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***An analysis of the Dutch Haringvliet sluices case***

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# Water managers' boundary judgments and adaptive water governance
## *An analysis of the Dutch Haringvliet sluices case*

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**Abstract**

In this paper, we explore how managing actors' boundary judgments influence the adaptability of water governance. We approach this question by examining the relationship between the way water managers frame, and act in, complex water issues on the one hand and develop adaptive water governance strategies on the other. We define four categories of boundary judgments made by water managers in order to deal with the complexities in water governance issues. An in-depth case study analysis of an attempt to adjust the management of the water regime in the south-west Delta of the Netherlands is provided in order to reconstruct the water managers' boundary judgments and their impact upon governance strategies used. We found that, most of the time, the water managers involved predominantly made tight boundary judgments. These tight boundary judgments seemed to hamper the mutual learning process among a variety of stakeholders that is needed to realize adaptive water governance. We argue that wide boundary judgments enhance the chance of realizing adaptive practices and build upon exploration, learning, and connection.

**Keywords**: adaptive water governance; boundary judgments; complex water issues; complexity management

## 1. Introduction

Management of complex water issues is highly challenging, as managers have to deal with both the unpredictability of ecosystems and the complexity of social systems (Huitema et al. 2009). Furthermore, water issues often cross different kinds of boundaries, such as physical and geographical boundaries (e.g. surface and ground water), different administrative and institutional boundaries (e.g. governmental levels and sectors), and social boundaries (e.g. between social and economic groups) (Mostert et al. 2008). In the literature on water management, it is therefore stated that actors have to use adaptive strategies to deal with both the uncertainty of ecosystem dynamics and the social system's complexity (Olsson et al. 2006). Accepting unpredictability, adaptive governance emphasizes learning and flexibility (Foxon et al. 2009).

However, many questions still remain about why certain water governance systems are able to bring such approaches into practice, whereas others are not (e.g. Mostert et al. 2008; Olsson et al. 2006). Reflecting on the realization of adaptive water governance in practice, Pahl-Wostl et al. (2011) note that there is a lacuna in the translation of political rhetoric into change at the operational level. Moreover, Huitema et al. (2009) make the case that "despite its obvious attractiveness as an idea, [adaptive (co-)management] is very hard to introduce and sustain in practice". It seems difficult to implement or manage a transition towards adaptive water governance. The literature on

adaptive governance, addressing the political dimension, pays attention to institutional factors, power relationships, and process conditions in this matter (e.g. Folke et al. 2005; Huitema et al. 2009; Olsson et al. 2006). As changes in water system management regimes touch upon the interests of many actors, this literature shows that, for adaptive water governance, public participation, social learning, and knowledge building among a variety of involved stakeholders are important; thus also addressing questions of legitimacy. This emphasizes both the importance, and the fragility and political character of actors' cross-boundary interaction (Mostert et al. 2008; Edelenbos and Teisman 2011).

Less attention is paid to the way water managers demarcate the complex social-ecological system with which they deal and how they interpret the relevance and impact of the interdependencies they encounter. This is an important aspect to consider, as it influence the process of cross-boundary interaction that emerges in practice (cf. Mostert et al. 2008; Pel and Boons 2010; Pahl-Wostl et al. 2011). In this paper, we elaborate such an analysis with the help of the concept of boundary judgments. This concept emphasizes the unavoidable need and act of actors to draw boundaries around their system of action. It focuses on the way in which actors cope with the complexities of everyday reality by demarcating and making sense of their surroundings (Luhmann 1995). We approach adaptive governance as the way actors respond to dynamics and complexity regarding social-ecological issues (cf. Pahl-Wostl et al. 2007). We focus on the governance process and how managing actors deal in an adaptive way with the dynamics resulting from the unpredictability and complexity of social-ecological systems. The "adaptive" part of the concept recognizes that water management is a complex system that changes over time, such that policies must adjust to new information and insights about dynamic social and ecological processes (Medema 2008).

In the next two sections, we elaborate the concept of boundary judgments. We then use the resulting analytical framework to analyze a case in which water managers tried to change the existing water governance regime in order to give ecological values more weight. However, during the implementation they are confronted with several difficulties, and after more than 20 years a new water governance regime has still not been realized.

