the Science and Monitoring program of the project, Laura Valoppi, who is also a member of the PMT. Laura Valoppi functions also as a liaison between the PMT and the researchers bringing important scientific updates (including monitoring updates) to the meetings of the PMT that take place once a month. Despite the fact that the PMT consists of a certain number of scientists, Laura Valoppi is also responsible to translate and pass on important issues coming up relating to monitoring (Valoppi, 2014; Bourgeois, 2014; Selkirk, 2014). In this way the PMT is constantly informed about the monitoring needs. The formal communication and cooperation channel among the project managers and the researchers is the annual meeting among the PMT and the Science

[20]The researchers performing the monitoring project belong to various agencies, institutes and organizations: Government Agencies: USGS, USFWS, CDFW, NGO's: SFBBO, Point Blue, Academia: San Jose State University, UC Davis, University of San Francisco, Private Sector: Brian Fulfrost Associates and H.T. Harvey & Associates.

Team[21]. Summaries of the updates on science and monitoring are communicated also through emails and newsletters to the project managers but also to the policymakers.

The communication and cooperation with the policymakers on the monitoring results is mainly organized and conducted by the executive project manager of the project, John Bourgeois. There is a lot of informal, regular communication among the regulators/policymakers and the PMT through emails and phone calls; the policymakers are well-informed, in a timely manner about the development of the project and the monitoring results and needs. This does not exclude any potential negative implications relating to the project according to Bourgeois (2014). Bourgeois (2014) argues that this was the intention of the PMT from the beginning of the project – honest and open communications with the policymakers. In this way, the project has achieved 'leniency' and understanding also about its monitoring needs. The formal communication and cooperation channel among the project managers and the policymakers is the annual meeting among the PMT and the various regulatory/policymaking agencies. It is important to mention at this point that the researchers are represented during those meetings through Laura Valoppi, who is also a member of the PMT (Valoppi, 2014).

The communication and cooperation on the monitoring results and needs among the groups involved in the monitoring program of the SBSPR project is considered *sufficient*. Producers of the data cooperate and communicate in a consistent way on the monitoring results with the users of the data i.e. the project managers who are responsible for project-level decisionmaking and the policymakers who have permitting and policymaking authority.

c) Integration of multiple types of knowledge

This explanatory variable addresses the degree to which the project integrated multiple types of knowledge in its monitoring program. These types of knowledge refer to practical knowledge as well as knowledge on a variety of disciplines relevant to project aspects that are monitored. Practical knowledge might include local environmental groups' practical expertise, voluntary monitoring efforts or plain observations; knowledge on various fields might provide significant input on ecological aspects, biological, spatial planning, etc.

As far as the practical knowledge input is concerned, Bourgeois (2014) argues that there were a lot of efforts to obtain knowledge from various sources e.g. stakeholders with such knowledge, by the PMT themselves. In addition, luckily in the Bay area, there are very robust environmental communities, such as the birdwatching community, that were willing to provide their knowledge on the natural habitat of the area. A lot of anecdotal observations by residents and environmental groups were brought to the table during the planning phase and were utilized by the project also for the development of the monitoring program; for example, there also was voluntary monitoring of harbor seals. This kind of practical knowledge input has declined after the four-year planning phase of the project (Selkirk, 2014). However, during the community workshops arranged in all three project areas and the annual stakeholder meetings, everyone can present and share their knowledge (they are open to the public). There are specific all-day workshops on the monitoring part attended by a wide variety of people i.e. members of the Stakeholder Forum and the general public, who also

[21]The Science Team that meets annually with the project managers consists of various local scientists who are hired to conduct research and monitoring; the researchers from the NGO's, academia and the private sector collecting monitoring data, do not participate in those meetings.

participated in the designing of scenarios of the restoration. Therefore, there are opportunities for laypeople to actually interact with scientists and bring their knowledge to the table (Selkirk, 2014).

Efforts for integration of knowledge from various disciplines were an integral part of the SBSPR project already from the planning phase. When the project was initiated, the PMT convened a 'Science Team' of local scientists and experts, as a well as a 'National Science Panel' consisting of scientists from all over the US and international scientists on coastal management from Australia Selkirk (2014). These teams were responsible to provide a broad perspective and guidance for the planning; they brought knowledge and foundational expertise to the project on a wide variety of disciplines such as coastal management, public access, ecology, biology, spatial planning, recreational activities etc. Once the 50-year vision (see section 5.3) of the project was established, these groups were disbanded (Bourgeois, 2014).

When the project started being implemented, some of the people who previously belonged to the Science Team were hired by the PMT to conduct the applied studies for the project – these people are now the 'Science Team' of the SBSPR project. Subsequently, a potential conflict of interests arose; during the planning phase the 'Science Team' and the 'National Science Panel' were not funded by the project, therefore, they could provide impartial and independent guidance. This conflict of interests was avoided by the PMT; another team was convened, that was not funded by the project. This team is called the Technical Advisory Committee (TAC) and consists of independent experts and scientists. In the first years of implementation they provided independent oversight on the aforementioned variety of disciplines. However, in the recent years of the project, the TAC is only occasionally used in an official capacity. TAC members are often included in working groups such as the Pond Management, Mercury and Mudflat groups. The TAC and the Stakeholder Forum are used as independent checks and balances to the PMT and the Science Team activities (Bourgeois, 2014).

The integration of multiple types of knowledge in the SBSPR project is considered *sufficient*. Firstly, there was opportunity for stakeholder input both in the planning phase which continues to this day. Efforts by the PMT to obtain practical knowledge aimed at providing the project with local expertise that probably could not have been obtained otherwise (or it might have been too expensive to obtain). This input was taken into account by the project and utilized in various occasions. Secondly, there was an intensive effort to include and make use of knowledge on numerous fields and disciplines (by hiring a wide array of experts in the planning phase and still having a wide range of experts in the Science Team or as consultants). This effort aimed at providing the project with a comprehensive list of aspects that required attention and research; extensive knowledge and information on various disciplines could assist in problem solving for the project.

d) Feedback mechanisms on knowledge and monitoring results

This explanatory variable addresses the degree to and manner in which the actors involved in the monitoring of the SBSPR project were receiving and giving feedback to one another, in other words, the creation and maintenance of feedback mechanisms on the knowledge gained by the monitoring and on the way monitoring processes are taking place.

Previously, the various forms of communications and cooperation were described. For the sake of efficiency, they will not be mentioned again, but the 'content' of those communications needs to be explained. In particular, firstly, there is feedback among the PMT and the scientific researchers; the

scientists' concerns and updates are passed on by the Lead Scientist to the project managers monthly (and through mails, summaries etc.) as a feedback from the science part of the project to the management part of the project (Laura Valoppi, 2014). The Lead Scientist also passes on the managerial concerns and news to the scientists through their internal communications. The official venue for exchange of feedback is the annual meetings between the PMT and the researchers. There is feedback among the PMT and the regulators/policymakers. Again, there is constant informal feedback exchanged between John Bourgeois (executive project manager, who is scientist himself (MSc in biology and worked more than ten years as restoration ecologist) and the regulatory agencies through mails, phone calls etc. John Bourgeois, in his communications with the policymakers keeps them informed about the development of the project, as well as extracts their opinions and ideas with regard to the project's progress. In addition, he ensures that the policymakers are aware of the main upcoming plans of the project; therefore they can deliberate on those plans (Bourgeois, 2014). This two-way communication ensures feedback exchange. The official venue for exchange of feedback is the annual PMT-Regulatory agencies meetings.

All in all, the groups involved in the monitoring of the SBSPR project have the opportunity to receive as well as give feedback on the monitoring results and processes to each other. The PMT and the scientists working on the applied studies of the project constantly try to incorporate and address in monitoring major issues that come up depending on the necessity, urgency, and the availability of financial resources. Part of those issues might entail emerging monitoring needs. The creation and maintenance of feedback mechanisms among the parties involved in monitoring of the SBSPR project is considered *sufficient*.

e) Strength of the link between monitoring results and policymaking

This explanatory variable addresses the strength of the link between the monitoring results and needs of the SBSPR project to the (regulatory) policymaking. More specifically, the aim of this variable is to illustrate of the quality of that link, in order to achieve better understanding and acknowledgement of the monitoring needs by the policymakers (and therefore e.g. leniency, when necessary, with regard to legal compliance, extension of deadlines for compliance etc.). The regulators/policymakers who are relevant to the project (and to similar projects such as the SBSPR project) are people making decisions on environmental regulations and permits with which the project is obliged to comply.

One of the main initial concerns of the project partners, and the PMT a little later, was to ensure that the project fulfills the legal requirements already from the planning phase. One important example is the compliance monitoring set up in the first year of the project's planning. Similarly to the invitation of the stakeholders to discuss with the project managers and various scientists, the policymakers were also invited to contemplate on the major challenges and issues of project. The policymakers and regulators had the opportunity to express their opinions and inform the project managers about what they should expect in terms of legal requirements already from the beginning. These open and honest discussions about what the project would face in terms of legal compliance but also what the project needs to address through monitoring continue to this day. John Bourgeois is in constant communication with all the regulatory agencies, with which he achieved to foster honest and cooperative relations (Valoppi, 2014; Bourgeois, 2014; Selkirk, 2014).

Apart from openness of the communications among the project and the policymakers, it is important to mention that the feedback which is being exchanged is meaningful also for an

important reason. The results are not crudely passed on to the policymakers as lists of numerous natural aspects being monitored; instead, the results are 'translated' to them if necessary. In other words, the meaning of the results is simplified, making sure that issues of urgency and significance are pointed out, for the sake of efficiency and clarity (Valoppi, 2014; Bourgeois, 2014). Furthermore, the results are directly communicated to them, in a timely manner. These discussions are made mainly by John Bourgeois and Laura Valoppi through phone calls, emails, scientific updates and summaries and during the annual meetings between the policymakers and the PMT.

Based on the aspects mentioned above, the link between the monitoring results and the policymaking is *sufficient*. There is translation of the results when necessary in order for the policymakers to be able to interpret and process them more easily. In addition, the project has ensured openness and disclosure on the effects of the project activities within their communications with the policymakers.

f) Flexibility of the monitoring program

This is the last explanatory variable that will assist in the evaluation of the 'sufficiency' of the monitoring arrangements of this case, in terms of the degree to which they facilitate the adaptive implementation of the project). The flexibility of the program, for the purposes of this research, refers to the degree to which the roles and responsibilities of the people involved in the monitoring are clearly laid out in e.g. the monitoring plan. In addition, the last variable reflects the degree to which the monitoring program has ensured the existence of efficient 'funding searching' and acquisition mechanisms.

An important arrangement that requires attention and enhances the monitoring program's flexibility is the degree to which each party involved in monitoring has a clear picture of their role and responsibility. It is not possible to foresee all the changes and new conditions that may appear during the course of a project. However, depending on the monitoring needs of the project the roles and responsibilities should be stipulated accordingly. For sure, in the beginning of a project there are, to a certain degree, different monitoring needs than during later phases of the project. The roles and responsibilities of the various internal groups of the project such as the roles of the PMT, the scientific researchers, are clearly stipulated in the AMP (see SBSPR Final EIR/EIS, 2007, Appendix D, p.49). For example, each participating agency on the PMT has signed a Memorandum of Understanding at a certain point during their involvement with the project with regard to their overall responsibilities in the SBSPR project.

The roles of the various parties for certain monitoring processes were laid out in the beginning of the project, along with projections for the future regarding deadlines, management triggers, potential management actions etc. Selkirk (2014) argues that there was extraordinary detail with regard to various aspects of monitoring in the early days of the project. However, arrangements for clear and efficient appointment of roles and responsibilities in light of new monitoring needs (and/or conditions) seem not to be in place. The appointment of roles, i.e. the assignment of monitoring tasks to the monitoring partners is being done by the PMT (it is within their spectrum of responsibilities). However, appointing monitoring tasks to the scientific partners of the project is not the problem; monitoring partners who are paid by the project are able to address certain needs which emerge. There are however other or additional needs that have to be covered by other agencies (such as regulatory agencies or agencies belonging to the PMT) that do not obtain enough available financial resources to do so.

The responsibility of finding funding for additional monitoring lies with the PMT. Most interviews revealed that there is the need to engage in more efficient and effective funding searching efforts to support the additional monitoring. According to all the interviewees (two of them are members of the PMT) the project struggles with the search and acquisition of funding for further monitoring (Selkirk, 2014; Bourgeois, 2014; Valoppi, 2014; Burns, 2014). Selkirk (2014) argues that: "It is historically proven that people love to pay for stuff happening on the ground, no one likes to pay to monitor what happened." Therefore, there is this whole struggle by mainly the executive project manager and the Lead Scientist to approach the agencies to fund further monitoring. Burns (2014) suggests: "if the PMT's roles were more clearly assigned (with regard to the monitoring), and spread across the involved parties then, that would probably be positive for the project in the sense that more people would engage in finding the necessary funding."

