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Governance conditions for successful ecological restoration of estuaries: lessons from the Dutch Haringvliet case

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Ecological restoration projects may provide solutions for degraded ecosystems in estuaries, but are challenging due to complex governance processes. Scientific studies on the latter are limited. The aim of this paper is to provide a better understanding of the governance process aiming at ecological restoration in estuaries. Based on a literature review, five success conditions for ecological restoration projects in estuaries were formulated. These conditions concern: (1) the presence of options for *experimentation*; (2) the use of the right *communication strategies*; (3) a pro-active *role of key individuals*; (4) sufficient *project support*; (5) *active stakeholder and knowledge integration*. These conditions were elaborated upon in a case study on the reopening of the sluices in the Dutch Haringvliet and by conducting seven expert interviews. The case study was a clear "example of failure" due to absence of several conditions. We conclude with some recommendations to enhance future ecological restoration projects.

Keywords: delta area; ecological restoration; estuaries; governance; Haringvliet

1. Introduction

In estuaries, where a river meets the sea, natural processes have created unique dynamic ecosystems. Water within estuaries consists of a mix of salt seawater and fresh water inputs from rivers and precipitation (NWP 2014; Paalvast and Van der Velde 2014). Sedimentation processes, tidal fluctuations and related changing gradients in salinity and turbidity allowed estuaries to develop into valuable natural environments with dynamic ecosystems that provide for a high biodiversity (Paalvast and Van der Velde 2014). Estuaries function as essential locations for the nursery, feeding and reproduction of different species (van Meerkerk, van Buuren, and Edelenbos 2013; Ysebaert *et al.* 2016).

Over the years, estuarine areas have become densely populated and of high social-economic importance (Ducrotoy 2010; NWP 2014). In order to protect people and property against flooding, hard coastal defence structures have been constructed. However, the construction of coastal defence structures has severe ecological

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implications (Airoldi *et al.* 2005; Ducrotoy 2010). Estuarine areas are reduced in size and negative changes have occurred in the natural dynamics of the areas (Ducrotoy 2010; Paalvast and Van der Velde 2014). The ecological zonation in the estuaries (i.e. the division of an estuary into different zones based on variation in environmental factors) is severely affected by the introduction of hard coastal defence structures that close off the estuary from the sea. As a result, estuarine habitats deteriorate due to a lack of connection with the sea and the loss of natural dynamics (Nienhuis 2008; van Meerkerk, van Buuren, and Edelenbos 2013; Ysebaert *et al.* 2016). Hard infrastructural works also prevent the migration of fish species between the sea and the rivers. In order to address these ecological problems, practices that restore the ecological system of these estuaries are considered necessary.

Ecological restoration is defined as "the process of assisting the recovery of an ecosystem that has been degraded, damaged or destroyed" (Wortley, Hero, and Howes 2013, 538). The involvement of humans and their values are implicit fundamentals of ecological restoration (Shackelford *et al.* 2013). Ecological restoration is a management strategy – an intentional and practical human activity – that has the potential to recover degraded habitats and restore natural dynamics in the area (Apfelbaum and Chapman 2015; Friberg *et al.* 2017).

The development and implementation of ecological restoration in estuaries is a governance process, since it involves a wide array of actors, with their own competencies and interests, who interact with each other (Failing, Gregory, and Higgins 2013; Richardson and Lefroy 2016). The governance concept emphasises that competencies are shared between multiple public and private actors, who have an interest in achieving certain outcomes. Issues are not only dealt with by governments; multiple actors at multiple levels are involved and interact with each other to discuss and find solutions (Driessen *et al.* 2012; Knill and Tosun 2012; Richardson and Lefroy 2016). Conflicts of interest, however, may occur – social-economic interests are often preferred over ecological interests – and policy debates may slow down restoration processes (Atkins *et al.* 2011). So far, social and political science has shown limited interest in ecological restoration practices (Marks *et al.* 2014); while literature on coastal and estuarine zones has also examined topics such as management and governance to a lesser extent (Airoldi *et al.* 2005; Elliot *et al.* 2007; Baker, Eckerberg, and Zachrisson 2014; France 2016).

We address this knowledge gap by studying which governance conditions are required for the successful development and implementation of ecological restoration projects in estuaries. We first elaborate on the concept of 'successful ecological restoration' and discuss governance conditions that are found in scientific literature. The literature review resulted in an assessment framework, which is used in a case study on the reopening of the sluices in the Dutch Haringvliet and used as input in expert interviews. In the results section, we analysed the role of our theoretical conditions in understanding the lengthy process of the reopening of the sluices. This is further elaborated upon in the discussion, in which we further reflect on the relevance of the conditions. We conclude the paper with some recommendations for decision-makers that aim to develop and implement ecological restoration projects.