## 2 Theoretical framework: boundary judgments and adaptive water governance

### 2.1 Boundary judgments: coping with complexity

The concept of boundary judgments has been developed within critical system thinking, and it refers to the assumptions about what should belong to the system in question and what should belong to its environment (Ulrich 1987). As Pel and Boons (2010: 1251) put it: "Behind any apparently self-evident identification of systems there is judgment, and to be critical means to account for these constitutive 'boundary judgments'." According to Luhmann (1995), drawing boundaries is a way of coping with the complexity of everyday reality, and through these boundary judgments actors are able to make sense of their surroundings. Boundary judgments determine "what is in view and might be taken into account at the moment and what is out of view and thus excluded from consideration" (Flood 1999: 92).

Actors make boundary judgments in order to cope with the complexities in their surroundings, by demarcating what is included or excluded. In the literature on management within complex systems, a distinction is made between complexity reducing behavior versus complexity embracing behavior (Ashmos et al. 2000; Teisman 2005; Uhl-Bien et al. 2007; Edelenbos et al. 2012). Tight (or exclusive) boundary judgments focus on reducing or controlling complexity, whereby complexity is decomposed in isolated parts, and problems in those parts are first resolved in isolation and subsequently integrated with other problem fields (Axelrod and Cohen 1999). It "…helps a manager to restrict his/her actions and attentions to a […] system that can be known and controlled better" (Boons et al. 2009: 248). This means that internal or external dynamics of governance processes should be avoided, because it leads away from initially designed solutions. However, water issues cross all kinds of system boundaries, and tight boundary judgments could prevent the learning and joint knowledge building needed among a variety of actors, as emphasized in the literature on adaptive governance.

Wide (or inclusive) boundary judgments start from a more holistic system approach (Holling et al. 1998) in which the cross-cutting characteristics of complex water issues are taken as the point of departure. Water managers with wide boundary judgments focus on the interdependencies of issues, actors, processes, and structures. This means that managers are oriented towards making meaningful connections (Edelenbos et al. 2012). This could lead to more inclusive water governance processes "…where ambitions and actions can be combined and consensus between possible diverging strategies more easily realized" (Boons et al. 2009: 248).

In order to analyze the boundary judgments of water managers in a systematic way, we have developed an analytical framework in which we distinguish four categories of boundary judgments relating to different dimensions of complexity faced by water managers (table 1).

## 2.2 Four categories of boundary judgments

In dealing with complex water issues, water managers have to make boundary judgments with respect to the substance of the issue at question. Which kinds of aspects and domains are involved? These demarcations could be typified as *substantive boundary judgments*. The choice of values that are considered relevant is important for these boundary judgments. For example, is the specific water issue about realizing ecological sustainability or about economic vitality, or both? Within political processes, substantive boundary judgments are often made explicitly when decisions are made concerning the priority of policy programs and related values; but technical experts examining water issues also make substantive boundary judgments, whether implicit or explicit (e.g. Dewulf et al. 2005; Koppenjan and Klijn 2004).

A second dimension stems from the emergent dynamics during the governance process, resulting from interaction between involved actors (e.g. Ashmos et al. 2000; Koppenjan and Klijn 2004). The way in which stakeholders are involved (the width and depth of participation) influences the governance process (e.g. Edelenbos and Klijn 2006; Raadgever et al. 2008). Water managers make *participation boundary judgments* regarding the involvement of different actors at different junctures (cf. Ashmos et al. 2000). Hence, these judgments are about actors' inclusion in, and exclusion from, the

governance process and the depth of participation, influencing the specific interaction patterns emerging during the governance process.

Although involved stakeholders may come to consensus about the substantive issue at stake, designing and implementing policy measures is certainly not straightforward. A third dimension of complexity in this respect stems from the institutional fragmentation of the water governance system. Especially in more polycentric governance systems (Huitema et al. 2009), this structural complexity is relatively large (cf. Ashmos et al. 2000) as a result of the increasing specialization and fragmentation of the responsibilities concerning water among different organizations and sectors (Edelenbos and Teisman 2011). Furthermore, the cross-cutting characteristic of water issues, including different jurisdictions and institutional domains or sectors, enhances this structural complexity. It often means that cooperation and coordination among a variety of governmental agencies is necessary to realize policy measures. This is challenging, as every pillar often has the tendency to defend its own interest (Edelenbos and Teisman 2011). Regarding this structural complexity, actors make *structural boundary judgments*. Water managers have to make choices about how to organize their activities. These are demarcations regarding the structure of governance processes: demarcations of different phases and elements of a policy process, how these different parts are connected, and which agents are responsible for each part.