To wrap up, the arrangements laying out the roles and responsibilities in light of new monitoring needs are problematic in the sense that not all the parties can contribute the necessary funding for the monitoring needs. In addition, the responsibility for the search of funding lies with the PMT but it is largely concentrated on the efforts of two people. The arrangements for the appointment of roles and responsibilities to the project managers (i.e. at the project decisionmaking level) should be revisited and redefined in more efficient and effective ones (e.g. disseminate the roles among the PMT). Therefore, the flexibility of the monitoring program of the SBSPR project is scored as '*moderately sufficient*'. The table below presents the degree to which the six variables are satisfied by the monitoring arrangements the SBSPR project:

Table 11: Scoring of the explanatory variables for the SBSPR project

Explanatory Variable	Score
Stakeholders' interests and concerns integration	Sufficient
Integration of multiple types of knowledge	Sufficient
Communication and cooperation on the monitoring needs and results	Sufficient
Strength of the link between monitoring results and policymaking	Sufficient
Feedback mechanisms on knowledge and monitoring results	Sufficient
Flexibility of the monitoring program	Moderately Sufficient

5.9 Conclusions

The final section of this chapter will entail a reflection on the degree to which the monitoring arrangements of the SBSPR project are believed to facilitate monitoring effectiveness. In addition, there will also be a reflection on the degree to which the explanatory variables seem to influence monitoring effectiveness in the case of the SBSPR project.

5.9.1 Effectiveness of the monitoring arrangements of the SBSPR project

The arrangements of the SBSPR restoration have been assessed earlier in the chapter in terms of the degree to which the four criteria defined by this research are fulfilled. This section recaps the findings of this research with regard to the monitoring effectiveness of the SBSPR project.

Firstly, in the SBSPR case, there are arrangements in place that have facilitated the creation of a common vision of the project's objectives of the SBSPR project. Stakeholders had the opportunity to express their concerns in the planning phase and those were heard and integrated in the major

questions the project needed to address also through monitoring. The project goes to this day to great lengths to invite all types of stakeholders and extract their opinions and ideas about the project activities; this enhances their understanding of the efforts of the project to address their needs. Therefore, their affiliation and interest towards the project is maintained.

The project has also achieved awareness of its monitoring needs among the regulators/policymakers. By engaging in constant and open communications the policymakers know the effects of the project and recognize to a sufficient degree its contribution to the ecosystem of the Bay. The aforementioned facts seem to also increase the willingness of the policymakers to take action on the monitoring needs of the project by e.g. issuing a certain permit or altering an existing one, as well as by providing additional funding. However, the willingness of the policymakers to act upon the results is largely dependent on the availability of financial resources, which are seemingly scarce, according to the respondents.

Finally, the monitoring arrangements of the SBSPR do not fulfill the fourth criterion to the full extent. The project's arrangements do not facilitate the incorporation of new needs because the responsibility of 'funding searching' is not appropriately appointed. However, there are arrangements in place which facilitate the incorporation of new and/or updated legal requirements. This achievement relates with the fact that the project is in constant interaction with the policymakers. In that way, the project is able to stay informed about upcoming permits early enough and to proactively engage in action towards their integration in the monitoring program.

The effectiveness of the monitoring arrangements for the creation of a shared vision (first criterion) explains to a great extent the fulfillment of the learning function in this case. The fact that the arrangements are effective in creating a common vision and awareness among policymakers, explains to a large degree why the learning function appears to be achieved. Similarly, the achievement of the evaluation function is moderate, although the arrangements succeed in creating a common vision and awareness among policymakers. The fact that the arrangements are moderately effective in terms of ensuring adaptive capacity results in moderate achievement of the evaluation function. Finally, the fact that the steering function is achieved to a sufficient degree is largely dependent on the circumstance that the arrangements are effective in creating awareness among policymakers and enhance their willingness to act upon the monitoring results. As mentioned in the respective section, the additional function identified is achieved to a moderate extent by the arrangements.

The next section presents the extent to which the explanatory variables influence monitoring effectiveness of the SBSPR monitoring program. That degree is partly formulated based on the interpretation of the author and the respective scores of the variables (based on the interviewees' responses).

5.9.2 Degree of influence of explanatory variables on monitoring effectiveness of the SBSPR monitoring

The aim of this section is to present the explanatory variables' estimated degree of influence on monitoring effectiveness in the SBSPR case. The first explanatory variable i.e. interests and concerns integration of the broad spectrum of stakeholders is considered to influence to a high degree monitoring effectiveness in the SBSPR case. All the respondents mentioned that it was important and an intention of the project to seek and extract public and stakeholder comment. The project had

the intention to create a common vision among project managers, scientists and stakeholders with regard to the objectives of the project. This intention is related on the one hand to the inclusive and participatory culture fostered within the project. On the other hand, the intention of the project to inform as well as be consulted by the stakeholders, also about monitoring (during workshops), is largely connected with the fact that the project tries to achieve receiving a parcel tax of certain stakeholders.

Before it was mentioned that the project is being consulted also by stakeholders; this happens mainly during the regional workshops (but also through the stakeholder meetings) in the three project areas, and more specifically the ones about monitoring, where people are contributing their knowledge to the project. This means that there are efforts to obtain multiple types of knowledge (as those types are defined by this research). The integration of multiple types of knowledge is an explanatory variable of high influence with regard to monitoring effectiveness for the SBSPR project; it also relates and is very connected to the formulation of a common vision that is crucial for the SBSPR project.

The variables of communication and cooperation and feedback exchange among the parties appear to influence monitoring effectiveness of the SPBSR arrangements strongly. They both significantly enhance the awareness of the policymakers regarding the monitoring needs and increase the possibility of the policymakers being willing to act upon them. Similarly, the stronger the link between the monitoring results is, by means of translation of the monitoring results and openness about what the results show, appears to assist in creating awareness of the needs to the policymakers as well as their willingness for action.

The last variable of flexibility is probably the most crucial for the case of SBSPR project, in the sense that the monitoring of the SBPSR is largely inflicted by 'malfunctioning' 'funding searching' mechanisms as well as with problematic appointment of the responsibility of the funding searching responsibility.

Below, table 12 summarizes the degrees of influence of the explanatory variables of this research for the SBSPR case. As also mentioned in chapter 4, the degrees of influence of each variable are the same for the related criteria as described in Chapter 2, Table 2. In table 12 below, certain additional variables are also ranked according to their degree of influence and they are explained in the next section.

Table 12: Degree of influence of the explanatory variables for the Sand Engine's monitoring arrangements

Explanatory variables	Degree of influence
1. Stakeholders' interests and concerns integration	High
2. Integration of multiple types of knowledge	High
3. Communication and cooperation on the monitoring needs and results	High
4. Feedback mechanisms on knowledge and monitoring results	High
5. Strength of the link between monitoring results and policymaking	High
6. Flexibility of the monitoring program	High

Additional explanatory variables	
7. Start of the monitoring	Medium
8. Visibility of consideration of stakeholders' concerns	High
9. Hurdles with legal requirements	High
10. Distinction of jurisdictions of the parties involved	High
11. Financial constraints of policymaking authorities	High

5.9.3 Additional explanatory variables

Apart from the explanatory variables that were analyzed in a previous section, the interviews revealed certain additional variables that appear to influence the fulfillment of the effectiveness criteria. One respondent stressed that the monitoring should have started earlier for certain aspects relating to the SBSPR project. That latency created difficulties in keeping track and understanding of changes and the evolution of those aspects during the course of the project. However, this variable is considered to be of a *medium* degree of influence in this case, as the other interviewees stressed it as of medium importance. Moreover, most respondents' answers designated the visibility of consideration of stakeholders' concerns in monitoring as very important. Therefore, this variable appears to have a *high* degree of influence on monitoring effectiveness. The SBPSR project has encountered certain hurdles with legal requirements that created difficulties in the monitoring program; the integration of those legal requirements in monitoring was complicated. That implies that the variable hurdles with legal requirement, has a *high* degree of influence. Another explanatory variable that was revealed during the interviews was the issue of jurisdictional overlaps among the agencies involved. There is a wide variety of agencies involved in the SBSPR project, which also participate in its monitoring program. On occasions, there are difficulties, for example in terms of funding, because a State authority involved in the monitoring might not be able to fund activities on federal land. The last variable identified through the interviews that appears to be of *high* influence is the one of financial constraints of regulatory agencies. As already mentioned, part of the monitoring activities is funded by regulatory agencies (agencies that have policymaking/permitting authority over the SBSPR project's activities). Financial constraints of those agencies appeared to be hindering the satisfaction of monitoring needs of the project on many occasions, according to the interviewees, thus having a high degree of influence on monitoring effectiveness.

The next chapter entails the comparison of the findings of the two cases' analysis. Its purpose chapter is to provide general design principles for monitoring arrangements that are believed to facilitate the adaptive implementation of BwN projects.

Chapter 6: Comparison of the ex-post cases and general design principles

The aim of this chapter is to reflect upon the degree to which the monitoring arrangements of the ex-post cases managed to fulfill the effectiveness criteria. In addition, there is also a reflection on the degree of influence of the explanatory variables with regard to the fulfillment of the effectiveness criteria. Next, there will be an analysis of to the degree to which the monitoring arrangements of the ex-post cases facilitate the fulfillment of the main monitoring functions in adaptive management contexts, introduced and explained in Chapter 2. In this way, the research can extract conclusions with regard to the importance of criteria that facilitate effectiveness as well as the degree of influence of the explanatory variables on monitoring effectiveness. The final sections of this chapter will provide an introduction in the ex-ante case of Marker Wadden, as well as an explanation of how the conclusions extracted (in the form of design principles), can provide lessons for the future design of monitoring arrangements for the Marker Wadden project.

6.1 Comparison of varying degrees of effectiveness of the two ex-post cases

The monitoring arrangements of the two ex-post cases were assessed based on four effectiveness criteria in the cases' analysis chapters. Based on the monitoring functions in adaptive management contexts of BwN projects the four criteria (see section 2.5.1) have to be met in order for monitoring effectiveness to be achieved. In order to address the varying degrees of effectiveness between the monitoring arrangements of the two ex-post cases, it is important to juxtapose their scores which reflect the degree to which they achieve monitoring effectiveness. The focus will be on the criteria in which the ex-post arrangements score differently, in order to explain the reasons of these discrepancies according to the respective findings/evidence. The table below shows the scores of both ex-post arrangements in the four effectiveness criteria.

Table 13: Monitoring effectiveness of the ex-post cases' arrangements

Criteria	Cases	
	Sand Engine	**South Bay Salt Pond Restoration**
1. Shared vision of the project's objectives	Moderately effective	Effective
2. Awareness of the monitoring needs by policymakers	Effective	Effective
3. Willingness of policymakers to act on the monitoring needs	Moderately Effective	Effective
4. Adaptive capacity of the monitoring in light of new needs and/or legal requirements	Moderately Effective	Moderately effective

In the case of the Sand Engine, the arrangements that would facilitate the creation of a shared vision of the project's objectives among the project managers, scientists and stakeholders are moderately effective, while the SBSPR project has ensured the creation of arrangements that facilitate a shared vision of the project's objectives. The SBSPR project has ensured the creation of stronger arrangements compared to the Sand Engine which actually represent efforts of (1) seeking stakeholder comment (i.e. opinion on the monitoring) as well as (2) obtaining and utilizing multiple types of knowledge input (e.g. through Stakeholder meetings, Science Symposia, workshops, see section 5.1). These efforts have facilitated the creation of a common perception of the project's objectives. For example, those efforts entail the arrangement of workshops, where stakeholders and the public can participate, and therefore maintaining affiliation with the project. In addition, they

'see' that their opinion and knowledge matters. Therefore, the creation of a shared vision of the project's objectives is facilitated. The extensive efforts to seek and obtain the opinion of the broad spectrum of stakeholders observed in the SBSPR project - also after the end of the planning phase - are not equally evident in the Sand Engine case. Indeed, in the beginning of the Sand Engine there were more efforts to inform and seek public and stakeholder comment on the project plans. After the end of the construction of the Sand Engine those efforts were significantly reduced. Currently, meetings with stakeholders, mainly technical ones (e.g. dredging companies), are held. Various meetings were arranged with other stakeholders, also non-technical, after the construction of the project i.e. 2011-2014, but not in a consistent way. However, de Wilde (2014) mentioned that the efforts for the enhancement of the affiliation of the project with the public and stakeholders and vice versa will start to be again more consistent. One example of those efforts being, is a meeting arranged in April 2014, among the RWS, the Province and stakeholders concerned with both recreational and swimmer safety issues.