2. Conceptualising the conditions for successful ecological restoration

A literature review of three bodies of literature was conducted to identify conditions that may contribute to the successful development and implementation process for

ecological restoration projects. Firstly, ecological restoration projects in estuaries with coastal defence structures are specific projects that may ask for a certain approach to their implementation; therefore, a specific set of conditions may be necessary for successful implementation. Specific literature on this topic could provide greater insight into these conditions and was analysed. Secondly, literature on ecological restoration projects in aquatic ecosystems was analysed. Lessons may be learned on which conditions are relevant for successful implementation for estuaries as a specific kind of aquatic ecosystem. Finally, several studies on project management were analysed to complement the previously identified conditions with conditions related to implementing projects in general. By reviewing these three types of literature, we were able to study literature that differs from specific to broad, related to the research topic. Relevant papers were found by using (combinations of) keywords ('conditions'; 'implementation process'; 'ecological restoration projects'; 'estuarine areas'; and '(hard) coastal defence structures') to search Scopus, Google Scholar and Web of Sciences. The use of variant terminology for the concepts was accounted for by using alternative key terms with similar meanings. Also, search techniques were used: (1) Boolean operators (AND; OR; NOT; " … "); (2) Truncation (adding a *); and (3) Wildcards (placing a question mark in a search term). We restricted our search to papers published after 2010. The literature was further selected on an analysis of the abstract or the introduction.

2.1. The definition of "successful" ecological restoration

Several authors have defined successful ecological restoration. Wood (2011), however, indicates that similarities can be found in the definitions of successful ecological restoration that scholars apply. The success of ecological restoration projects is, according to Kentula (2000), determined both by achieving desired goals (compliance) and if the project results in a functioning ecosystem (functional). This definition shows similarities with that of both Giller (2005) and Ruiz-Jaen and Aide (2005) who argue that an ecological restoration project is successful if the goal of creating an ecosystem that is robust and self-supporting is achieved. Palmer *et al*. (2005) argue that the success of ecological restoration projects depends on their ability to achieve the goal of replacing the degraded ecosystem with an improved healthy ecosystem that shows signs of self-sustainability. All in all, the definitions argue that for an ecological restoration project to be successful it should be able to achieve the original goals and objectives of replacing the degraded ecosystem by one that is resilient and self-supporting.

Next to ecological success, it is also necessary to take human aspects into account when speaking of success (Shackelford *et al.* 2013; Wortley, Hero, and Howes 2013). Ecological restoration activities are developed and implemented by a process of involvement and interaction of multiple actors at multiple levels with differing interests, creating dynamic governance contexts (Richardson and Lefroy 2016). Ecological restoration may affect the interests of these actors positively or negatively. So, involved actors also need to be satisfied with the ecological restoration projects, as the projects are dependent on their involvement and interplay during the process (Palmer *et al.* 2005). Finally, the implementation of an ecological restoration project can be considered a success when its development and implementation contribute to the existing scientific knowledge and provide for lessons to improve the management of future ecological restoration projects (Palmer *et al.* 2005).

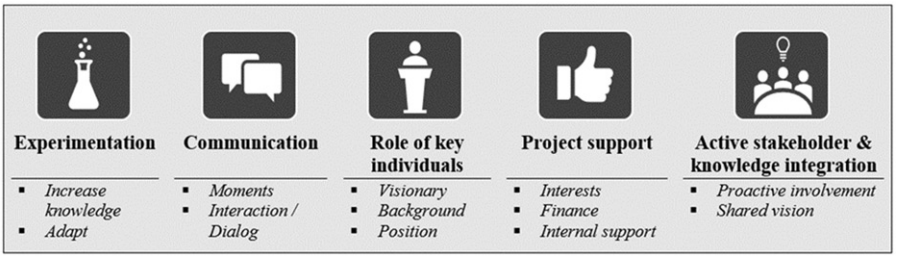

Figure 1. Five theoretical conditions for a successful development and implementation process of ecological restoration projects in estuarine areas.

In short, ecological restoration projects in estuarine areas are regarded as successful when they contribute to a healthy and resilient ecosystem, are backed up by actor satisfaction, and advance knowledge for future implementation processes.

2.2. *Conditions for successful ecological restoration projects*

Several conditions for successful ecological restoration projects were identified in the literature. These conditions are clustered in five categories: (1) the presence of options for experimentation; (2) the use of the right communication strategies; (3) a pro-active role of key individuals; (4) sufficient project support; and (5) active stakeholder and knowledge integration (depicted in Figure 1).

2.2.1. *Presence of options for experimentation*

The idea of allowing experiments is widely discussed in the theory related to ecological restoration projects (e.g. studies on the wetland restoration of Lake Hula (Israel) make a strong case for experimentation). Experiments make it possible to gain context specific information on the ecological processes that will be restored, as well as on the efficacy of the measures (Naylor *et al.* 2012; Zedler, Doherty, and Miller 2012; France 2016; Dawson *et al.* 2017; Evans *et al.* 2017). The results of experiments can be used to *adapt* the restoration accordingly and improve the ability to cope with uncertainty (Carvalho and Fidélis 2013; Wasson *et al.* 2015; Zedler 2017). This means that the process of the estuarine restoration project can be tailored to the situation to increase its effectiveness (Naylor *et al.* 2012; Fidélis and Carvalho 2015; Evans *et al.* 2017; Zedler 2017). The collected evidence can increase actor support for the project and can be used for future projects (Bulleri and Chapman 2010; Naylor *et al.* 2012; Evans *et al.* 2017).