These three different dimensions of complexity are oriented towards the internal dynamics within the specific governance process, resulting from the evolution of interpretations, actions, and interactions of involved actors. As complex water issues cross different geographical borders and governance levels, dynamics could also occur in the environment of the project. These external dynamics constitute a fourth dimension of complexity. An example of these external dynamics are so-called change events (e.g. De Bruijn et al. 2002; Teisman et al. 2009), such as abrupt political developments (e.g. changing coalitions), new knowledge concerning climate conditions, or changing conditions of another, but influencing (water) system. These external events could change the scope of the issue or the position of the issue on the policy agenda (Kingdon 1984). Boundary judgments regarding these external dynamics could be typified as *contextual boundary judgments*. Water managers can differ in their (implicit) orientation and behavior to include or exclude developments in the surroundings or context of their project.

----------*Insert Table 1 around here*----------

We stress that in reality these four categories are related. For example, participation boundary judgments also influence the values that are being considered, thereby influencing substantive boundary judgments. In our analysis, we also pay explicit attention to these interrelationships. In order to analyze the boundary judgments of water managers in our case study, we need to further conceptualize and operationalize the four categories of boundary judgments.

## 3 Operationalization and research methodology

### 3.1 Operationalization

On the basis of the distinction between the different categories of boundary judgments, we analyze the case by focusing on the following specific demarcations that actors make. We use a five point scale (from -- to ++) to indicate the tightness or wideness of the boundary judgments:

- To analyze the substantive boundary judgments, we examine the domain demarcations indicating the extent to which different values are included in the project. Tight substantive boundary judgments are made when the project is (mainly) approached and developed from one functional domain, for example water quality. Wide boundary judgments are made when different domains play a significant role in formulating measures;
- To analyze the participation boundary judgments, we examine the demarcations with regard to the actors involved. Tight participation boundary judgments are made when relatively few stakeholders in the policy process are (actively) involved and many are (implicitly) excluded. Wide boundary judgments are made when relatively many stakeholders are actively involved in the policy process;
- To analyze the structural boundary judgments, we examine the demarcations with regard to the different parts of policy processes (e.g. policy development and implementation) and the coordination of actors' responsibilities to act on these parts. Tight structural boundary judgments are applied when the project is divided into clearly separated parts by strictly defined responsibilities. Wide boundary judgments are made when parts of the project and related projects are approached as interacting and co-evolving;
- To analyze the contextual boundary judgments, we examine the way the responsible actors relate the project to its environment. Tight contextual boundary judgments are applied when the project is approached as relatively separate from the context. Developments on other scales are ignored. Wide boundary judgments are made when external dynamics are constantly taken into account. Attempts to connect the project with these external dynamics could easily lead to adaptation of the initially planned course of action.

### 3.2 Methodology

In order to examine the relationship between actors' boundary judgments and their relationship with adaptive governance around complex water issues, we conducted an in-depth case analysis of the decision to change the management of the Haringvliet sluices. It comprises an instrumental case study, in which the researcher uses a specific case to gain more understanding about a particular phenomenon of interest (Stake 1995). The research design of a single in-depth case study does not enable us to develop generalized empirical knowledge about achieving adaptive governance, but it does provide a detailed understanding of how managers' boundary judgments could be related to adaptive governance. The case has not been selected explicitly as an example of adaptive water governance. However, the case is about responding to ecological developments as a result of the policy goal to increase estuarine dynamics in the area. We are interested in whether and how water managers implement adaptive strategies, and to what extent their

boundary judgments relate to these. The case is especially interesting as it already takes more than 20 years to change the water management regime.

Boundary judgments can be reconstructed by 'observation of observations' (Pel 2009: 127). To enhance the internal validity of our research, we used triangulation of research methods and resources: in-depth semi-structured interviews, document analysis, and observations. At time of writing, we have been following the case for more than two years. All relevant written documents were subjected to detailed study, such as policy documents, memos, technical reports, and council minutes. Furthermore, we observed seven meetings between stakeholders and experts concerning the issue. These occasions were used to observe stakeholder interactions and to check our findings derived from the interviews and the document analysis. We interviewed 15 key players who are representatives of the key stakeholders in the project. These interviews lasted two hours on average, and the interview reports were checked and controlled by the respondents. We focused on the boundary judgments of the main managing actors in the case, i.e. a national governmental agency (i.e. *Rijkswaterstaat*: *RWS*), and the regional government (*the Province*), responsible for enabling a change in the water management regime in the Haringvliet estuary. We therefore extensively interviewed these two actors (six interviews). We asked questions regarding the four types of boundary judgments (1) the scope of the issue, the problem to be resolved, and the consequences of possible measures, (2) the interaction process with other actors (e.g. the stakeholders involved, in what way, and on which occasions), (3) the structuring of the policy process, the allocation of responsibilities, and the relationships with other projects, and (4) the external developments relating to the project according to the actors, and what these meant or should mean for the project according to the respondents.