The monitoring arrangements of the Sand Engine score *moderately effective* with regard to the third criterion. This score relates (1) to the degree of visibility of the monitoring needs to the policymakers, (2) but most importantly to the degree to which those needs are seen and acknowledged also by stakeholders (i.e. there is a shared vision of the project's objectives). Both cases entail arrangements that ensure visibility of the monitoring needs by the policymakers (though a variety of ways mentioned in the respective chapters 4 and 5), but only the SBSPR project has also ensured that the stakeholders share a common vision of the project's objectives, which boosts policymakers' willingness to act upon the results. Neither of the projects 'enjoys' willingness by the policymakers to act on every emerging need. That is related to financial constraints the RWS and the Province for the Sand Engine, and on financial constraints faced by the regulatory agencies for the SBSPR project. The monitoring arrangements of the SBSPR project are considered effective, as the unavailability of financial resources of policymakers is an external factor, outside the control of the project.

The ex-post cases' arrangements are *moderately effective* in terms of fulfilment of the fourth criterion i.e. ensuring adaptive capacity of the monitoring program. On the one hand, in the Sand Engine case, certain jurisdictional issues among the RWS and the Province of South Holland do not allow monitoring needs to be satisfied to the full extent. More specifically, one important aspect which is implications for and by the recreational use of the project area falls mainly under the authority of the Province. However, the monitoring for that aspect is still neither rigorous nor sufficiently addresses this main objective of the Sand Engine (recreation). On the other hand, the adaptive capacity of the monitoring program to new or updated legal requirements is ensured because the RWS (as a Ministerial branch) employs legal experts who communicate directly with the people working on the Sand Engine within RWS on the upcoming legal requirements. The fact that the requirements are known in good time, gives adequate time to the people working on the monitoring, to integrate the requirements in the monitoring. In the SBSPR case, the arrangements for the fulfilment of the fourth criterion are also *moderately effective*. On the one hand, new or updated legal requirements are known by the project early enough allowing for their proactive integration in the monitoring program. However, the arrangements are scored as moderately effective, because of only mediocrely allow for and facilitate the incorporation of new monitoring needs. This happens due to a mixture of reasons. Firstly, certain agencies of the PMT are facing financial constraints, therefore being unable to take over monitoring responsibilities. Secondly, the task of 'funding searching' is concentrated on two members of the PMT, the Executive Project

Manager and the Lead Scientist (Selkirk, 2014, Valoppi, 2014, Bourgeois, 2014). Seemingly, this situation is problematic, and as already suggested, the task of 'funding searching' should probably be more diffused among the PMT.

The following section entails a comparison of the degree of influence of the explanatory variables with regard to the fulfilment of the criteria. In other words, there will be a reflection on the extent to which the explanatory variables actually influence monitoring effectiveness.

6.2 Comparison of the degree of fulfillment of monitoring functions

This part of the paper entails a comparison of the degrees to which the monitoring functions seem to be fulfilled in the two ex-post cases.

Learning

The arrangements of the Sand Engine are believed to facilitate the learning function of its monitoring program to a medium degree. This conclusion is based on the fact that although learning processes occur among scientists, project managers and stakeholders, not all stakeholders interact in a consistent way with the project. This implies that arrangements ensuring learning from all stakeholders are not in place. The monitoring arrangements of the SBSPR project seem to have achieved the learning function of monitoring to a high degree. There are consistent meetings among the scientists working on the project, the project managers, and the policymakers, as well as with the stakeholders. It is important to mention here that the variety of stakeholders identified for the SBSPR are largely involved after 10 years of implementation, mainly due to the consistent and persistent effort of the PMT to keep them engaged and seek knowledge from them. In other words, the aforementioned groups in the SBSPR are able to interact with each other and learn from one another, to a greater extent than in the Sand Engine case.

Evaluation

The monitoring arrangements of Sand Engine do not appear to facilitate to a high degree the evaluation function. Although evaluation on the knowledge gained (by monitoring) and on the way monitoring process are conducted is taking place, evaluation on the degree to which the project takes consistent and responsive action to stakeholders' concerns is missing from monitoring. That is believed to be largely related to the fact that certain stakes are insufficiently addressed by monitoring. The SBSPR monitoring arrangements on the other hand seem to facilitate the evaluation function to a satisfactory degree. Similarly to the Sand Engine case, there are arrangements allowing for evaluation processes among the involved parties on the knowledge created by monitoring and on the monitoring processes. The important difference between the two projects is that the SBSPR project entails arrangements that enable the evaluation of the degree to which the stakeholders' interests and concerns are taken into account, while in the Sand Engine there is more room for improvement with regard to this issue.

Steering

The monitoring arrangements of the Sand Engine appear to facilitate the third monitoring function of steering. The project has managed to make use of monitoring as a steering mechanism for policymakers. The link between the monitoring results and policymaking is strong, as the project translates results sufficiently if and when necessary for policymakers, designating in that way monitoring knowledge and insights as policymaking supportive. The monitoring arrangements of the

SBSPR project also appear to facilitate the steering monitoring function, as the case analysis reveals. The SBSPR keeps close communication and collaboration with the regulatory agencies that have permitting authority over the SBSPR project area. Similarly to the Sand Engine, there is sufficient translation and highlighting of key issues, which are relevant to the formulation of future policies.

In both cases an additional function of monitoring was given prominence. Interviewees (in both cases) stressed the need for stakeholder support that can be achieved by taking steps such as identification and integration of in monitoring as early as possible, in the course of the project. What proved crucial after having ensured that the stakes are known, understood and addressed in monitoring, is to actually make this action evident to the stakeholders. In other words, this research considers monitoring as an opportunity for garnering stakeholders' approval and support. The next part of the comparison chapter entails a comparison of the relative degree of influence of the explanatory variables on monitoring effectiveness.

6.3 Comparison of the degree of influence of the explanatory variables

Based on the analysis of the ex-post cases, this section aims to provide a reflection on the degree to which the explanatory variables defined and assessed, actually influence monitoring effectiveness. This reflection will be conducted by analyzing each variable's degree of influence in the two ex-post cases.

Stakeholders' interests and concerns integration - (Degree of Influence: Sand Engine: High, SBSPR: High)

For the case of the Sand Engine, the explanatory variable of stakeholders' interests and concerns integration has a high effect on monitoring effectiveness. However, according to the interviewees it does not explain effectiveness in the sense of creating a common vision of the monitoring needs. It is important to integrate stakeholders' concerns because the project needs to provide proof of the consideration of its stakeholders' interests. All the interviewees stressed that certain stakeholders do not 'care' for the monitoring itself, as long as they see proof of how the project accounts for their stakes. The fact that the project has not achieved sufficient integration of certain stakes also did not allow for certain functions of monitoring to be achieved.

In the case the of the SBSPR project, the integration of stakeholders' interests and concerns is also of paramount importance; the integration of stakeholders' concerns facilitated to a high degree the creation of a common vision of the project's objectives in the SBSPR case. Similarly to the Sand Engine the importance of visibility of the consideration of stakeholders' concerns and interests to stakeholders themselves is evident in the SBSPR case as well. However, in contrast to the Sand Engine, there are arrangements in place ensuring visibility of the integration of the broad spectrum of stakes to the SBSPR stakeholders, even if they did not participate in the monitoring processes per se. The project invites them on a constant basis to express their thoughts with regard to the progress of the project, deliberate on future plans, and provide knowledge that is discussed during the workshops on monitoring.

Integration of multiple types of knowledge - (Degree of Influence: Sand Engine: Medium, SBSPR: High)

For the case of the Sand Engine the integration of multiple types of knowledge appears to be of medium influence on monitoring effectiveness. None of the interviewees stressed the importance of

integration of practical knowledge, e.g. from local experts or recreational groups. Some NGOs have contributed some knowledge to the project in the planning phase. However, other than that, the knowledge for the monitoring comes from the research institutes, the universities and the NatureCoast program. Due to the absence of practical knowledge, the multiplicity of knowledge does not seem of importance for the monitoring of the Sand Engine. For the case of the SBSPR case, the integration of multiple types of knowledge as defined by this research (practical and multidisciplinary) appears to have a medium effect in monitoring effectiveness. The project made efforts to obtain multiple types of knowledge (practical and multidisciplinary), but after the planning phase the practical knowledge input has declined. Multidisciplinary knowledge is still of importance for the project.

Communication and cooperation on the monitoring results and needs - (Degree of Influence: Sand Engine: High, SBSPR: High)

For both the cases, communication and cooperation on the monitoring results and needs is of great importance for monitoring effectiveness. All the respondents for both cases agreed on the fact that it is crucial to create channels of communication among the scientists, who are probably the first to realize monitoring needs, the project managers, that are able and responsible to act on the monitoring needs on the project level, and the policymakers that have permitting and legal authority that might affect the course of the monitoring program.

Feedback mechanisms on the knowledge gained and on monitoring processes - (Degree of Influence: Sand Engine: High, SBSPR: High)

Similarly to the previous variable, the variable reflecting the degree to which feedback is exchanged among the parties involved in monitoring (in both cases the three parties are scientists, project managers, policymakers) is considered to influence monitoring effectiveness to a high degree, in both cases. The respondents stressed the importance of all the parties having the opportunity to give as well to receive feedback on the knowledge gained by monitoring (i.e. what do monitoring data and their interpretation show and mean for each party). In addition, the exchange of feedback on the way the various monitoring processes take place is equally important in both cases. In other words, the respondents argued that it is significant to exchange feedback on what we learn and what it means, but it is also important to exchange feedback on 'how are we doing things' i.e. the way the processes are conducted.

Strength of the link between monitoring results and policymaking - (Degree of Influence: Sand Engine: Low, SBSPR: High)

The analysis of both cases and the answers given by the interviewees, have shown that the stronger the link between the monitoring results, the more effective monitoring seems to be. The answers of the interviewees revealed the need for translation of the results to the policymakers. That translation might imply the presentation of key points and the summarization of important aspects for the policymakers, i.e. the points that require their attention and their consideration in terms of action. In addition, openness and disclosure with regard to the effects of the project shown by monitoring, is another aspect designated as substantial, by analysis of the cases. However, this variable is of medium influence for the Sand Engine as there is no particular need for translation, as the policymakers are largely involved in the monitoring itself and have the capacity and knowledge to interpret the results themselves. However, for the SBSPR case this variable if of high influence. All

the respondents stressed that the project tries to maintain that strong link because they are in certain cases no experts that need special approach for the presentation of monitoring results. The respondents add that only if policymakers are aware of the needs of the project as well as its effects, they are more willing to act upon the results. Furthermore, their willingness is enhanced if they are aware of the next plans and actions of the project. In other words, when they know what to expect in terms of future monitoring needs and activities, they do not suspect that the project will 'surprise' them in a negative way.

Flexibility of the monitoring program - (Degree of Influence: Sand Engine: High, SBSPR: High)

In the case of the Sand Engine, flexibility appears to have a high degree of influence on monitoring effectiveness. All the respondents for the Sand Engine stressed that it is important for the parties involved to be aware of their responsibilities with regard to monitoring. This research concluded that the creation of 'funding searching' mechanisms is not applicable in the case of the Sand Engine (according to the interviews and literature reviewed), because the primary funding source is the governmental branch of RWS and to a considerably smaller fraction, the Province. However, the appointment of funding responsibility appears to be of great importance in the Sand Engine case. In the case of the SBSPR, flexibility appears to have a high influence on monitoring effectiveness. All the respondents stressed that the main problem of the monitoring is the struggle regarding the search for funding.

The table below summarizes the degrees of influence of the explanatory variables defined by this research on the monitoring effectiveness of the two ex-post cases.

Explanatory variables	**Cases**	
	Sand Engine	**South Bay Salt Pond Restoration**
1. Stakeholders' interests and concerns integration	High	High
2. Integration of multiple types of knowledge	Medium	High
3. Communication and cooperation on the monitoring needs and results	High	High
4. Strength of the link between monitoring results and policymaking	Low	High
5. Feedback mechanisms on knowledge and monitoring results	High	High
6. Flexibility of the monitoring program	High	High
Additional explanatory variables		
7. Start of the monitoring program	High	Medium
8. Visibility of consideration of stakeholders' concerns	High	High
9. Hurdles with legal requirements	Medium	High
10. Distinction of jurisdictions of the parties involved	High	High
11. Financial constraints of the policymaking authorities	High	High

6.4 Additional explanatory variables

At this point it is important to mention certain organizational and contextual differences between the monitoring programs of the two ex-post cases that constitute additional explanatory variables of monitoring effectiveness, to the ones already mentioned and assessed.