2.2.2. *Use of the right communication strategies*

Communication is considered essential for successful development and implementation of ecological restoration projects. The use of the right communication strategies is necessary to gain project support and stakeholder participation and is key for the exchange of knowledge (Druschke and Hychka 2015; Evans *et al.* 2017). Communication strategies allow the transfer of knowledge to be tailored per actor and situation to clearly explain the development and implementation process. These

communication strategies facilitate formal and informal *moments* of communication between actors (Druschke and Hychka 2015; Dawson *et al.* 2017). The right communication strategy means that stakeholders are able to exchange perspectives, knowledge and interests in a process of *interaction*. They gain the opportunity to engage in *dialogues* that make it possible to recognise mutual interests, to build long-term actor relationships and to create a sense of community (Papke-Shields, Beise, and Quan 2010; Tabish and Jha 2012; Druschke and Hychka 2015; Dawson *et al.* 2017).

2.2.3. *Proactive role of key individuals*

Individuals can play relevant roles during the development and implementation of ecological restoration projects. Their presence can be beneficial for the success of the project when they are able to recognise windows of opportunity to start the implementation process of the restoration project or when they are *visionaries* who are able to translate their vision into practical action (Dawson *et al.* 2017). Key individuals have a professional *background* and have relevant knowledge (Naylor *et al.* 2012; Tabish and Jha 2012; Asad Mir and Pinnington 2014; Wasson *et al.* 2015; Dawson *et al.* 2017; Evans *et al.* 2017; Zedler 2017). Employing key individuals in positions that allow them to be deeply engaged is crucial. They have central *positions* in the network of involved actors and access to key stakeholders. This way they can function as knowledge brokers who exchange knowledge and facilitate interaction (Naylor *et al.* 2012; Wasson *et al.* 2015; Dawson *et al.* 2017; Evans *et al.* 2017; Zedler 2017).

2.2.4. *Sufficient project support*

A fourth condition is the presence of sufficient support for the ecological restoration project. In order to obtain support, the process must show that the benefits of the project are in line with the *interests* of the stakeholders. This will make the stakeholders more willing to cooperate and makes better project execution possible (Naylor *et al.* 2012; Dawson *et al.* 2017). While the delivery of the outcomes needs to be perceived as positive, they also need to occur within an acceptable timeframe and budget. Implementation of ecological restoration projects remains dependent on financial input. Financial resources are essential for an ecological restoration project to deliver change and are regarded as "a vital expression of support" (Dawson *et al.* 2017, 35). Not only do the financial sources help with the execution of the project, they also help to sustain the feeling of forward momentum and legitimacy. Funding of any size from a diverse set of public and private funds is vital for a project (Dawson *et al.* 2017). It is, however, a challenge to obtain sufficient financial support for a longer period. The head of the project needs to be capable of securing and sustaining appropriate funds (Dawson *et al.* 2017). Apart from external support, *internal support* in terms of trained and motivated human resources is also needed (Tabish and Jha 2012; Asad Mir and Pinnington 2014).

2.2.5. *Active stakeholder and knowledge integration*

Finally, it was argued in the literature that to increase the success of ecological restoration projects, knowledge and interests need to be exchanged between experts, and stakeholders need to be proactively integrated into the implementation process. The

latter allows them to share their knowledge, understanding and information on the estuarine area or the project (Wasson *et al.* 2015; Zedler 2017). Stakeholder involvement needs to be facilitated (Dawson *et al.* 2017; Evans *et al*. 2017). Such a *proactive involvement* will be perceived by stakeholders as willingness to collaborate and to allow for non-scientific, practical (local) knowledge. Integration may result in a *shared vision* based on different interests, mutual trust, and a rigorous and transparent implementation process. If stakeholders feel represented, they become more engaged and supportive in the implementation process (Druschke and Hychka 2015; Wasson *et al.* 2015; Dawson *et al.* 2017; Zedler 2017).

3. Methods

To examine in what way our five theoretical conditions matter in practice, an in-depth case study of the Haringvliet (an estuary in the Southwest delta of the Netherlands) project was conducted (Figure 2). Ecological restoration in this project means that a decision is made to partially reverse the enclosure of the estuary.

The case study is based on triangulation of complementary sources: scientific (peer reviewed) literature, policy documents, newspapers and expert interviews. Policy documents provided insight into the governance challenges and stakeholder perspectives. In addition, newspapers have documented the process since the beginning of the 1990s and allowed different stakeholders to voice their opinion.

Figure 2. Location of the Haringvliet in the Province of South-Holland, the Netherlands (Adapted from TUBS 2011).