## 4 Case description Haringvliet Sluices

The Haringvliet sluices are part of the Dutch Delta Works built in reaction to the storm flood of 1953. The sluices were finished in 1970 and closed off the Haringvliet estuary from the North Sea. This had major consequences for the surrounding social-ecological system. The closing off led to the disappearance of estuarial tides and turned the Haringvliet into a freshwater lake. This was especially valuable for safety, agriculture, and freshwater supply in the south-west Delta, particularly on the islands of Goeree-Overflakkee and Voorne Putten. On the other hand, the closing off has led toward "a system with generally low natural ecological values [due to] the accumulation of contaminated sediments, disappearance of intertidal areas and nursery grounds for fish, disturbance of fish migration, and less mixing of river and seawater" (Smit et al. 1997).

----------*Insert Figure 1 around here. Caption: Figure 1 South-west Delta Source: Google Maps* ----------

In the 1980s, integrated water resource management (IWRM) was introduced in Dutch water management (Disco 2002; Mostert 2006). With its adoption, national government aimed at "optimal coordination of the wishes of society with regard to the functioning and functions of the water systems … by means of an integral consideration of (these wishes and) the potential of the systems" (Ministerie van Verkeer en Waterstaat

1985 in Mostert 2006: 20). By the time of its adoption, this IWRM approach had a strong ecological emphasis. Disco (2002) speaks of the ecological turn in Dutch water management and the 'ecologization' of Dutch coastal engineering. In line with this changing paradigm on water management, national government started to investigate whether it was possible to change the management of the Haringvliet sluices to restore estuarine dynamics in the Rhine-Meuse estuary in 1988 (see table 2). As a possible opening of the sluices was also considered to be important for the migration of fish as salmon and sea trout, this policy was connected to the Rhine Action Program for Ecological Rehabilitation, started in 1987 by the International Commission for the Protection of the Rhine (Smit et al. 1997).

After an environmental impact assessment, it was decided to open the sluices also during periods of high tides, allowing brackish North Sea water into the Haringvliet system. RWS concluded that the most appropriate policy scenario would be to change the management regime of the sluices in various steps. The first step was to open the sluices slightly (leave them ajar) in 2005. This decision was taken in June 2000 by the minister (henceforth: '*the decision to change the management of the sluices*'). In this way, learning could take place during implementation about how best to achieve greater estuarial dynamics, and the effects for the users and stakeholders could be controlled. Although this first step will not improve tidal dynamics, it was considered to be at least of direct value for enhancing the migration of fish as part of the Rhine Action Program. However, a higher level of salinity has negative consequences for different water system users, such as farmers and water companies. Therefore, two important conditions had to be met: (1) the salt intrusion should not move any further than a specified line and (2) the intakes for water for drinking and agriculture should be relocated before the sluices were opened. In this way, the functionality of the freshwater intakes was secured. RWS focused on realizing the first condition. In figure 2, the imaginary border with regard to the salt intrusion is shown. The Province was given responsibility for realizing the second condition. To meet this condition, freshwater canals have been developed (see figure 2).

----------*Insert table 2 around here*----------

----------*Insert figure 2 around here. Caption: Figure 2 Project Area (Adapted from Province of South-Holland 2010)* ----------

However, during the policy development and implementation of these two conditions, the policy program was confronted with dynamics in the actor environment and in the physical environment that created pressures on the direction, and the aim of the policy program. Ten years after the decision to change the management of the sluices, the policy program was provisionally cancelled in 2011 by national government as a result of a strong regional lobby. However, because of the international agreements on fish migration and possible financial consequences for non-implementation, national government eventually decided to proceed with implementation.

## 5 Case analysis: boundary judgments of managing actors and adaptive governance

In this section, we analyze the boundary judgments of the managing actors: Rijkswaterstaat and the Province. We conclude this section with table 3, in which we provide an overview of the assessment of boundary judgments in relation to the realization or otherwise of adaptive water governance in the Haringvliet sluices case.

### 5.1 Analysis of the substantive boundary judgments

From the beginning, there was high uncertainty and ambiguity about the consequences of changing the management of the sluices. The water system users were critical with regard to RWS' examinations concerning the consequences of the decision. Although the ecological effects were extensively examined, the economic effects were not. For example, it remained unclear what the economic risks of the decision would be for the farmers and drinking water companies.