Start of the monitoring program - (Degree of Influence: Sand Engine: High, SBSPR: High)

The monitoring program of the Sand Engine started in 2011, after the end of the construction of the Sand Engine. In other words, in the timeframe from 2008, when the EIA was being conducted, until 2011 when the project started being implemented, there was no monitoring program for the Sand Engine. Den Heijer (2014), argued that the monitoring program for the project started rather late, supporting that having a clearer picture of certain baseline conditions (of the various important aspects) earlier on, would have helped with the design of the Sand Engine itself, as well as its official monitoring program. The monitoring program for the SBSPR project started in 2003, i.e. in the first year of the planning phase. As mentioned in the previous chapter, the initial monitoring for the SBSPR project entailed definition of baseline conditions of the ponds, as well as monitoring for compliance purposes. However, Burns (2014) pointed out that information on certain aspects such as species' abundance should have been sought in the early days of the monitoring; that would assist nowadays in the measurement of the restoration's effect on those species' numbers. This incident however implies that the effect of the variable was only medium.

As a conclusion, from the interviews and the case analysis it is suggested that it is important to identify the spectrum of the various aspects that need to be monitored before the start of the monitoring program and make efforts to incorporate and address them in the monitoring program sufficiently. Equally important for the monitoring program of a BwN project is an early start, that will facilitate the characterization of baseline conditions of the various relevant aspects, which will continue to be monitored during the course of the project's implementation. In this way, stakeholders' interests and concerns are proactively and more systematically accounted for. Therefore, this research identifies as the (time of) *start of the monitoring* as an additional explanatory variable for monitoring effectiveness that has a high degree of influence in both cases.

Visibility of consideration of stakeholders' concerns - (Degree of Influence: Sand Engine: High, SBSPR: High)

An important explanatory variable of monitoring effectiveness is the recognition of the integration of stakeholders' concerns in monitoring by the stakeholders themselves. Both cases' analysis revealed that it is crucial for monitoring effectiveness to ensure that the monitoring functions as a proof mechanism for the stakeholders, showing them that their interests and concerns were actively taken into consideration. Monitoring can provide a continuous inflow of information and updates on the effects and implications of the project on their stakes. In this way, the creation of a shared vision of the project plans and objectives is enabled and has better chances of being maintained. The respondents of both cases, also stressed that stakeholders need to be constantly reminded of the positive effects of the project for them, and provided with opportunities to affiliate with the project and its activities on a regular and consistent basis. Therefore, the 'visibility of consideration of stakeholders' concerns to stakeholders themselves is considered of high importance for monitoring effectiveness and has a high degree of influence in both cases.

Hurdles with legal requirements - (Degree of Influence: Sand Engine: Medium, SBSPR: High)

Both projects have encountered several regulatory obstacles and hurdles during the course of their implementation. Firstly, the ones faced by the Sand Engine are presented briefly. Although in general the project has no important problems with the permits. However, there are some permits that the project is difficult to fully satisfy due to the contradictory requirements they entail. Boon (2014) mentioned specifically one situation in which the project faced a difficulty in terms of legal compliance. On the one hand, certain permits relating to the Sans Engine are issued by the Ministry of Economic Affairs and reflect 'Natura 2000'[22] objectives. On the other hand, other permits for extractions, nourishments, are instructed by the Ministry of Infrastructure and the Environment.

The actual issue is that certain permits of the two Ministries that are relevant to the Sand Engine have divergent goals. More specifically, the conflicting permits of the Ministry of Infrastructure and the Environment relate to construction and maintenance goals, while the ones of the Ministry of Economic Affairs relate to nature and biodiversity preservation. For example, when on the one hand the Ministry of Economic Affairs expects compliance with the Birds Directive[23] (relating to bird life) there are obstacles in terms of legal compliance for the Sand Engine. That is because the Sand Engine must also meet the other Ministry's requirements, which are in conflict with nature and biodiversity permits. Boon (2014) added that the financial constraints both Ministries face aggravates the problem – both ministries are devoid of experts (i.e. specialists that would be able to figure out how to integrate those two sets of goals). The integration is then assigned to the applied research institutes. From the answers of the respondents this research has found out that legislation or permits with opposing requirements have constituted an obstacle at certain occasions for effectiveness but in general there are no examples of significant problems. The degree of influence of this variable for the Sand Engine is medium.

In the case of the SBSPR, there are some regulatory requirements that the project has difficulty to follow, mainly because fully complying with one implies instantly that a project cannot comply to the same degree with another. According to Bourgeois (2014), one of the most important regulatory hurdles for the SBSPR project is the Endangered Species Act. That Act indicates that the projects should not cause any species extinction. Certain species, whose native environment is the salt ponds, are now endangered, considering that their habitat is being altered (restored) to marshland. The primary objective of the project is to restore the former salt pond habitat to tidal marsh. Therefore, one of the implications the project has, is the loss of those species native to the salt ponds. Another example described by both Bourgeois (2014) and Valoppi (2014), is the issue of the historic mercury deposits in the Bay area from mining activities. The regional water quality control agency, which was the authority responsible of issuing a water quality permit for a pond of SBSPR project, was concerned about potential enhancement of mercury bioaccumulation in the Bay from certain restoration activities. That was because the project planned to open the pond and expose it to Bay waters. This plan was based on mercury research that advised earlier opening of that pond because it would better for the minimization of the mercury bioaccumulation within that pond. Another regulatory agency that deals with migratory fish species of the Bay (in this case the steelhead fish) was opposite to the plan for that pond. The latter agency was concerned with the possibility of that

[22] Natura 2000 is a network of protected areas in the framework of the European Union's nature and biodiversity policy (http://ec.europa.eu/environment/nature/natura2000/)

[23] http://ec.europa.eu/environment/nature/legislation/birdsdirective/index_en.htm

fish being trapped in the pond and not being able to get out. The project was then caught between two requirements. On the one hand, there was the requirement of dropping bioaccumulation of mercury, and on the other hand there were fisheries' concerns about the steelhead fish being trapped in the opened pond. The solution was that there was an agreement with the national marine fisheries service to let the project open the gate earlier this year, in order to test the hypothesis that it would help minimize mercury. In exchange, the project had to conduct a study where steelhead fish would be tagged with small pit tags, and then, their movement would be observed by an antenna array. This study's purpose was to figure out whether the fish did actually get into the pond. The aforementioned example showing hurdles with legal requirements implies that the adaptation to new or updated legal requirements is sometimes hindered, in the SBSPR case. As a conclusion, the existence of *hurdles with legal requirements* appears to influence monitoring effectiveness to a high degree in the SBPSR project.

Distinction of jurisdictions of the parties involved - (Degree of Influence: Sand Engine: High, SBSPR: High)

By addressing the issue of overlapping jurisdictions the aim is to describe how this issue might cause difficulties in the facilitation of monitoring effectiveness. In the case of the Sand Engine, there has been indeed some jurisdictional hurdles; the RWS is in charge of the coastal safety of the Netherlands as explained, while the Province of South Holland is in charge and keeps track of the swimmer safety and manages daily the Sand Motor project area.

In the spring of 2012, the use of the Sand Engine area has been intensified by an increasing number of swimmers, hikers on the coast, kite surfers etc. Certain incidents raised questions about the degree to which the Sand Engine is safe for swimmers, especially after the creation of a "long, narrow feeder channel and the associated strong current velocities" (Aarninkhof et al., 2012, p.6). The Swimmer Safety Association quickly observed the potentially hazardous currents (for swimmers) and the various incidents taking place in the area. They communicated this issue to the local authorities in order for action to be taken to prevent further accidents. As stated, swimmer safety is a responsibility of the Province of South Holland, which at the time considered that this issue needed to be dealt immediately and took the decision to block these currents with a stone dam. This action was contradictory to the whole idea of the Sand Engine and the BwN principles (i.e. not disturbing the natural processes). This action was also technically wrong, as the creation of the channel was predicted in the development of the Sand Engine and blocking the channels with stones might have resulted in change in the direction of water, causing coastal erosion. Coastal maintenance, which falls under the jurisdiction of the RWS, would be an adverse effect of this action. The essence of referring to this incident is that the communication and cooperation on what monitoring shows (in this case on-shore monitoring by the Swimmer Safety Association) has to be consistent and feedback has to be exchanged among the parties involved, before proceeding with an action. After this incident of suboptimal communication and feedback exchange among the project managers, a steering group was assembled (already in 2012) for the improvement of communications and cooperation among various parties (see section 4.5 b). Therefore, this research regards the *distinction of jurisdictions of the parties involved* as an explanatory variable with high degree of influence on the monitoring effectiveness for the Sand Engine case.

In the case of the SBSPR, there are certain jurisdictional hurdles mentioned previously, mainly relating to legal requirements and permits of the various regulatory agencies. However, there are

certain jurisdictional issues among the project managers (i.e. the agencies-members of the PMT of the SBSPR project). Bourgeois (2014) mentioned that for example the US Army Corps of Engineers (see section 5.3), cannot pay for activities on federal land owned by another agency (USFWS) if the other agency's mission is opposing to the one of US Army Corps of Engineers (i.e., they can pay for flood protection, but not habitat features).

As a conclusion, the potentially overlapping jurisdictions or opposing missions of the agencies involved might constitute a hindering factor for monitoring effectiveness also in the SBSPR case. The degree of influence of this additional variable for the SBSPR project is high.

Financial constraints of policymaking authorities- (Degree of Influence: Sand Engine: High, SBSPR: High)

Probably the most salient issue of concern with regard to monitoring, also evident during the interviews, is the issue of funding for monitoring. In the case of the Sand Engine, along with decisionmaking power over the official monitoring program, the RWS has also the responsibility to fund almost the all the necessary monitoring processes-tasks. If a new need comes up which relates to monitoring, the RWS gets notified by the entities conducting the monitoring, and is responsible to proceed with a responsive action, e.g. the addition of further monitoring activities. It is important to mention here that depending on the availability of funding priorities may shift also with regard to monitoring. For example, certain aspects might be given priority compared to other due to financial constraints of the project management/policymaking entity. This situation is not optimal, but it commonly occurs in reality. Markedly, Tonnon (2014) mentioned that already during the design of the monitoring plan there were financial constraints. The objectives of the monitoring went through a 'balancing' process of satisfying the various needs identified to a certain degree, due to budget constraints.

The funding for the SBSPR project's activities comes from agencies-members of the PMT the CDFW and USFWS. However, it sometimes comes also from the regulatory agencies. This complicates the funding procedure as the decision of the regulatory agencies to fund further needs of the project is largely dependent on the visibility of the needs to them, but perhaps most importantly, on the availability of financial resources to support such decisions. The explanatory variable of financial constraints of policymaking authorities seems to condition to a high degree monitoring effectiveness in both ex-post cases.

In the next page an updated version of the framework in chapter 2 (figure 3) is presented which includes the conceptual path already identified by the theory and methodology of this research with the addition of certain explanatory variables and a monitoring function. The reason why this model is revised is because the literature did not provide (1) all the functions which monitoring should have in adaptive management of BwN projects and (2) all the variables that explain the degree to which the criteria of monitoring effectiveness are met.