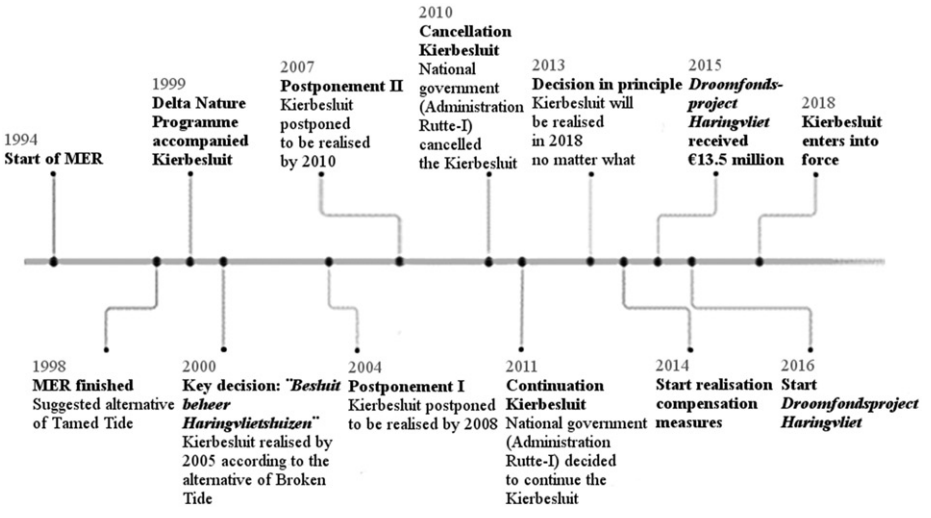

Figure 3. Key Moments in the Haringvliet Project.

The case was first described and analysed in a longitudinal way in order to get a detailed view on the process and its temporal context. Key events were recorded in a timeline (see Figure 3). Next, we analysed in what way our conditions manifested themselves in our case and how this possibly affected the development and implementation process.

Seven semi-structured, in-depth expert interviews were conducted. The experts (researchers specialised in water governance, representatives of the Dutch farmers' association and the regional water company and public servants of the national Public Works Department (*Rijkswaterstaat*) and the Province of South-Holland) not only supplied case-specific information and validation, but also contributed to the research through the supply of relevant and contemporary information on success conditions for the development and implementation of ecological restoration projects. The interviewed experts remain anonymous on request. The experts were selected based on their close relationship to, or involvement in, the so-called "Kierbesluit" (The Dutch words "kier" and "besluit" translate in English respectively to: "a small opening" (a chink) and "decision"). The interviews were held at a location chosen by the interviewee or via telephone. The interviews were converted into transcripts, which were coded and analysed using NVivo software. The codes were based on our theoretical conditions, but also on additional themes identified in the transcripts.

Finally, it is necessary to describe how the comparative evaluation of the conditions took shape. The conditions were systematically judged based on argumentation. The literature did not mention weighting between the conditions. However, during the literature review, several conditions were mentioned more frequently than others; forming the first base for determining importance. Then, by analysing the case study, it became clearer that the absence of some conditions had more impact on the development and implementation process than others. Moreover, the evaluation of the conditions was further subject to the interpretation of the experts. The expert interviews were used as a way of validating the importance of the conditions.

4. Results and discussion

As Figure 3 demonstrates, the restoration of the natural estuarine dynamics in the Haringvliet has suffered from procrastination and shows the difficulties of introducing an ecological restoration activity in estuaries. The case, however, offers the opportunity to better understand the role of the theoretical conditions during the development and implementation of ecological restoration in an estuary by changing the management of a hard coastal defence structure. We will first give an historical overview of the process towards reopening the sluices, to be followed by a clarification of the relevance of our theoretical conditions. In the discussion, we will further reflect on the latter.

4.1. Reopening the Haringvliet sluices as a governance challenge

Being part of the Deltaworks, the Haringvliet was closed off from the North Sea in 1970. The dam not only offered safety against flooding, but also improved the supply of fresh water in the region. Tidal movements and the intrusion of salt water disappeared. The Haringvliet slowly changed into a freshwater basin and a freshwater source for regional agriculture and water companies. The sluices in the dam were only used for discharging water into the North Sea (Smits, Nienhuis, and Saejis 2006; Storm, Kuijpers, and Harmsen 2006; van Meerkerk, van Buuren, and Edelenbos 2013). As a result, the estuarine ecosystem degraded. In the 1990s, as shown in Figure 3, the Dutch national government began to investigate the possibilities of restoring the estuarine dynamics by changing the management of the Haringvliet sluices. In 2018, the Kierbesluit will be implemented.

In 1994, the Dutch government commissioned an environmental impact assessment to study different alternatives for reintroducing estuarine dynamics in the Haringvliet. The report was finished in 1998 and recommended the so-called "Tamed Tide alternative", meaning that the Haringvliet would be in open connection with the North Sea for 95% of the time to introduce small scale tidal dynamics. The sluices would be partially to fully open (from 2,000 m^2 to 6,000 m^2) dependent on the river discharge (RWS 1998). This alternative was chosen in the 1999 draft decision to reopen the sluices. Apart from this, the Ministry of Agriculture, Nature and Fisheries (MANF) wanted to develop 3,000 hectares of additional delta nature in the area by investing €24 million in its Delta Nature programme. The Delta Nature programme led to additional concerns by local stakeholders regarding the loss of land and possible negative effects on the freshwater supply (Marks *et al.* 2014; van Meerkerk 2010). In 2000, the key decision was made to slightly open the sluices five years later. As social support for the far-reaching decision was lacking, a step-wise approach was suggested to change the management of the sluices with, as a first step, the alternative of "Broken Tide" (allowing limited influx of salt water during high tide). Restoration of true estuarine dynamics would be limited, but migratory fish species would be able to pass the dam – which was in line with international agreements made with other Rhine-Meuse countries (Storm, Kuijpers, and Harmsen 2006; van Meerkerk, van Buuren, and Edelenbos 2013; Marks *et al.* 2014;). However, it would take more than a decade before the decision to change the management of the sluices could be implemented (RWS 2016). Apart from the Dutch government, the Province of South-Holland and several environmental organisations favoured the decision. Regional actors (e.g. water authorities, farmers, municipalities, water companies), however, felt that their interests were not seriously considered. In their opinion, the decision would negatively affect

the freshwater supply for agriculture and drinking water and would lead to the loss of good arable land. Regional actors, therefore, demanded compensation measures to safeguard the freshwater supply (such as the construction of a new and adapted regional freshwater infrastructure).