#### *5.1.1 Rijkswaterstaat*

Within Rijkswaterstaat, we observe a strong domination of water, ecology, and nature protection. In line with the ecological turn (Disco 2002) and the IWRM approach in Dutch water management, the underlying values of nature and ecology have been shaping the decision about estuarial restoration. RWS concentrated heavily on water safety and water quality. Regarding the necessary compensating measures for freshwater on the islands, RWS initially aimed at pipe lines. "*Until 2002 we thought pipe lines on the islands could be used as compensating measures. […] This meant that it would only have been a 'case of water' […] A typical Rijkswaterstaat project.*" (Interview PM 3). Although the effects of the decision for other domains, such as agriculture were examined, they were not incorporated in the policy development and implementation. In this sense, they did not influence the aim and direction of the policy program. This changed in 2003 when it became clear that the project costs were underestimated and regional support for the decision was lacking. Therefore, it was decided to connect the development of the compensating measures with other domains. "*We realized that we couldn't make it by ourselves. We are going to broaden the project. We are going to try to realize the compensating measures in broad area zones by which you could combine natural development, recreation, and water retention. In this way, you could include more financial resources […]. However, it also became far more complex.*" (Interview PM 3).

As Rijkswaterstaat initially considered few domains, but later on more domains were included, we assess the substantive boundary judgments as moderate (+/-).

#### *5.1.2 Province*

In the development of the compensating measures, important criteria for the Province were the consequences for spatial planning and the natural environment. When the Province started to cooperate with the Goeree-Overflakkee Water Board and when

connections were made with the Delta Nature project, water retention and recreation were also included. This led to an integral development plan in which these three values were important drivers. However, the inclusion of agriculture and economic development was avoided, despite initiatives of local stakeholders (i.e. farmers, inhabitants, and municipalities) to realize this. The Province had somewhat conflicting goals in this respect. Because it was their responsibility to realize Delta Nature, there was little room for maneuver according to the Province's project manager: "*Concerning alternatives in the area, there is little flexibility. We want to realize new nature. We are not going to transform existing nature. This automatically means that you have to sacrifice agricultural land*" (Interview PM 5).

In all, the Province had a moderate consideration of domains (+/-), including recreation and water retention, but mainly excluding agriculture and local economic development.

## 5.2 Analysis of the participation boundary judgments

To implement the decision, the initiating parties were dependent on a variety of actors. For example, the water boards are responsible for water management on the islands, and the land is owned by local governments and private users. The relocation of the water intake points therefore needed the cooperation of the water boards, the local governments on the islands, and private owners. These actors had different interests and perceived the decision to change the management of the sluices in different ways. On both islands, there was increasing resistance against the relocation projects and, in the end, also against the decision to change the management of the sluices.

### *5.2.1 Rijkswaterstaat*

The process organized by RWS in the development of the decision (1990–2000) was characterized by a relatively low representation of stakeholders touched by the decision. RWS notes about this: "*The somewhat small regional stakeholder representation was a consequence of the desire to keep the administrative complexity under control*" (Interview PM 1). One formal representative of each group of regional stakeholders was involved (i.e. one dike count for the different water boards and one mayor for the different local governments on the islands). The interaction with these representatives was mainly characterized by informing and consulting. After the decision, there was sporadic interaction between stakeholders and RWS. This interaction was about communication with stakeholders concerning the state of affairs. As RWS notes in this matter: "*After the decision, the communication with the region became less frequent. A decision had been taken, so this was not considered necessary anymore*." (Interview PM 2).

To sum up: the interaction with regional stakeholders was mainly characterized by communication and not co-production. Relatively few stakeholders were actively involved. Therefore we assess the participation boundary judgments as tight (-).

### *5.2.2 Province*

The policy process with regard to the compensating measures on the two islands was characterized by low stakeholder involvement. At Goeree-Overflakkee, there was frequent interaction with only one stakeholder (i.e. the water board). The Province mainly developed the compensating measures internally and translated them into formal procedures that were then communicated to local governments. The local government council (Bernisse) rejected the relocation in 2008. The Province responded by using procedural steering mechanisms in order to bypass the local government. This resulted in further delays, procedural struggles, and juridical conflicts between regional stakeholders and the Province. This changed significantly at the end of 2009 when the Province decided to reconsider the plans. At Voorne Putten, an interaction process with many local and regional stakeholders was set up. There were frequent interactions, and the process aimed to develop a freshwater route, taking into account the regional stakes as much as possible. The location and the form of the freshwater route were developed in co-production between the Province and the regional stakeholders. "*The group [of stakeholders] came together every three weeks till the summer of 2010 [since March]. This resulted in a more positive attitude of the regional stakeholders. […] They are getting the feeling that they are being listened to seriously and they now really do have influence in the planning process.*" (Interview PM 6).