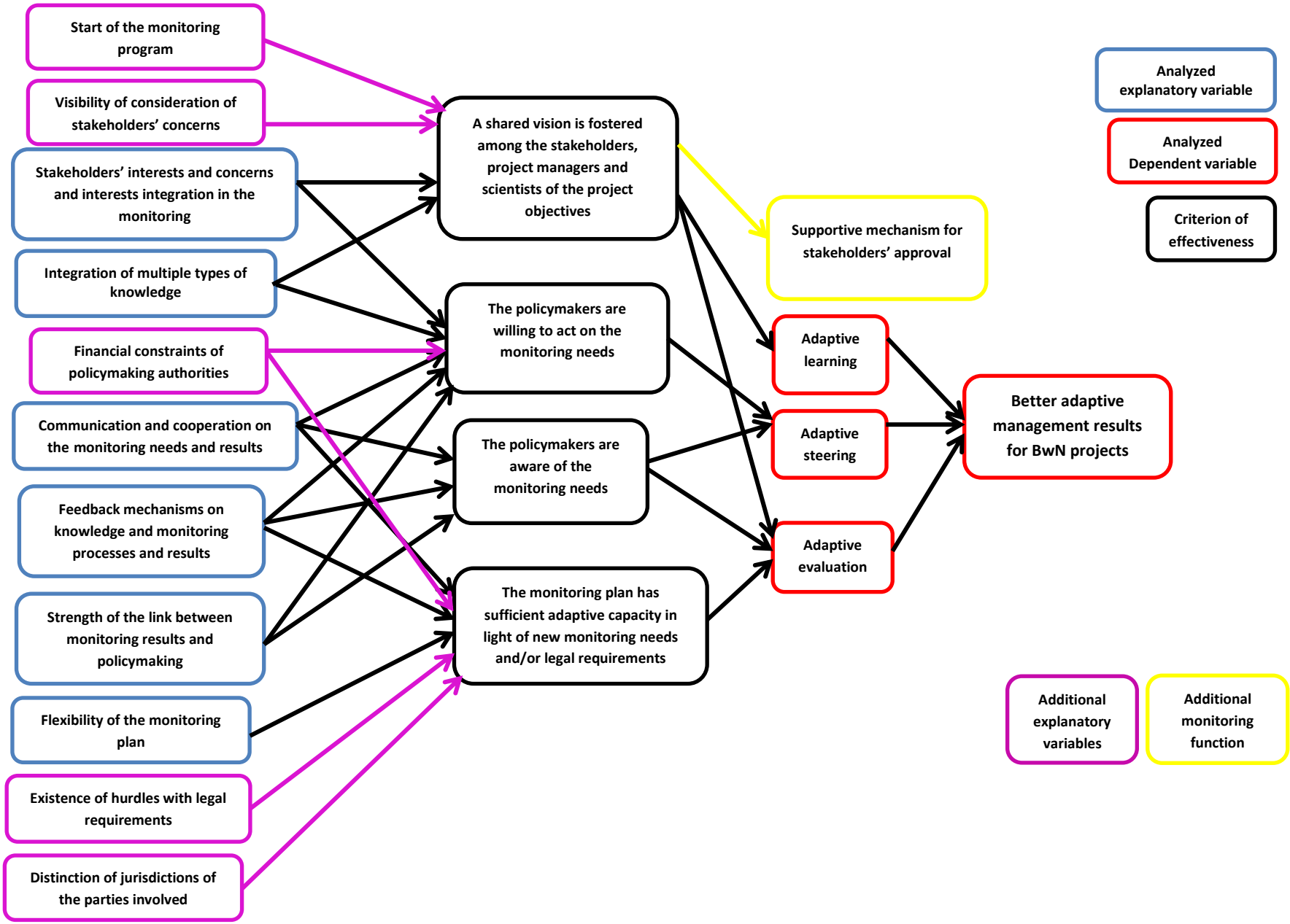

Figure 12: Updated conceptual framework with the additional variables

The diagram above provides a visualization of the revised conceptual framework of this research after the analysis of the two ex-post cases. More specifically, (1) the functions monitoring should have in adaptive management contexts of BwN projects, (2) the criteria which have to be met in order for the functions to be achieved and (3) the variables explaining the degree to which each criterion is met were presented in the updated diagram.

6.5 Design principles for monitoring arrangements of BwN projects

The analyses of the cases in combination with the theoretical foundation of this research concluded that the design principles for monitoring arrangements that facilitate adaptive implementation of BwN projects are the following:

1. **Ensure that each party involved in the monitoring program of a BwN project is well aware of its responsibilities with regard to monitoring** including communication, cooperation and area of authority. If necessary, articulate and agree upon management triggers and guidelines that specify as much as possible who is going to do what, in what case, within what time frame, and in what way (e.g. what monitoring methods should be used).
2. **Ensure that the funding responsibility (and/or the 'funding searching' responsibility) is appointed efficiently among the parties involved.** In case funding for monitoring comes from a variety of sources, there should be arrangements in place that are very clear on the funding searching process. The more parties committed to find the necessary, the better the chances that monitoring needs are addressed efficiently and in a timely manner.
3. **Conduct an extensive exploratory research on the stakes and concerns of potentially affected or interested parties, before the setup of the monitoring program**. Organize and conduct meetings and sufficient and representative amount of interviews with people representing the variety of stakes.
4. **Ensure an early start of the monitoring program, before the start of the project's implementation.** Facilitate with an early start the assessment of the situation of the aspects the project aims to change, before the project starts being implemented. Ensure that those aspects are monitored consistently also after the start of the project.
5. **Ensure that the stakeholders see their interests and concerns taken into account by the monitoring**. After having identified the variety of stakes and having addressed them in the monitoring, ensure that the monitoring functions as a mechanism to garner stakeholder support, by organizing meetings with the stakeholders to show them how the project takes their concern into consideration.
6. **Ensure that the monitoring program integrates and makes use of multiple types of knowledge already in its design process.** Gather, and if necessary hire, experts from a variety of fields and disciplines, as well as non-experts who have practical knowledge on the local environment and can contribute practical insights. Arrange meetings and discussion groups on how the various disciplinary aspects that need to be taken into account can be coupled, fine-tuned and therefore better integrated in the monitoring.
7. **Ensure communication and cooperation channels on the monitoring needs and results among the parties involved in monitoring.** Arrange and pre-define as much as possible the form and time of meetings and reporting of each involved party to one another. Appoint a person or a group of persons responsible for the communications among the parties.

8. **Ensure the exchange of feedback on the knowledge and monitoring processes and results among of the parties involved in monitoring.** Define to the greatest possible extent the content of reporting expected by each party involved in the monitoring. Ensure that it is disseminated across all the other parties involved through reports, meetings or even more informal types of communication such as emails and phone calls.
9. **Ensure a strong link between policymaking and the monitoring results.** Appoint a team of policy experts for the communication of the results to policymakers, i.e. the presentation and if necessary the translation of the results to them. Organize consistent communication with them and consistent 'feeding' of updates on the monitoring.
10. **Ensure the fine-tuning and conciliation of legal rules with opposing requirements.** Assemble a team of legal experts and bring them together with the experts from various disciplines in order to brainstorm solutions that surpass legal obstacles and couple multidisciplinary aspects.

For the purposes of this paper the next section of this chapter will introduce the ex-ante case of Marker Wadden. By providing certain information on the project, such as organizational structure and the planning of its monitoring program so far, the aim of the next chapter is explain how the design principles presented above can accommodate the future monitoring needs of the Marker Wadden project.

Chapter 7: Lessons for the Marker Wadden ex-ante case

This part of the paper will start by presenting background information on the project area in which the BwN project of 'Marker Wadden' is going to be implemented and its main objectives. Next, the will be a description and information on the planning phase of Marker Wadden so far and the prospective organizational structure of the project. This chapter will be finalized by describing how the design principles presented in Chapter 6 fit and can be applied the Marker Wadden case.

7.1 Background Information

The geomorphology of the Netherlands was briefly described in chapter 4, focusing mainly on the need for flood protection and coastal defense practices. These major challenges were largely reflected in the Dutch coastal policies and still are. The Marker Wadden project aims to address the problem of huge amounts of sludge existing in the lake Markermeer located in the center of the Netherlands, north-east of Amsterdam (see figure 13). Before delving more into the specifics of the Marker Wadden it is important to provide background information on the circumstances which created the impaired ecological environment in the Markermeer area.

Figure 13: Marker Wadden project location

Until the 20th century, the large inland gulf of the Netherlands was known as Zuiderzee. During the previous century a big part of this gulf was reclaimed due to the need of the Netherlands for farmland and was 'isolated' from the North Sea. Before these coastline alterations were made the Zuiderzee was a large tidal sink. Tidal waters were flowing up and down the North Sea, draining in and out of the Zuiderzee (Daly, 2000).

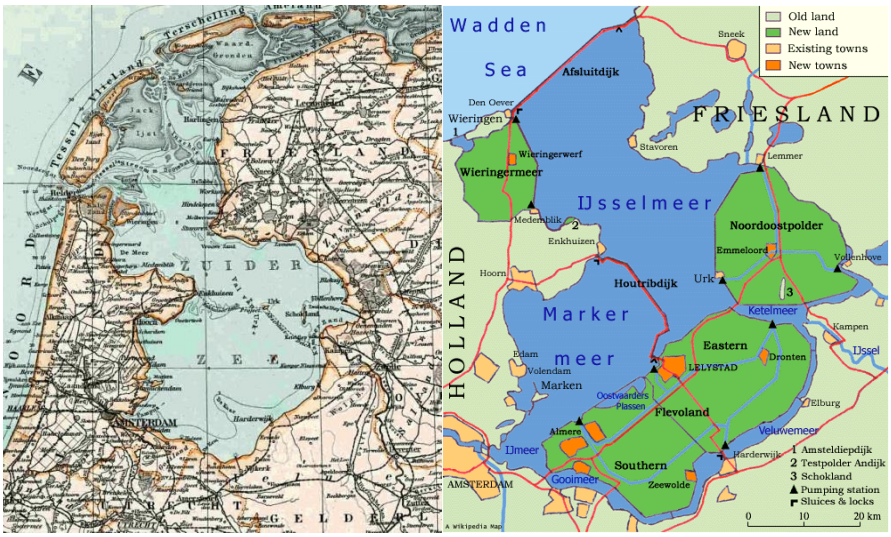

Figure 14: Zuiderzee area until the advent of the 20th century

The flow of water enabled the existence of sand flats, mud fields and reed banks, creating a rich ecosystem habitat for birds, fish and other species. However, this naturally created environment ceased to exist due to the extensive construction of dams, dikes polders, etc. that were necessary for

the flood defense of the adjacent regions. One of the dikes was the 'Houtribdijk' which was built in 1976 between the cities of Lelystad and Enkhuizen, with the purpose of enhancing flood protection of the surrounding areas. The artificial lakes of Markermeer and adjoining IJmeer were then created in the area below the dike (see figure 14).

The problem in the Markermeer's natural ecosystem started already with the construction of the Houtribdijk (Waterhout et al., 2013). The depth of the lake is around 4 meters and its bottom is largely covered by silt soil and sludge. That results in movement and stirring of the silt and sludge even by mild winds. As a result the lake has a big problem with sludge floating around; the turbidity prevents vegetation and clean water species from inhabiting the lake (van Gogh, 2012). The Markermeer and adjoining IJmeer have been acknowledged as Special Protection Zone (SPA) under the Birds directive in 1994 and 2000 respectively. Both areas form actually a larger lake which was nominated as a Natura 2000 protected area in 2009. The aforementioned actions with regard to the broader Markermeer area illustrate the need for consideration of ecological concerns in the area, which was evident already 10 years ago (Waterhout et al., 2013).

Various plans for the situation of the Markermeer have been contemplated by the government, local authorities, social and environmental organizations which resulted in initial ideas for the formulation of the 'Toekomst Bestendig Ecologisch Systeem' (TBES hereafter) plan, whose translation is 'future robust ecological system' (Waterhout et al., 2013). In 2012, there were improvements in this plan that indicated the creation of an open market for nature development plans. Those plans focused mainly on three possible designs for the treatment of the decline of ecological value of the Markermeer with the parallel opportunities for public access and recreation. Van Gogh (2012) suggests that the Marker Wadden project, which indicates the construction of a large scale swamp area in the North-East of the Markermeer, is the most effective as well as efficient approach for solving the silt problem while reducing the costs as much as possible, taking Natura-2000, TBES as well as other nature preservation and development requirements into consideration.

Figure 15: The vision of Marker Wadden project

The Marker Wadden project's main objective is to restore the wildlife of the Markermeer which has been inflicted, as mentioned before, due to and since the extensive creation of flood defense and land claiming constructions. The Marker Wadden will comprise "'windwadden' sites, lagoons, mud flats, reed fields, 'mangrove'-like plants and beaches, protected against the waves of the open Markermeer by a reef" (Posthoorn et al., 2012, p.7). This cluster of sites will be located in the northern part of the Markermeer, 15 kilometers alongside the Houtribdijk. The vision of Marker Wadden is to reinstate the rich wildlife once existing in the Markermeer (Zuiderzee) which means the return of an abundance of plants, mussels, fish and birds (see figure 15). The Marker Wadden wildlife site is expected to create opportunities for recreation and water sports; during the 'construction phase', the combination of nature development processes along with the existence of technological will provide an interesting attraction for local residents and tourists (Posthoorn et al., 2012). Marker Wadden is a project that will follow the principles of the Dutch hydraulic engineering paradigm of BwN; during the first phase of Marker Wadden technological means will assist in bringing the aquatic

ecosystem to a situation in which natural processes and ecosystem attributes will be able to function undisturbed and in the long-term restore gradually the wildlife and plant ecosystem at the Markermeer. The plans indicate that after the finalization of the construction phase, the technological means will be withdrawn in order for the natural process to take over towards the long-term aim.

The next section will describe the steps made during the planning phase of the Marker Wadden so far.

7.2 The planning phase of the Marker Wadden so far

The initiator of the Marker Wadden is the Dutch organization for nature preservation 'Natuurmonumenten' which in April 2013, together with the Central Government (Rijksoverheid) jointly took the initiative to embark upon of a venture which will focus on the realization of the first phase of the Marker Wadden project: an island with a size of approximately 500 hectares (5 km^2). The Central Government i.e. the land owner of the project area intends to engage in a long-term lease of that area to public and private sector entities, which are expected to invest and collaborate towards the realization of the Marker Wadden project. The actual estimated start year for the First Phase of the project is 2015; the First Phase is expected to be complete in 2020. The Central Government arranged in September 2013 'an expression of participation interest' procedure which enabled potential public and private sector parties to express interest in participating in the form of collaboration and funding in the realization of the First Phase of the Markerwadden project (Natuurmonumenten and Rijk, 2013). From this procedure certain parties were distinguished which will have important roles in the organization structure of the Markerwadden (explained in the next section).