Discontent about the decision and the need to realise compensation measures led to postponements (2004, 2007) and even the cancellation of the decision in 2010. In 2011, following international pressure, the national government decided that the Kierbesluit will be realised by 2018, no matter what. Agreement was found on the realisation of compensation measures. Apart from this, six environmental organisations (*Ark Natuur Ontwikkeling, Natuurmonumenten, Sportvisserij Nederland, Staatsbosbeheer, Bird Watch Nederland* and *WWF Nederland*) started – in collaboration with each other – a nature project to further enhance the ecological restoration of the Haringvliet in anticipation of the opening of the sluices. Their "Dream fund project Haringvliet" was made financially possible through a €13.5 million donation from the Dutch National Postcode Lottery.

4.2. Characteristics of the conditions in the Haringvliet case

4.2.1. Experimentation

Scientific literature regarded experimentation as essential, because it could provide new information and allows the project to progressively change accordingly. To be able to follow such an approach, there should be room within the project to allow experimentation. However, it seemed that the development and implementation process of the Kierbesluit could not take advantage of an experimental approach, as resistance from the stakeholders did not allow the experimentation to take place.

The initial idea of the Kierbesluit was to allow a step wise approach to finally reach the alternative of Tamed Tide (Storm, Kuijpers, and Harmsen 2006). The experiment was to gradually open the sluices – to introduce tidal dynamics and salt water in the Haringvliet – while extensive monitoring would lead to insight into how this would affect the estuary. This would have provided an opportunity to gain knowledge before further opening the sluices. This step wise – experimental - approach was, however, stopped due to a lack of support. The opportunity to learn from the effects per step was no longer part of the process. It even resulted in the less effective intermediate step of Broken Tide becoming the end goal, instead of the alternative of Tamed Tide. The Delta Nature program could be regarded as an experiment to learn more about integrating multiple functions in an area. The supply of fresh water for the drinking facilities and agricultural sector would be transferred via new open canals that would run through the natural area. It was intended to enhance compensation measures in such a way that they would also contribute to the restoration of estuarine nature. The idea, however, did not leave the drawing board due to an increase in complexity and stakeholder resistance. Apart from two practical experiments done in the 1990s (the opening of the sluices during several periods of high tide on a trial basis), of which the second was not fully performed due to pressure from regional stakeholders, experimentation has not played a major role in the process (Storm, Kuijpers, and Harmsen 2006; Bakker and Tromp 2009).

4.2.2. Communication

Overall, communication between the different stakeholders can be characterised as the provision of one-way streams of information instead of a constructive dialogue. The initiating stakeholders, the national Public Works Department and the Province, facilitated moments of communication, but these were arranged to notify regional stakeholders on the state of affairs of the project (van Meerkerk, van Buuren, and Edelenbos 2013). These large-scale meetings on location, however, did not contribute to achieving a constructive interaction process and the atmosphere was mostly characterised by resistance (Expert 5 and 7 2017). Involved stakeholders were also faced with different project leaders and communication advisors during the information meetings. This meant that they continuously needed to re-explain their perspective on the project (Expert 1, 5 and 7 2017). Local stakeholders had the feeling that decisions had already been made and they were only being informed (Expert 5 2017). Moreover, communication developed more towards convincing each other of their perspectives instead of searching for a shared solution (Expert 4 and 6 2017). The exact goal and underlying thoughts of the Kierbesluit were lost in the process. Core aspects of the Kierbesluit needed to be constantly repeated, namely that the safety of fresh water in the Haringvliet was guaranteed, that the salt intrusion would not exceed the promised levels and that the sluices would be closed during heavy storms (van Meerkerk 2010; Expert 3 2017). As a result, a sense of community could not be created.

Eventually, the restart of the Kierbesluit also led to a revision of the communication approach. A more interactive approach was chosen, in which more stakeholders were integrated in the communication process. Representatives of the Province and national government also visited the region to talk directly with stakeholders to better understand their resistance (Expert 4 and 7 2017). Communication also took place outside the formal project setting (Expert 5 2017).

4.2.3. Role of key individuals

For a long time, there were no individuals who were really able to connect the stakeholders by overcoming the differences in perspectives. Several individuals, however, played key roles during the Haringvliet case. The representative of the Province of South Holland at that time, was deeply engaged in the Haringvliet case. As a politician, she knew her way in the divided field of stakeholders and was able to communicate and defend the state of affairs from the perspective of the Province (Bakker and Tromp 2009; Expert 2 and 7 2017). After the restart in 2011, the former Minister of Infrastructure and Environment was determined to realise the Kierbesluit and the compensation measures. The Minister was able to acquire funds for the project and to declare that the Kierbesluit would be implemented in 2018 (Schreuder 2015; Expert 1 2017).