As the involvement of regional stakeholders was initially weak, but changed later on as more stakeholders were included in the planning process, we assess the participation boundary judgments of the province as moderate (+/-).

## 5.3 Analysis of the structural boundary judgments

After delegation to the Province of the task of establishing compensatory measures, there was increasing ambiguity with regard to which governmental organization was responsible for which part of the policy program, and no one was assigned overall responsibility for the program (Kuijken 2010). Furthermore, the relocation of the water intake points interfered with environmental and spatial development projects in the area. For example, on the island of Goeree-Overflakkee, there were provincial nature development projects running in the same spatial area as the planned relocations of the water intake points. This caused ambiguity regarding the relationship between these projects and what they meant for the regional stakeholders.

### *5.3.1 Rijkswaterstaat*

A strong indicator of the structural boundary judgments in the case is the clear subdivision of the program into different subprojects and accompanying project responsibility. Although the administrative agreement between national government and the Province in 2004 stated that the involved governmental actors should cooperate as much as possible, both actors mainly acted on their own until 2010. "*In that period, we were operating at a distance. This was also in line with national policy […]. The […] integral execution of the compensating measures is a responsibility of the Province. […] The position was that we shouldn't interfere in the Province's business. And vice versa, from the perspective of the Province: we don't need any 'busybodies'."* (Interview PM 3). In an evaluation of the project, commissioned by national government, it is stated that

"the complexity of the implementation is underestimated and has increased during the project [implementation]: there is a lack of one party taking responsibility for the overall program. […] The activities of the province and RWS are administratively not well coordinated and managed" (Kuijken 2010: 8). Since 2010, this has been changing. There is now more or less joint responsibility, marked by the involvement of national government in the administrative steering group to realize the compensating measures.

In general, Rijkswaterstaat imposed a very strong division of the project into separate parts/subprojects and responsibilities, although this changed in the end. Hence, tight boundary judgments are made on this category (-).

### *5.3.2 Province*

The Province focused on the development of the compensating measures on the two islands. In the development of the freshwater route on Goeree-Overflakkee, a connection was made with another provincial project, Delta Nature, dealing with wetland development. Thus, an area development program was set up. This coupling remained at project level: it was not addressed in the overall program, although both programs were about enhancing the natural transition in the Delta. As one of the project managers of the Province illustratively notes: "*Delta Nature is a separate project. There is a connection at the northern edge of Goeree-Overflakkee, but the two projects are independent of each other*" (Interview PM 5). Furthermore, inclusion of projects of local stakeholders was avoided or not actively managed. A typical quote is the following: "*Local governments have their own agenda. They wanted to connect their own recreational plan to the area designated for the compensating measures. This was a political issue in the local council and an important reason for rejecting the relocation. We were sucked into a process that we had nothing to do with.*" (Interview PM 5). The Province was focused on realizing her own project and was rather surprised by these local interferences.

In all, the Province made a strong division into subprojects and therefore we assess the structural boundary judgments as tight (-).

## 5.4 Analysis of the contextual boundary judgments

In order to assess the contextual boundary judgments, we identified three concrete external dynamics mentioned by a majority of the respondents as highly important. Firstly, there was a growth of blue-green algae in a connected freshwater basin (Volkerak Zoommeer) (1). As a solution to this issue, it was planned to increase the level of salinity of this water basin. This measure could also affect the level of salinity in the Haringvliet. Secondly, increasing attention was paid to the future availability of fresh water in the Netherlands, as part of the increasing awareness of the climate change issue (2). A national Delta Program was set up, in which freshwater availability was an explicit theme. The decision to change the management of the sluices would affect the availability of freshwater in the south-west Delta. Thirdly, in cooperation with different provincial governments, water boards, and the national government, an integral program with regard to the whole south-west Delta was developed in which freshwater, ecological resilience, and economic vitality were key themes (3). In this cooperation, decisions were

prepared regarding the water governance in the south-west Delta in the near future, but also for the long term. Changes in Haringvliet water governance pose consequences for this integral policy program and vice versa.