In November 2013, the plans for the Markermeer were incorporated in the National Structural Plans for the areas of Amsterdam, Almere and Markermeer (Rijk Regioprogramma Amsterdam-Almere-Markermeer). These plans obtain inherent challenges relating to housing areas, public access and nature. The construction of the Marker Wadden along with the 'Hoornse Hop' abatement measures, have initiated the process towards nature restoration of the Markermeer until the official start of the First Phase Markerwadden in 2015. Other sectors are expected to benefit from the Marker Wadden, for example the development and deployment of new technologies in hydraulic engineering (RRAAM, 2014).

7.3 The organizational structure of the Marker Wadden

This part of the chapter will present the organizational structure of the Marker Wadden project, as well as the known involved parties (certain aspects of the project have not been yet arranged, therefore the parties that will participate are not yet definitive).

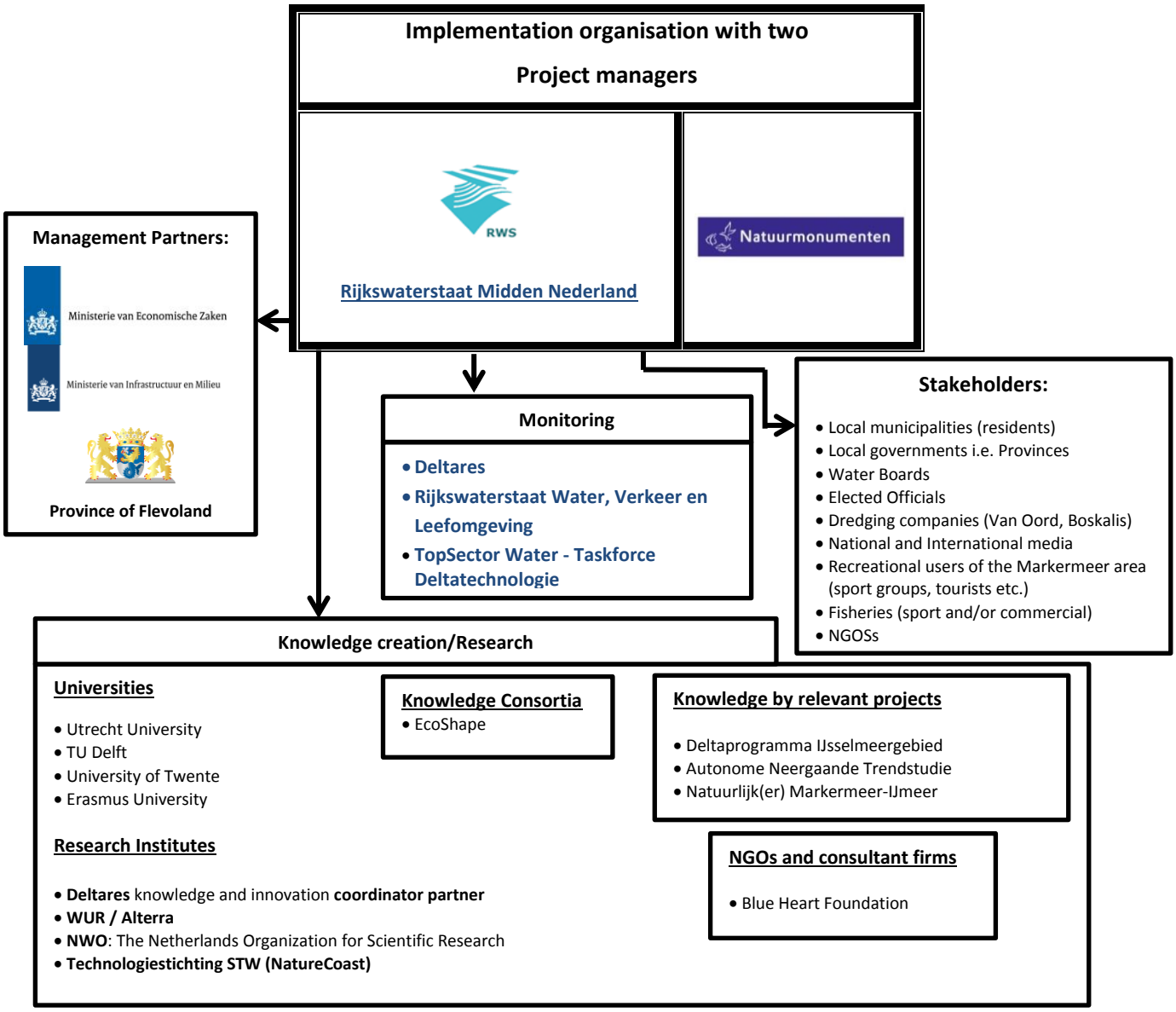

Figure 16: Organizational structure of the actors involved or expected to be involved in the Marker Wadden project

The diagram above shows that the project managers of the Markerwadden are going to be Natuurmonumenten and RWS Midden Nederland[24] representing the Ministry of Infrastructure and the Environment. The first phase of the project of the Markerwadden estimated cost is expected to be 75 million euros. The initiator of the Marker Wadden, Natuurmonumenten, contributes 15 million to the initiation of the project, provided by the Dream Fund of the private party of the National Postcode Lottery (the largest charity in the Netherlands[25]). The Ministries of Economic Affairs and Infrastructure and the Environment provide 15 million each. There are 30 million therefore that are expected to come from other public and private parties (RRAAM, 2014). As mentioned before, public and private parties have been invited to declare their interest and intention to participate in the First

[24] The RWS department responsible for the regions in middle of the Netherlands
[25] http://www.postcodeloterij.nl/

Phase of Marker Wadden. Four parties were distinguished based on certain criteria[26] designated by the Central Government. One of them is the authority of the Province of Flevoland. Natuurmonumenten and RWS Midden Nederland will play a prominent role in the implementation of the First Phase of the Marker Wadden along with State Department of Land and Development (Rijksvastgoed en Ontwikkelingsbedrijf) which will lease the state-owned land (Natuurmonumenten, 2014).

The expected organizational hierarchy is therefore expected to have as project managers a state authority, the RWS Midden Nederland and a private organization, Natuurmonumenten. The Province of Flevoland will be a managing partner. The implementation organization of Natuurmonumenten and RWS Midden Nederland is going to coordinate the research and monitoring conducted for the Marker Wadden. The organizations and institutes that are expected to participate in the various processes and governance of the project are presented in figure 16 in more detail.

The next section presents certain information on the current situation with regard to the development of the monitoring program of Marker Wadden.

7.4 The monitoring program of the Marker Wadden

For the first phase of the Marker Wadden project, an official monitoring and innovation program has not been fully articulated yet. In order to identify key issues and prospective partners in knowledge creation, monitoring and funding of Marker Wadden, the RWS Water Verkeer and Leefomgeving (Water Transport and Environment) and Deltares have been authorized by Natuurmonumenten and the RWS Midden Nederland, with the support of the Top Consortium for Knowledge and Innovation (TKI) Deltatechnologie, to perform an exploratory study on the aforementioned key issues. This study consists of a round of interviews and follow-up conversations during which ideas are shared and recommendations are given by relevant parties (Lenselink et al., 2014). The table below presents the main thematic areas of the interviews:

Table 14: Key thematic topics of interviews with relevant parties for Marker Wadden monitoring

Key issues of exploration	**Knowledge and expectations of partner organizations with regard to monitoring**
Current situation	Which current monitoring and innovation projects are relevant to Marker Wadden?
Desired situation for monitoring and innovation	• Which ambition has your organization for monitoring the effects of interventions and systemic effects of the construction of the First Phase Marker Wadden? • Which ambition has your organization for (large-scale) experiments and innovations in the First Phase Marker Wadden? • What do you see as a potential driving force for funding? How do you see the development of the next phases of Marker Wadden?
Means for monitoring	What resources does your organization have for monitoring, innovation and exploration for financing subsequent phases? What options are there for funding?
Role of the monitoring partner	What kind of role will your organization have in the monitoring and innovation program of Marker Wadden?

[26] There were certain criteria guiding the partners' selection procedure: (1) criteria for membership: (2) criteria for registration (3) criteria for partnership (accompanied with requirements relating to the First Phase).

The Marker Wadden project is currently in this exploration phase and Lenselink (2014) pointed out there is the need for certain guidelines and design principles with regard to the upcoming monitoring arrangements for the project. The next section presents the design principles that this research delineated with regard to the adaptive implementation of BwN projects and more specifically of the Marker Wadden project.

7.5 Design principles for the monitoring arrangements of Marker Wadden

In this section a set of design principles will be presented for the monitoring arrangements of Marker Wadden in general based on the knowledge gained by both the cases' analysis of the ex-post cases. However, the interviews for the Sand Engine case and the respective lessons learnt appear to be applicable to a great extent to the Marker Wadden project, due to the similarity of actors involved and types of stakeholders. The design principles are also largely based on information obtained by Lenselink et al. (2014) that assisted in making the design principles as specific and to-the-point as possible.

Ensure that each party is well aware of its responsibilities with regard to monitoring including communication, cooperation and area of authority. For the Marker Wadden case this design principle seems particularly important; again its importance relates a lot to the intricate relation of the authorities involved in the project (RWS Midden Nederland and Province of Flevoland) and probably also in monitoring. A big part of the responsibilities the two authorities earlier follow from their constitutional obligations, however, from the analyses of the ex-post cases the need for further elaboration on responsibility is evident. In the case of the Sand Engine, due to jurisdictional overlaps among the project managers there was difficulty on certain urgent occasions to understand who was responsible to act and how. In order for this to be avoided in the Marker Wadden, there is the need to clarify roles, responsibilities and guidelines of authorities with jurisdictional authority on the project area, in order for misunderstandings to be avoided about who is responsible to act on which situation and accountability to be enhanced. For example, guidelines should be articulated defining management triggers stemming from monitoring results and/or indications.

Ensure that the funding responsibility (and/or the 'funding searching' responsibility) is appointed efficiently among the parties involved. It is considered important for the adaptive implementation of the Marker Wadden project to ensure that the responsibility of funding is appropriately appointed and defined. What appears to be crucial in terms of the funding responsibility is the need to define the expected monitoring needs as a vital part of the Marker Wadden's adaptive implementation, and not as a crude obligation of certain parties involved. For example, the fact that certain aspects relating to Marker Wadden might fall under the jurisdiction of a certain party e.g. the province of Flevoland, should not automatically imply that the funding is a responsibility for those aspects lies with the Province. In other words, the funding responsibility should not be appointed in a bureaucratic manner, e.g. only based on lawful obligations of certain parties. The potential and/or expected needs should also be proactively contemplated and foreseen (to the greatest possible extent), allowing for the funding responsibility to be appointed according to the financial 'power' of the parties involved. In that way, the emerging monitoring needs can be addressed more efficiently and in timely manner, without being hindered by a bureaucratic organization. In the Sand Engine case, where the types of two key actors having funding responsibility were the same, i.e. the governmental branch RWS (Midden Nederland) and a Province (of Flevoland), a seemingly

bureaucratic way of appointing funding responsibilities resulted in certain main objectives of the project to be under-investigated by monitoring.

Conduct an extensive exploratory research on the stakes and concerns of potentially affected or interested parties before the setup of the monitoring program. In this way, there are better chances for the parties involved to be able to identify and 'get a good grasp' of the (probably) broad spectrum of stakes and concerns related to the Marker Wadden. If this research is conducted well before the design of the monitoring program, then the project managers along with the scientists and the other various involved parties will have more time to figure out a better way to incorporate and address the various stakes in the Marker Wadden monitoring program. In the Marker Wadden case, an exploratory research on the stakes and interests of various parties began in 2013 revealed that key interested parties are (similarly to the Sand Engine) technical stakeholders such as dredging companies, fishery parties (not specified more yet), but also recreational users of the project area such as local residents, tourists etc. Considering that the monitoring program will start in 2015 there is enough time to integrate the concerns and interests adequately in the initial monitoring program of first phase of Marker Wadden. In this way, the project managers, the scientists and the variety of stakeholders can shape a common vision of the more long term but also the short term objectives of the project, that need to be addressed through monitoring. An idea would also be to contemplate the inclusion of stakeholders in monitoring processes (i.e. collaborative monitoring), considering that after making a relevant research such an activity appears to be co-effective and enhances stakeholder interest and support towards the project.

Ensure an early start of the monitoring program, before the start of the project's implementation. Based on the analyses of the two cases, an early start of the monitoring program of a BwN project, in this case Marker Wadden has been designated as important. This research supports this arrangement as it is believed to facilitate a better consideration of technical, recreational and as pointed out by Lenselink (2014) potentially commercial interests of stakeholders. More specifically, dredging companies', hikers', bird watchers', sport and/or commercial fisheries' stakes are better attended as they will be integrated in the monitoring before the construction of the project i.e. before the project actually having a real effect on those stakes. This is a proactive way of exploring potential effects, either positive or negative. One the one hand, if the effects emerging from the monitoring are negative the project can proceed with changes and adjustments so that those effects are minimized or even avoided. On the other hand, if the monitoring reveals certain proven or expected positive effects relating to certain stakes, then the monitoring results can function as a support tool-mechanism for garnering stakeholder support.