It can also be observed that the setting within some involved organisations changed due to changes in directors or representatives (Bakker and Tromp 2009; Expert 1 2017). An example is the change in the chairman of the regional water authority *Hollandse Delta.* The former chairman was a strong opponent of the Kierbesluit and this influenced the stance of the water authority in the process (Bakker and Tromp 2009; Expert 4 2017). His successor was a former politician who managed - despite his earlier doubts about the Kierbesluit in the House of Representatives - to shift the position of the water authority in favour of more cooperation.

However, what seemed to be missing during the development and implementation process was that there were no individuals who were really able to connect to the stakeholders by overcoming the differences in perspectives.

4.2.4. Project support

The project to change the management of the sluices in the Haringvliet was supported by the national Public Works Department, the Province of South Holland and the environmental organisations, because of the ecological benefits of the project. Support was, however, very low among the regional actors, since the project interfered too much with their core interests. These stakeholders were not able to perceive benefits in the project and felt that the measure was taken at the expense of their own individual interests. The underlying reasons for the ecological restoration were not clear to these stakeholders. From the start of the project, regional stakeholders already gained the feeling that they were not being heard, while the intervention directly influenced their personal interests. Support for the project stayed low and it became very hard to turn this around.

The financial budget of the Kierbesluit was discussed several times. It became part of the trade-offs within the project and came under the influence of political affiliations. The Kierbesluit was accompanied by the Delta Nature Programme. This not only led to an enlargement of the budget, but also to further controversy and an increase in resistance by regional stakeholders; thus further complicating the process. The financial situation became one of the reasons for cancelling the Kierbesluit in 2010. The measure was regarded as too expensive and would not be appropriate in times of governmental budget cuts (van Calmthout 2010; Kuijken 2010; Meerhof 2011; Schreuder 2015). It was, however, also fear of the financial consequences that led to the continuation of the Kierbesluit, because it became clear that the costs of not implementing the Kierbesluit would be very high; the Netherlands were threatened with high financial costs due to international claims and loss of credibility in international matters (Expert 1 2 6 and 7 2017; van Meerkerk, van Buuren, and Edelenbos 2013).

The estimated costs of the project were reduced - when it was decided to continue the process in 2011 - by abandoning the creation of delta nature. This reduced complexity and increased stakeholder support. This then led to new discussions on the realisation of compensation measures, since it became clear that costs would be high if these compensation measures were realised separately. Apart from the national government, the water company and regional water authority also decided to contribute financially, as both would receive some benefits from the measures (Rijksoverheid 2016). The realisation of delta nature was no longer part of the plan, but became possible in 2015 when the Dutch national lottery donated €13.5 million to six environmental organisations to collaborate on an extensive ecological restoration project called the *Droomfondsproject Haringvliet*.

4.2.5. Active stakeholder and knowledge integration

Regional stakeholders were mostly left out of the development and implementation process during the Haringvliet project. This is partly the result of the misconception that when the Province of South Holland was integrated into the project, the region

would also be integrated. The project was developed at provincial level and sent to the region as a set of procedures. For a long time the project was, therefore, mostly based on the vision of the initiating actors without the consensus of the regional stakeholders. This also meant that local knowledge was not incorporated. The project can thus be characterised by a top-down construction, and this was also felt by the regional stakeholders. The result was that regional resistance against the restoration project grew.

4.2.6. Other conditions

Apart from our theoretical conditions, other factors also appeared to influence the project. An extremely warm and dry summer in the Netherlands showed the vulnerability of the country's freshwater supply; this raised questions about the potential role of the Haringvliet in guaranteeing freshwater security (van Meerkerk, van Buuren, and Edelenbos 2013; Marks *et al.* 2014; Expert 2 2017). The realisation of the project also showed a certain dependency on the (international) political setting. The Dutch general elections of 2010 changed the political setting and position of the national government on the Kierbesluit. The national government first decided to cancel the Kierbesluit by arguing that it was too expensive and that societal support was lacking (Atsma 2011; van Meerkerk, van Buuren, and Edelenbos 2013; Expert 1 and 2 2017). A year later, they decided to continue the reopening of the sluices in order to restore the fish migration routes (Expert 1 and 5 2017). This restart was driven by international politics, since the Netherlands had entered into international agreements on fish migration. Diplomatic pressure from other European countries to open the sluices was thus put on the Netherlands. The Netherlands were threatened with high financial costs due to claims and loss of credibility in international matters (van Meerkerk, van Buuren, and Edelenbos 2013; Expert 1, 2, 6 and 7 2017).

Finally, complexity grew during the process when it was decided to increase the scale of the project by integrating other elements, such as the Delta Nature Project (Expert 4 and 6 2017). Resistance against the creation of delta nature negatively influenced the Kierbesluit (Kuijken 2010; van Rijswick 2010; Expert 2, 4 and 7 2017). The complexity was reduced as the Delta Nature Project was left out as part of the restart in 2011. Stakeholder interests were to a lesser extent affected and room was provided for better supported solutions for the supply of fresh water (Expert 1, 5 and 7 2017).