*5.4.1 Rijkswaterstaat*

Before the decision to change the management of the sluices was made, developments in, and consequences for, connected water systems and areas were taken into account by RWS. However, once the decision was made, new external dynamics did not influence the direction or aim of the policy. This indicates a tight boundary with regard to the context. Regarding the developments in the Volkerak Zoommeer, one of the respondents notes: "*The developments in the Volkerak have no relationship with the decision to change the management of the sluices. There is a possible leakage of salt water, but that is also the case without the decision to change the management of the sluices.*" (Interview PM 1). After the decision, management focused solely on technical implementation. Connections with emerging policy programs and issues in the environment were not made in a mutual way. The project was framed as conditioning for other policies in the south-west Delta.

To sum up: Rijkswaterstaat was not receptive to external dynamics; therefore we assess the contextual boundary judgments as tight (-).

*5.4.2 Province*

The Province also made tight boundary judgments regarding the relationship between the program projects that it manages and the context. The policy was that connections with other projects (e.g. nature development, recreation) were only allowed if these connections would not slow down the process. This was an important reason for not making a connection with the integral policy development of the south-west Delta.

Overall, the Province had a very closed attitude towards external dynamics; therefore we assess the contextual boundary judgments as very tight (--).

Table 3 provides a summary and assessment of the boundary judgments made by the two managing actors for the four categories.

----------*Insert Table 3 around here*----------

5.5 Boundary judgments and adaptive governance in the case

Our case study reveals that there is little *adaptive* water governance as mutual learning processes between a variety of stakeholders did not take place. The interaction process was highly conflictive. Project management was mainly characterized by tight boundary judgments. RWS displayed a strong focus on ecological values. Because the Province had a strong orientation towards nature development, including with regard to its responsibilities in the Delta Nature program, a strong connection between these two actors was established. However, these rather tight substantive boundary judgments conflicted strongly with the values and interests of regional stakeholders, rooted in

agricultural land use and the protection of freshwater availability. This tension was increased by tight boundary judgments on participation and structure by the managing actors who tried to keep control of the governance process by demarcating the issue, clearly dividing responsibilities and restricting the participation of other stakeholders. Pressures from the environment of the project increased during the implementation process. Non-supportive behavior by important stakeholders, decreasing political support for ecological restoration, and cost overruns brought the project to the edge.

These pressures resulted in an important broadening of the project scope in 2004. RWS and the Province decided to realize the compensating measures in broad area zones by which more functions could be combined. Connections emerged between the Haringvliet sluices project and Delta Nature. More inclusive boundary judgments emerged with regard to substance, although the domain of agriculture was not included in the planning process, despite stakeholders representing this domain being among the fiercest opponents of the project. Furthermore, boundary judgments with regard to structure, participation, and context remained relatively tight, and connections with regional stakeholders and their agendas were not made. Increasing delays, because of procedural struggles between the Province and local stakeholders, resulted in a loose coupling between both projects. The broadening of the project scope was declined.

## 6. Conclusions and discussion

In this article, we examined how water managers demarcate complex water issues. This approach makes it possible to increase our understanding of why certain governance processes prove more adaptive than others. Water managers' specific boundary judgments influence the specific connections in which they invest.

Before drawing conclusions from our research, we want to stress several important research limitations. We are fully aware that care must be taken in generalizing the insights from this case study as it is simply one case in one specific country, i.e. The Netherlands. The specific patterns from the case suggest that the relative dominance of tight boundary judgments was not supportive to the adaptability of the governance process. More empirical research (comparative and quantitative) is needed to provide more evidence for this relationship. Secondly, we did not examine the factors or conditions which were influencing the construction of these boundary judgments. Furthermore, and in relation to this, we did not include (transnational) external factors influencing the adaptability of the governance process in the specific and local project of Haringvliet sluices. For example, as mentioned in our case description, an important factor concerns the international agreements on Ecological Rehabilitation in this respect. These international agreements conditioned the project of changing the sluice management to a large extent and were an important reason why national government decided to continue with the implementation of the decision in 2011 and contributed to the tight focus on ecological restoration. Despite these limitations, we believe that our analysis provides useful new insights into adaptive water governance.

A first insight emerging from the case study is that adaptive water governance seems to be conditioned or hampered by tight boundary judgments. Limiting the scope for decision-making, the level of participation and focusing upon formal competencies

and initial ambitions, conflicts with stimulating or allowing for variety and flexibility. Although tight boundary judgments could reduce feelings of uncertainty or provide a feeling of control for managing actors, they also make the project vulnerable for growing pressures in the project environment, due to conflict and resistance as we have seen in this case.