Ensure that the stakeholders see their interests and concerns taken into account by the monitoring. Following the aforementioned argument of using early monitoring results to garner support from stakeholders, there is an additional, important arrangement the Marker Wadden should care for. Apart from the functions of monitoring for the project itself there are functions of monitoring relating to external parties i.e. the policymakers (the two Ministries involved) and the stakeholders (interested parties). Marker Wadden needs to ensure that its monitoring program entails constant and consistent mechanisms to take its stakeholders' interests and concerns into consideration, but also to ensure visibility of this consideration to the stakeholders themselves. In this way there is readymade evidence that the project can use to garner stakeholder support and probably increase stakeholders' interest in the monitoring itself. This is crucial considering that certain stakeholders might be able to assist the project or the monitoring financially by being willing

to participate in the project (Marker Wadden is now within a funding acquisition process). Similarly, the project has to make efforts to do the same for the interests and concerns of policymakers; the two Ministries involved are certainly interested in the legal compliance of the project (also reflected by monitoring) but appear to be also interested in a proactive and maybe innovative integration of policy concerns in the monitoring programs of BwN projects.

Ensure that the monitoring program integrates and makes use of multiple types of knowledge already in its design process. It is crucial that the monitoring program of Marker Wadden, already from its launch, to have integrated and utilized multiple types of knowledge. For example, the project should engage in efforts to obtain practical expertise from local Markermeer residents or environmental groups and/or knowledge and experience from people affiliating with the project area on a regular basis e.g. recreational users such as sport fisheries. In addition, it is equally important in order to enhance effectiveness of the monitoring program to make use and take into account aspects deriving from a variety of disciplines relevant to the project. The Marker Wadden relates to various disciplines would be ecology (silt problem and the effects on the ecology of the local environment), spatial planning (Marker Wadden entails a mud-flat island whose construction has to be through over also be a spatial planning perspective), biology (of the marine ecosystem), engineering (dredging) etc., considering the main objectives of the project. The project should assemble a working group with people/experts from the variety of disciplines in order to figure out cost-effective solutions for the integration of multi-disciplinary aspects in the monitoring program. In this way, the various types of monitoring will be more clear and evident and as concerns relating to various disciplines are integrated.

Ensure arrangements that facilitate the communication and cooperation on the monitoring needs and results of the parties involved in monitoring. As evident in both ex-post cases, the creation of communication and cooperation channels among the parties involved is crucial for monitoring effectiveness. The Marker Wadden management should define as soon as possible the form and time of communication of the groups and ensure that they are planned in a consistent and efficient manner through e.g. scheduled meetings etc. Similarly, certain persons should be appointed from each involved party (e.g. Province of Flevoland, RWS Midden Nederland, Natuurmonumenten, Deltares etc.) to be responsible for the communication of information and updates on the respective type of monitoring in which their organization/institute/authority participates. It is important to ensure through arrangements, that all groups involved have the opportunity to interact with one another in order to exchange information and guidelines that can be useful on the various types of monitoring carried out. In that way, when the results are indicating a new monitoring need e.g. a change in a process, if there are channels of communicating this issue and cooperate on its solution, it is bound to be resolved more efficiently and more effectively. Furthermore, the communication is considered efficient when it is not taking place in a bureaucratic way, but in a professional but still cooperative and communicative spirit. This implies that when an issue comes up that it requires immediate attention then there should be adjusted rules/arrangements that apply to a more urgent situation such as adjusted form of communications e.g. contingency meetings.

Ensure the exchange of feedback on the knowledge and monitoring processes and results among of the parties involved in monitoring. This design principle is largely connected with the previous one. After having ensured consistent and efficient communication it is also important to foster the exchange of feedback among the parties involved. More specifically, this process can be facilitated by ensuring that during the meetings every group has a voice to discuss and deliberate on the

development of the monitoring program and on potential emerging issues. By ensuring that the parties forming the body of the monitoring program have the opportunity to extract knowledge and insight from the other parties increases the chances of achieving important knowledge creation though the monitoring processes such as data interpretation and analysis (learning function of monitoring). Therefore, the problem-solving capacity of the project is enhanced and the learning function of monitoring achieved. Moreover, the roles and responsibilities of the involved parties should clarify that they commit, by participating in the project and its monitoring program to report on a number of aspects expected (from the project).

Ensure a strong link between policymaking and the monitoring results. Another design principle deriving from this research is the one indicating ensuring the existence of arrangements that strengthen the connection of the monitoring results and what the results show with policymaking. The project should for example appoint a team of policy experts that would be responsible for the translation of the results to the policymakers (two Ministries involved). They would also be responsible to highlight and guide the discussions with them (two Ministries) to the key points and significant information deriving from monitoring. By promoting and focusing on the aspects relevant to policy concerns respectively for the two Ministries, the monitoring is designated as a policymaking supportive tool, attractive to higher level policymakers. In addition, the project has to ensure communication channels that allow for and facilitate constant affiliation of the policymakers with the project and its monitoring needs. For example, there should be separate meetings with them and conferences where the focus should be how the needs of the project and monitoring can be integrated in relevant policies and vice versa.

Ensure the fine-tuning and conciliation of legal rules with opposing requirements. Both ex-post cases have encountered during the course of their development the obligation to comply with opposing legal permits. Then, the project was caught in the middle of those requirements having to figure out a way to comply with both without violating any of them. It is important for Marker Wadden to employ individuals with different scientific and/or disciplinary backgrounds in order to be able to articulate a solution with the opposing legal requirements permits. In the Sand Engine case for example the opposing requirements were instructed by the Ministries of Infrastructure and the Environment and the Ministry of Economic Affairs, as described in chapter 4. The aforementioned constitutes strong evidence that, considering that the two same Ministries have a central role in the Marker Wadden, their respective legal requirements have to be better dealt with (in the Marker Wadden case). For example a team of multidisciplinary experts can be appointed responsible for contemplating and deliberating on an integrative solution for the satisfaction of the opposing legal requirements. A similar process can be followed for the participating organizations (e.g. stakeholder or governmental parties) that have opposing (or not overlapping) missions. For example, Natuurmonumenten promotes a 'public access' function of Marker Wadden while the Ministry of Economic Affairs has Natura 2000 goals that have significant restrictions with regard to land use of Natura 2000 protected areas.

After having presented how the design principles of this research can be applied in the Marker Wadden this research will be finalized with certain conclusions on the overall course of this research project.

Chapter 8: Conclusions and Recommendations

The final chapter of this thesis will present conclusions on the attainment of the research objective and answers to the central research question as well as the sub-questions. By addressing the aforementioned aspects, there will be a reflection on the contribution of this research to the knowledge gap on monitoring arrangements for the adaptive implementation of BwN projects. There will also be a discussion on the limitations of this research in terms of methodology and data collection. This chapter will be finalized by presenting recommendations for future research.

8.1 Conclusion

This research's objective was to articulate an end product in the form of a set of design principles for monitoring arrangements that are believed to facilitate the adaptive implementation of BwN projects. In order for the research objective to be fulfilled, two projects were selected as ex-post cases, namely the Sand Engine and the South Bay Salt Pond Restoration projects. These projects presented similarities in terms of the core principles followed for the achievement of their stated objectives. The Sand Engine is a representative case of the BwN concept and the SBSPR project is strongly considered a BwN-like project as described in section 5.2. In order for the aforementioned design principles to be articulated, this research firstly engaged in extensive literature review, in order to identify the main functions monitoring appears to have in coastal management and flood protection projects. Then, there was the need to identify and explain the type of management that seemed more realistic and promising to cope with the BwN challenges. That appeared to be the adaptive management approach. In order to define monitoring effectiveness, the research defined certain conditions (*effectiveness criteria*) that have to be met in order for the monitoring functions to be achieved, as well as a number of factors (*explanatory variables*) that appear to influence monitoring effectiveness.

With regard to the central research question: '*What kind of monitoring arrangements can facilitate the adaptive implementation of Building with Nature projects?',* this thesis concludes that the following design principles for monitoring arrangements, already presented in section 6.5, are believed to facilitate the adaptive implementation of BwN projects:

Table 15: Design principles for monitoring arrangements of BwN projects

1. Ensure that each party involved in the monitoring program of a BwN project is well aware of its responsibilities with regard to monitoring
2. Ensure that the funding responsibility (and/or the 'funding searching' responsibility) is appointed *efficiently* among the parties involved.
3. Conduct an extensive exploratory research on the stakes and concerns of potentially affected or interested parties before the setup of the monitoring program.
4. Ensure an early start of the monitoring program, before the start of the project's implementation.
5. Ensure that the stakeholders see their interests and concerns taken into account by the monitoring, both in the beginning and during the course of the project.
6. Ensure that the monitoring program integrates and makes use of multiple types of knowledge, already in its design process.
7. Ensure communication and cooperation venues on the monitoring needs and results among the parties involved in monitoring.
8. Ensure the exchange of feedback among the parties involved in monitoring on the knowledge gained and on the way the monitoring processes are carried out.
9. Ensure a strong link between policymaking and the monitoring results.
10. Ensure the fine-tuning and conciliation of legal rules with opposing requirements

The aforementioned principles for monitoring arrangements have been formulated by joining together (1) the design principles that were theoretically believed to facilitate the adaptive implementation of BwN projects and (2) the key findings of this research. The key findings are reflected by the conclusions reached on the empirically tested effectiveness criteria and the explanatory variables influencing monitoring effectiveness (see Figure 12). It is important to mention at this point, that the aforementioned principles appear to be able to facilitate the adaptive implementation of other projects with 'BwN-like' characteristics and challenges (see chapter 1). Therefore, the main contribution to the knowledge gap can be identified in the articulation of the design principles. Furthermore, this research added to the knowledge on the functions monitoring should have in adaptive management of BwN (and BwN-like) projects. The third part of this research's contribution pertains to the additional explanatory variables (to the ones of the theory) identified that also seem to influence monitoring effectiveness and require attention in order not to constitute a barrier for effectiveness. It is important to clarify that the design principles produced by this research, cannot be applied as panacea - in an identical manner, to the wide variety of types of projects. Projects might differ in a variety of aspects such as main objectives, organizational structure, institutional context, number of involved actors etc. Therefore, the design principles are believed to be applicable, but always on the supposition that they are applied according to the specific characteristics of the project at issue.

As far as the ***first subquestion*** is concerned, the literature review had revealed that in theory, monitoring has three main functions in coastal management and flood protection: learning, evaluation, steering. The analyses of the two ex-post cases verified that monitoring indeed should have (and had in the ex-post cases) the three functions identified. However, the cases' analysis revealed that monitoring should have an additional, fourth function: monitoring in adaptive management of BwN projects needs to function as a (supportive) mechanism, in order for the project to be able to garner and maintain stakeholders' approval. The monitoring arrangements of the Sand Engine seem to facilitate only the achievement of the steering function to a sufficient degree. The learning and evaluation functions of monitoring appear to be achieved to a moderate degree. The fourth function is not believed to be achieved in the Sand Engine case. The monitoring arrangements of the SBSPR project appear to facilitate the three functions of learning, evaluation and steering. However, they facilitate the achievement of the fourth function to a moderate degree. That is because there are connections between the monitoring and stakeholders, but according to the document analysis and the interviews it is not so strong yet.

As far as the ***second subquestion*** is concerned, this research identified four effectiveness criteria with the assistance of the professional literature review. The criteria identified in order for the functions to be achieved, were derived from the literature and remained the same (after the cases' analysis). The Sand Engine's monitoring arrangements appear to score as moderately effective in three out of the four criteria: in the creation of a shared vision among the project managers, scientists and stakeholders (Criterion 1), in the enhancement of the willingness of policymakers to act upon the monitoring needs (Criterion 3), and in ensuring adaptive capacity of the monitoring program (Criterion 4). They facilitate, however, the creation of awareness among policymakers on the monitoring needs and results (Criterion 2). The monitoring arrangements of the SBSPR project score as effective in terms of the criterion 1, 2 and 3. However, they are moderately effective in ensuring adaptive capacity of the monitoring program.

As far as the ***third subquestion*** is concerned, this research identified six explanatory variables that could theoretically influence monitoring effectiveness. After having conducted a document analysis and a number of interviews, this research concludes that there are certain additional explanatory variables influencing monitoring effectiveness, not to the exclusion of the six already identified, but in addition to them. The degrees of influence of the explanatory variables, as well as the respective scores of the monitoring arrangements were elaborated in the respective cases' analysis and comparison chapters. Therefore, it is considered important in the concluding chapter of this research to refer to the variables that were designated as most important by the interviewees and by the findings of this research.