4.3. Discussion

4.3.1. A successful project?

The Haringvliet case provides insights into the practice of ecological restoration projects. We argued that an ecological restoration project is successful when the project contributes to the recovery of degraded ecosystems and leads to resilient ecosystems. Success, however, appeared to be dependent on the temporal scale used. If you look at the whole process of the Haringvliet case, it is clear that this case can be regarded as a key example of how the development and implementation of ecological restoration projects in estuaries can become problematic. However, when one looks at the process from the restart in 2011 and onwards, one sees an improved development and implementation process leading to a better fish passage. Further changes in the ecosystem will only become visible much later. Time is thus a factor to keep in mind in order to determine whether an ecological restoration project is successful.

The case study also shows that ecological interest can quickly become overshadowed by other social-economic interests of stakeholders. Stakeholder satisfaction with an ecological restoration project is, therefore, essential; as also recognised by Palmer *et al.* (2005). Stakeholder satisfaction may, however, also result in watered down compromises. This makes it necessary to look critically at projects that are recognised as successful. Despite this, our case analysis enables us to discuss how the governance conditions should take shape to positively influence the development and implementation process of ecological restoration projects.

4.3.2. Experimentation

Experimentation was discussed in the theory as a relevant condition. The realisation of an experimental approach in practice is, however, difficult; many external influences might interfere with the project. As a result, it will be hard and costly to assess its effectiveness and to draw lessons from it (Expert 2 and 6 2017). More interesting, perhaps, is that in the literature it was argued that an experimental approach could generate knowledge that could support decision-making. This was also a reason why an experimental approach was preferred at the start of the Kierbesluit. The case study, however, showed that such an approach could increase uncertainty in stakeholders about the project as a side effect. For the regional stakeholders of the Haringvliet case, it was not clear what the objectives of the experimental intervention were and what the effects would be. Perhaps the use of the word 'experimentation' had led to feelings that the intervention was not yet fully thought through. The experimental approach led to discontent with the stakeholders about the project; negatively influencing regional stakeholder support. The case study showed that the condition of experimentation should perhaps be addressed more critically as it could have a negative side effect.

4.3.3. Communication

Communication is necessary to understand the different interests related to the project. In the Haringvliet case, an interactive process was missing in which actors could collaboratively work on a shared vision and find solutions for (perceived) problems. Furthermore, the communication was not adjusted to deal with the sentiments of regional stakeholders who began to form a barrier to receiving content information. Thus, the form of the communication process needs to be considered carefully. Experts mentioned that communication should not simply be a one-way transfer of information from initiator to stakeholders: "It is about creating a process of interaction. That is more than just sending information, but also welcoming information and collaboratively working towards a goal." (Expert 4 2017). Communication should take the form of a dialogue in which involved actors all participate on an equal basis. The actors should get to know each other through a process of sharing values, ideas and concerns. The communication is an open and collective exploration to reach a common goal for the restoration project while building on mutual trust (Expert 2, 4 and 7 2017). A promising way to increase such social learning processes is through the use of serious games. This method offers opportunities for stakeholders to express their perspectives on ecological restoration, as well as to experience the perspectives of other stakeholders via interactive multi-player role-game-play (Hoekstra 2012; Zhou 2014; Medema *et al.* 2016). Serious games are seen as appropriate methods, due to

their ability to simulate the dynamic and interactive context with multiple stakeholders and (conflicting) interests that characterise ecological restoration projects, while also being able to deal with the technical-physical aspect related to estuaries (Zhou 2014; Medema *et al.* 2016). These communication methods ask that stakeholders actively participate, interact with other stakeholders and further delve into the fundamentals of the ecological restoration project; thus also contributing to the integration of stakeholders in the project. This example shows that some of our conditions may overlap, or are mutually related.

4.3.4. *Active stakeholder and knowledge integration*

Active stakeholder and knowledge integration is required to secure the inclusion of different interests in the foundation of restoration projects. A lack of integration of stakeholders will result in resistance, as a project will be interpreted as a top-down regulated decision by a group of outsiders: "Local actors experienced it [the Kierbesluit] as a fait accompli – This is what is going to happen – while people felt like they were never involved and never heard." (Expert 6 2017). Or:

> It is necessary to initiate the conversations sooner. When everything is already decided upon, and then afterwards you are going to involve the local actors, you will experience a lot of resistance. But when people can think alongside and contribute to the project, and can benefit from the measures, it will have a positive effect on the project. (Expert 5 2017)

The latter clearly went wrong in the Haringvliet case. Conflicts could have been avoided if a more bottom-up governance structure had been set up at the beginning of the project, such as the sounding boards set up for implementing the Water Framework Directive in the Netherlands (Dieperink *et al.* 2012); or multi-stakeholder dialogues concerning the Dutch Delta program, which include joint fact-finding, joint reviews of measures and providing feedback through information sharing and awareness-raising activities (Hassenforder *et al.* 2018); or even such as the Canadian ALUS Partnership Advisory Committees (PAC) made up of multiple stakeholders (farmers, County Councillors and Agricultural Services Board members, and experts of the government and NGOs) who take decisions on local agricultural restoration projects and have an advisory role within the projects (AEPA 2015). The examples have shown their potential for incorporating stakeholders in practice; thus providing explicit ways of how to give form to a bottom-up governance structure within ecological restoration projects.