Boundary judgments regarding substance, participation, structure and context, are important aspects to be considered in achieving adaptive water governance in practice. These boundary judgments are interrelated and can reinforce each other. In the case we observed that actors holding tight boundary judgments around nature development and ecology easily find each other, but mainly excluded other stakeholders with other interests and values. Tight participation boundary judgments increase the chance of fixation on certain solutions or values (see also Termeer and Koppenjan 1997). Tight substantive boundary judgments decreases the potential value for other actors to engage in water governance processes (tight participation boundary judgments).

Tight boundary judgments by organizations initiating and facilitating the process evoke pressures from the environment of the project which destabilize the existing tight boundary judgments and lead to temporarily opening up them. More room is created for participation, and new substance (ideas, interests, etc.). A learning process emerges in which new connections are made and progress in terms of process is made.

However, our final conclusion is that (tight) boundary judgments are rather persistent. When pressures become less strong and complexity as a result of a more adaptive approach becomes apparent and less easily to manage for managers, tight boundary judgments get revived and diminish the explorative and learning focus that is characteristic for adaptive water governance processes. In this sense, broad boundary judgments implies (the need for) connective capacity as the complexity of water issues and governance processes is more embraced (Edelenbos et al. 2012). This is however a very challenging task as making and maintaining connections require specific managerial skills. The literature speaks of boundary spanners: persons who manage the interface between organizations and their environment (e.g. Williams 2002). These are individuals with specific skills, who are able to operate at the boundaries of different (sub)systems. These persons are effective networkers, who understand the social constructions and coding schemes of other actors and institutions. Further research is needed to clarify the relationship between boundary spanning and the occurrence of (wide) boundary judgments. The presence and role of boundary spanners could be an important additional aspect to consider in research on adaptive water governance.

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## Tables

*Table 1 Four categories of boundary judgments*

| **Substantive boundary judgments** | **Participation boundary judgments** | **Structural boundary judgments** | **Contextual boundary judgments** |
|---|---|---|---|
| Demarcations concerning the content. | Demarcations concerning the involvement of actors. | Demarcations concerning the structure of the policy process. | Demarcations concerning the project and its environment. |
| What is the issue about? Which domains and values are included? | Which actors have to be involved, in which way and on which occasions? | Who is responsible for which part and how are the parts related? | Which external developments are relevant? |

*Table 2 Overview of policy and decision-making process*

| **Timeframe** | **Events/marking decisions** |
|---|---|
| 1985-1994 | Ecologization of Dutch Water management. Start of Rhine Action Program. Start of examinations to change the management of the sluices by national government |
| 1994-1998 | Environmental Impact Assessment |
| 1998-2000 | Decision to change the management of the sluices by national government |
| 2000-2004 | Delegation of part implementation program to the Province. Connection between nature development project Goeree-Overflakkee and relocation water intake points |
| 2005-2009 | Rejection of the relocation of the water intake points by Local Governments. Procedural struggles between the Province and regional stakeholders. |
| 2010-2012 | Decision to change the management of the sluices is reconsidered by the national government. Due to international agreements on fish migration, implementation of the decision is continued |

*Table 3 Boundary judgments of the two main managing actors in the Haringvliet sluices case*

| Type of boundary judgment | Rijkswaterstaat (RWS) | Province |
|---|---|---|
| Substantive | • The water system mainly judged from the domains of water and ecology<br>• Later, the domains of water retention and recreation are partly included<br><br>Assessment: +/- | • The freshwater routes mainly considered from the domain of nature development<br>• Later, the domains of water retention and recreation are partly included<br><br>Assessment: +/- |
| Participation | • During the preparation of the decision, stakeholders are consulted<br>• After the decision there is sporadic contact between RWS and regional stakeholders. Interaction is mainly characterized by one-side communication<br><br>Assessment: - | • Until 2009, few stakeholders actively involved<br>• After 2009 process management changed. More intensive interaction process with diverse regional stakeholders to develop the freshwater routes.<br><br>Assessment: +/- |
| Structural | • The project is clearly separated into different parts. RWS demarcated its responsibility around the technical preparation of the sluice management. Communication with the other managing actor (the Province) is weak<br><br>Assessment: - | • Focus on the compensating measures; the realization of the freshwater routes<br>• Later, connections made with other provincial projects in the region. At the end of the process these projects are deliberately uncoupled<br><br>Assessment: - |
| Contextual | • After the decision new developments in the field of water governance in the surrounding area and climate adaptation do not result in any changes of the direction or aim of the project<br><br>Assessment: - | • The project is considered to be a condition for other programs in the south-west Delta area<br><br>Assessment: -- |