One of the most prominent explanatory variables for the Sand Engine appears to be the *distinction of jurisdictions of the parties involved*. This variable proved to be hindering monitoring effectiveness in certain occasions, where there was confusion with regard to who was responsible to act on certain incidents. Another prominent variable for the Sand Engine is *stakeholders' interests and concerns integration in monitoring* for the Sand Engine. The fact that one of primary objectives of the Sand Engine is under-investigated by the monitoring program has created confusion and reactions among certain stakeholders. An important variable for monitoring effectiveness in the case of the Sand Engine appears to be the *financial constraints of policymakers*. The fact that the monitoring program is led and almost entirely funded by the RWS implies that the satisfaction of the monitoring needs relies heavily upon the financial situation of the Ministry of Infrastructure and the Environment, whose executive branch is the RWS.

In the case of the SBPSR project the most prominent explanatory variables appear to be the following. Firstly, the most prominent variable appears to be the *flexibility of the monitoring program*. The fact that the project's monitoring arrangements do not ensure efficient and effective funding 'searching and acquisition' mechanisms, is the most prominent problem the project faces, as far as its monitoring program is concerned. Another important variable for monitoring effectiveness of the SBSPR project is the *strength of the link between monitoring results and policymaking*. As mentioned before, part of the funding for the monitoring comes from various regulatory agencies (policymakers). The fact that those agencies face financial constraints aggravates the problem of funding acquisition for the SBSPR monitoring. It is therefore substantial for the project to maintain a strong link between its monitoring results (which reveal needs) and policymakers (i.e. regulatory agencies). That is because, if the regulatory agencies do not maintain an affiliation with the project, therefore being not fully aware of the monitoring needs their willingness to act upon the results is reduced.

8.2 Discussion on the methodology

In terms of methodological impediments this research presents certain weaknesses relating to the shortcomings of the 'most similar' comparative case study design. Firstly, the fact that the number of the units analyzed are two (in this research cases), created a situation where many variables had to be analyzed in a small number of cases. Yin (2009) argues that in order to achieve enhanced validity of the results, more than two cases should be analyzed and also the number of variables under analysis should be relatively smaller. In addition, for this particular research there was an effort to capture the opinions and spectrum of knowledge of the interviewees, but still there are a few considerations that have to be clarified in terms of reliability and generalizability of the results. The wide range of stakeholders and involved parties in both projects implies that choices in terms of

'appropriateness' of respondents had to be made by the author. In other words, due to time and accessibility (to respondents) constraints, the list of interviewees was formulated to a certain degree by the willingness of people involved in the project to respond and discuss with the author about the research. More specifically, in the case of the Sand Engine, where the key stakeholders were the ministerial executive branch of the RWS and the authority of the Province of South Holland, there was difficulty in getting answers. There was only one respondent from the RWS, the communication manager for the Sand Engine, although there has been an extensive effort to obtain knowledge from people working at RWS involved in the monitoring itself. However, the research achieved multiplicity and comprehensiveness by obtaining answers from the Province, and representativeness of opinions from the research institutes involved in the monitoring of the Sand Engine. In the SBSPR case, there were also respondents belonging to parties involved in monitoring as well as in the management team. Due to the extensive amount of stakeholder parties, there was not sufficient time and accessibility to certain people representing stakeholders and their affiliation with the monitoring program of the SBSPR project. Moreover, certain findings of this research apply to projects that are at least partly funded by governmental/policymaking authorities. That is because both ex-post cases were funded by such authorities, therefore, certain data and information steered the research towards that direction in terms of analysis and extraction of conclusions.

Another shortcoming relating to the reliability of the answers given by the interviewees is their affiliation with the central concept of this paper, i.e. monitoring. Due to the fact that specific groups of people were involved in the monitoring of the projects per se, not all the respondents had the necessary knowledge on the monitoring programs of the project, in order to be able to reflect to a sufficient degree on all the questions asked during the interviews. The research managed to extract knowledge and experiences from people and groups involved in the monitoring but not from every group involved in the monitoring programs. This implies that other groups that had affiliation with the monitoring activities of the project could have provided relevant input to the research.

Due to time constraints there was a difficulty to translate Dutch documents referring to specifics about the monitoring program of the Sand Engine, which also entailed technical knowledge. Although there has been enough time to translate crucial information about monitoring aspects, it was not possible for the author to obtain the full spectrum of relevant information, due to language constraints. These constraints did not apply to the SBSPR case, as all the documents available were in English. In other words the availability of documents was not the same for both cases. Therefore, the findings of this research pertaining to the Sand Engine case relied more on the answers of the respective respondents.

8.3 Recommendations for future research

After having reflected on the limitations and main findings of this research, certain recommendations for future research are presented below:

- The research addressed as an important explanatory variable for monitoring effectiveness the *financial constraints of policymakers* in both cases. As mentioned in Chapter 6, financial constraints are expected to affect negatively monitoring effectiveness, also in the BwN project of Marker Wadden, if it does not receive a proper amount of thought and planning. Therefore, it is important to conduct further research on how the negative effects caused by the financial constraints of policymakers on monitoring effectiveness can be avoided. More specifically,

possibilities for proactive planning and designing of more efficient and effective funding 'searching and acquisition' mechanisms can be sought for projects that are partly funded by regulatory/governmental agencies.

- The responses of the interviewees in both cases showed that monitoring programs were initially set up as mechanisms ensuring compliance with legal requirements. However, the research revealed that monitoring, if planned and designed accordingly, can function as a proactive mechanism that can assist in *garnering and maintaining stakeholder interest and support*. An interesting research can provide further insights and the methodological foundation of how such a function of monitoring can be achieved.
- This research has also suggested that collaborative monitoring can contribute to the fulfillment of the monitoring functions in adaptive management of BwN projects. By allowing for and facilitating the participation of stakeholders in the various monitoring processes a shared vision of the project's objectives is facilitated. In addition, the evaluation function is enhanced, as the stakeholders will be closely involved in the project and will be able to deliberate on the degree to which their respective stakes are addressed by monitoring. Finally, monitoring can function promptly as a mechanism for stakeholder support, as stakeholders are designated as parties closely involved in monitoring, therefore being able to see 'first hand' their stakes being accounted for. Therefore, an interesting research might be able to come up with guidelines and knowledge on how collaborative monitoring can facilitate stakeholder support and adaptive management of BwN projects.

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Appendix

MSc Thesis Questionnaire:

The research project I am working on has the title: 'Monitoring arrangements for the adaptive implementation of Building with Nature projects - Important lessons for the adaptive implementation of the Marker Wadden project'. Marker Wadden is a large nature restoration project in the Netherlands. This research focuses on the ***governance*** part of monitoring of Building with Nature projects, and more specifically on the arrangements concerning the interplay among project managers, policy makers, stakeholders, scientists, etc. With your permission I would like to (1) record the interview, (2) send you the interview report with the main parts of the discussion for verification by you.

For the purposes of this research a *monitoring program* is considered to entail the sum of processes of systematic collection, analysis and use of information from (environmental) projects and programs and policymakers. Furthermore, a *monitoring arrangement* is any type of *agreement* in the form of e.g. settlement, negotiation or responsibility appointment that relates to the monitoring processes of a BwN project. For example, a monitoring plan might include an arrangement that indicates the uptake of some monitoring responsibilities by NGOs and others by social groups, Ministries etc. Another monitoring arrangement might indicate the degree and the form of stakeholder involvement in the various monitoring processes of a BwN project. The ex-post cases that will be analyzed in this research are (1) the South Bay Salt Pond Restoration project in US California and (2) the Sand Engine in the Netherlands.

This research will evaluate the monitoring arrangements of the two ex-post cases, based on the hypothesis that traditional monitoring arrangements are no longer sufficient to meet the new BwN challenges. Briefly, the challenges are **(1)** the need to keep track of both nature and human related variables, at various temporal and spatial scales, **(2)** the need to incorporate stakeholders' stakes and concerns in the design of the monitoring plan, **(3)** the need to enhance the link between monitoring outputs and decisionmaking, and **(4)** the need to strengthen the adaptive capacity of the monitoring plan in light of new monitoring needs or legal requirements. For the purposes of this paper, the last three will be addressed, as the research focuses on the development of monitoring arrangements, and not on what type of variables should be addressed in the monitoring plan.

The end product of my research is expected to be ***a set of monitoring arrangements that can facilitate the adaptive implementation of a BwN project*** (and more specifically of the Marker Wadden project). In that respect, the monitoring plans of the ex-post cases will be analyzed in terms of their '***effectiveness', i.e. the degree to which they facilitate adaptive management results***. Certain explanatory factors are believed to influence monitoring effectiveness, and are presented in the table below:

Explanatory variables
Stakeholders' concern integration
Integration of multiple types of knowledge
Communication and cooperation on the monitoring results and needs
Strength of the link between monitoring results and policymaking
Feedback mechanisms on knowledge and monitoring results
Flexibility of the monitoring program

In order to arrive at useful conclusions with regard to monitoring effectiveness, the aforementioned factors have been operationalized (in text).

The aforementioned factors are expected to contribute (to a varying degree) to the fulfillment of four ***effectiveness criteria***, according to which the overall monitoring effectiveness will be evaluated. For example, if all explanatory factors are satisfied, then both criteria are also satisfied. (In that case the monitoring effectiveness would be high). The four effectiveness criteria are:

1. Stakeholders, project managers, scientists reach a ***shared vision*** with regard to the project's objectives of the project at issue;
2. The policymakers are **aware** of the monitoring needs of the project at issue;
3. The policymakers are **willing to act** on the monitoring needs of the project at issue;
4. The monitoring plan has sufficient ***adaptive capacity*** in light of ***new monitoring needs*** and ***legal requirements***

Questions for Interviews

1) Do you believe that the monitoring arrangements facilitated the fostering of a common perception and vision with the regard to the monitoring needs of the BwN project at issue?

i. Were the stakes, interests and concerns of all stakeholders taken into consideration and integrated in the design of the monitoring plan?
ii. Did all the stakeholders participate in the identification of the monitoring needs? Do the stakeholders have any assigned role in the monitoring program e.g. participate in the monitoring data collection (other than expressing their interests and concerns)?'
iii. If I needed to get a picture of the most important stakeholders which people or groups of people should I approach, possibly with opposing views?
iv. Do you believe that all the parties that have a stake were involved in the monitoring design? Is there a specific party that was not involved and you believe that it should have been involved?
v. Was there knowledge input from stakeholders such as residents, local environmental groups etc. in the monitoring design and or in the monitoring in general?
vi. Was there other types of knowledge utilized other than the knowledge that was strictly necessary for the project? If yes, what type of knowledge? Was it useful for the monitoring? Do you believe that such a process helps conciliating conflicting stakeholders' views?

vii. Did the monitoring plan ensure the creation of feedback mechanisms? Is there reflection on the (1) knowledge gained (2) and on the way monitoring tasks are being carried out.

viii. Are there meetings among the involved parties and how often do these take place? In other words, is there consistent interaction among project managers, scientists, and stakeholders about the monitoring results? Do all three groups interact with one another?

2) Did the aforementioned shared vision find fertile ground in decisionmaking?

ix. Were the interests and concerns of the policymakers established in the design of the monitoring plan? Did the policymakers participate in the indicator selection - were they present in the design of the monitoring plan? Do you think that their involvement was both necessary and sufficient?

x. Are the monitoring results directly communicated to decision/policy makers? In what way were they communicated (meetings, reports)? Do you consider that procedure efficient and necessary?

xi. Are the monitoring results 'translated' for the policymakers? I.e. do you think that there was a fast turnover of data information; could monitoring results easily trigger policy reforms?

3) Does the monitoring plan have sufficient adaptive capacity in light of new monitoring needs and/or legal requirements?

xii. Were the monitoring processes institutionalized in the design of the monitoring plan? I.e. were the rights and responsibilities of (1) the project managers (2) the scientists clearly defined in the monitoring plan (e.g. with regard to data collection, process, analysis, use and access)? Was the role of stakeholders defined, i.e. what their involvement entails?

xiii. Was there the opportunity for the various involved parties to express their opinions on the roles they have? (Were the parties actively engaged in the process of responsibilities appointment, did they 'have a say')?

xiv. Do you believe that the appointment of responsibilities was conducted taking into consideration the specific stakes, concerns (and even 'power') of the various involved parties?

xv. Were there arrangements ensuring the redefinition of the involved parties' rights and responsibilities in light of new data and needs? Was there reflection on the appointed roles of each involved party among project managers, scientists, and stakeholders later in the monitoring?

xvi. Did the monitoring plan have 'safety valves' i.e. arrangements that ensure eased adaptation and modification of the plan in light of new legal requirements?

xvii. Were there rigid legal requirements that the monitoring had to follow?