One could also assume that the integration of specific stakeholders could have a stronger positive influence on the implementation of an ecological restoration project; that not every stakeholder is perhaps of equal importance for the implementation process. Such a difference between stakeholders was, however, not discussed in the literature analysed. It could, therefore, be interesting to find out which stakeholders are important for enabling the implementation of ecological restoration projects. This could be of particular interest to project leaders at the start of a project.

4.3.5. *Key individuals*

Key individuals, but more specifically the formal position they have, did play a role. A higher and authoritative position provides individuals with power and direct access

to other stakeholders. This became clear in the Haringvliet case. What, however, seems to be more decisive is the personality of the individual, or as one of the experts described it:

> What can matter is if there are people who have a feeling for what is important for the other parties. Someone who is able to make the translation between different perceptions (…) A set of key figures who are able to connect people. That is partly about the design of the process, but that is also about certain individuals who are aware of sentiments in the region. People who are able to understand others and are trusted by the regional actors. (Expert 4 2017)

An individual with the ability to transcend his or her personal vision and the capability to connect stakeholders based on common ground can transform into a catalyst for ecological restoration projects.

4.3.6. Project support

Project support appeared to be very relevant for the success of ecological restoration projects. Other functions of the estuary – and the related spectrum of interests – are always involved during large interventions such as ecological restoration projects. This means that many actors are involved who need to support the project in order to realise it. For a long time, regional actor support was very low in the Haringvliet case, because stakeholders felt that their interests and concerns were not taken seriously. It is, therefore, important that stakeholders feel represented in the project:

> The first basis for successful implementation is that everyone has the idea that they are properly represented in the project (…). That it is a well-supported plan on which all parties agreed upon. And if there are disputes, the parties are able to overcome these in good faith. (Expert 6 2017)

Moreover, the case study showed that ecological restoration projects are also subject to economic interests. Costs are constantly part of trade-offs within a project and, when the costs are deemed too high, even a reason to stop working on the ecological project entirely. The fact that not implementing the Kierbesluit would lead to even higher costs was partly a reason why it was decided to restart the ecological restoration project. It became clear that the finances affiliated with the ecological restoration project can work both as a restraint or an incentive to continue the project.

Finally, the analysis of the Haringvliet case also led to the observation that *external events*, *political setting* and *complexity* can have an influence on the success of ecological restoration projects. These conditions were not extensively discussed in the literature. Further research, for instance through comparative case studies, could provide us with more insights into the relevance and relative weights of the conditions for the successful development of ecological restoration projects.

4. Conclusions

The successful development and implementation of an ecological restoration project appeared to be dependent on the presence of several governance conditions; however,

empirical studies on these governance conditions are scarce. The goal of this paper was, therefore, to find relevant governance conditions that contribute to the successful development and implementation of ecological restoration projects in estuarine areas. Five theoretically relevant governance conditions were identified and assessed against the Dutch Haringvliet case and several expert interviews. Our analysis has contributed to the literature on ecological restoration by providing empirical evidence about the relevance of the theoretical success conditions found. It nuanced their relevance found in theory (e.g. the condition of experimentation) and demonstrated that other conditions, that were hardly mentioned in theory, could also play a role in the success of ecological restoration projects.

It is hard to call the Haringvliet case successful. The absence of the five conditions made the development and implementation of the ecological restoration project challenging. This brings us to the conclusion that ecological restoration projects will have a higher chance of success when the following conditions are met. Firstly, stakeholders need to provide sufficient project support, or else the ecological restoration project runs into a barrier of resistance. In order to gain this support, it is necessary to integrate the stakeholders early on in the development and implementation process: not only to inform stakeholders about the project, but also to introduce an interactive setting in which stakeholders can actively participate in constructive dialogues. We recommend the organisation of multiple interactive workshops or serious games with small stakeholder groups on the project location. A collective exploration of opinions must result in a shared vision of the ecological restoration project.

Secondly, the development and implementation of ecological restoration projects can benefit from support from individuals in key positions. These individuals, however, should be able to step aside from their own perspective and rise above the diverse interests to benefit the project the most. We therefore suggest that independent and trained project coordinators, who are able to keep an overview of the process, are selected for key positions. The coordinator facilitates the interactions, builds trust and tries to suggest win-win proposals.

Thirdly, we recommend undertaking research on the target area prior to the development and implementation process of the project. This is necessary to understand the geographical context and the potential position of local actors. By discovering the underlying sentiment that can be found in the region of the ecological restoration project, it will become possible to anticipate the social-economic dynamics of the area. Moreover, governance and communication strategies can be adapted accordingly, and need to discourage a top-down approach. Knowledge for future ecological restoration projects can be provided by actively monitoring the development and implementation process.

This study confirms that ecological restoration projects are thus governance issues as much as ecological issues. It became even clearer that the (international) political setting influences the development and implementation of large ecological restoration projects. It showed the importance of a comprehensive understanding of the related governance process for the success of ecological restoration projects in estuarine areas. It is, therefore, interesting to further address the questions of how, and to what extent, (international) governance processes and arrangements influence ecological restoration projects, but also how this knowledge can be integrated into the preservation of nature to increase the success of ecological restoration practices.

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