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### Governing knowledge

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# 06. CONCLUSIONS AND REFLECTION

## 6.1 The interplay between environmental knowledge and governance

This thesis has investigated the diverse interrelations between environmental knowledge and governance that occur in the context of collaborative governance arrangements. The objective of this investigation has been to identify ways to enable well-informed environmental governance arrangements. The latter signifies arrangements that are able to produce, mobilize, and draw upon the knowledge that is needed for governing human-environment interactions in a sustainable way. This section provides the main conclusions on knowledge-governance interactions that can be drawn from my research. Section 6.2 builds on these conclusions in formulating recommendations on how well-informed governance arrangements may be enabled. Subsequently, section 6.3 reflects on the concepts and theoretical frameworks that have been used in this thesis, after which section 6.4 provides a closing reflection on the generalizability of my findings and directions for future research.

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### 6.1.1 Governance as dealing with conflicts

In all three domains of governance that have been studied in the preceding chapters, governance arrangements have emerged as a way of dealing with conflicts between governmental agencies, environmental protection NGOs, economic sectors, and civil society organizations. These conflicts have concerned different issues and have in part been characterized by different dynamics, but they also show clear resemblances. One common aspect is that they emerged between actors with different normative perspectives on whether particular human interventions in nature are acceptable, and if so, under what forms of regulation and under what conditions with respect to nature conservation.

A second key aspect of the conflicts I have studied is that knowledge has played a prominent role in them in various ways. For one thing, my findings suggest that it can be difficult to mobilize scientific knowledge for environmental governance in situations of conflict. The case of the mussel fishery illustrates that such difficulties may emerge when various actor coalitions with disparate knowledge systems are involved who have conflicting interpretations of the relevance and quality of the knowledge that is available or under development. Furthermore, the cases suggest that knowledge conflicts may come in the form of conflicting assessments of the nature and the gravity of the effects of human interventions in nature such as the effects of the disturbance of wildlife, the effects of shellfish collection

on the seabed, and the effects of sand nourishments on the coastal ecosystem. Moreover, in all three cases knowledge conflicts have played a role that concerned the substantive underpinning of existing policies, regulations and permit regimes. For instance, the mussel fishery permit regime, the designation of closed areas to protect birds and seals, and the execution of the sand nourishment program were all criticized and challenged by societal organizations for being poorly substantiated.

Accordingly, collaborative governance arrangements can be seen as initiatives that aim at dealing with multifaceted disputes that simultaneously relate to knowledge, interests, values, and objectives. My findings indicate that the arrangements I have studied have been quite successful in achieving this aim. An indicator of this success is that in all three cases conflicts between the involved actor groups and organizations have been channeled into collaborations that have existed and functioned for a substantial amount of time. This leads to the question: how have these arrangements managed to deal with these complex normative and epistemic conflicts?

My analysis indicates that the answer to this question lies in a combination of factors. Firstly, in all three cases interactive and participatory forms of governance have been started in which the various governmental and non-governmental actors are actively involved and collaborate on a relatively equal footing. This implies that in these cases settling disputes, solving problems, and making decisions have become joint efforts of negotiation and deliberation in which the interests and perspectives of various concerned actors are included. Secondly, in all three cases working according to a shared set of negotiated agreements has been an important factor in dealing with these conflicts. Notably two types of agreements have been crucial in dealing with conflicts and constituting collaborative processes. In all three cases the actors involved have worked together under the agreement to refrain from using legal means in settling conflicts and to use a deliberative approach instead. Furthermore, they have agreed to work together towards a shared common goal. Examples of such goals include the optimization of sand nourishment regarding nature conservation and promoting a form of recreational boating that combines experiencing and protecting the Wadden Sea. A third factor that has been important in dealing with conflicts is joint knowledge creation, which has occurred in several forms in the three cases. In the case of the mussel fishery, joint fact finding has contributed to creating shared and uncontested knowledge in a strongly polarized situation in which experts were distrusted, research was discredited, and conflicting interpretations of knowledge were abundant. In the case of recreational boating, collaborative monitoring has

for instance played an important role in testing new modes of governance that were proposed as alternatives to contested centralized governance arrangements. In the sand nourishment case, the conflict concerned a perceived lack of knowledge on the ecological effects of sand nourishments. Joint research was formulated and executed to fill various knowledge lacunae and to address the concerns of the stakeholders who had contested this allegedly ill-informed coastal engineering practice. My findings correspond with those of other authors who have indicated the value of joint knowledge creation for enabling collaborations between actors with different institutional backgrounds (e.g., Hegger et al., 2012; Seijger et al., 2013). In the next section I will elaborate further on joint knowledge creation for collaborative governance by highlighting the requirements that collaborative governance processes pose to knowledge creation. For this, I will use the notions of legitimacy, salience, and credibility that were introduced in chapter 4.

### **6.1.2 Knowledge requirements for collaborative governance**

The case studies indicate that it is important that knowledge creation reflects the concerns of the stakeholders involved in a way that is perceived as fair and unbiased. Thus, legitimacy is a key requirement in joint knowledge creation for collaborative governance. Both the mussel fishery and sand nourishment cases indicate that such legitimacy may be achieved by translating stakeholder concerns into research questions, and by actively involving stakeholders in formulating research questions and discussing the results of the joint research or monitoring efforts. However, the involvement of stakeholders in joint knowledge creation may be difficult to sustain, for instance due to shifting priorities and limited time and resources. Consequently, ensuring the commitment and organizing the representation of interested actors seems to be a crucial aspect of building and sustaining the legitimacy of knowledge creation in a collaborative governance context.

The case studies suggest that legitimacy is a particularly important requirement if there are strong conflicts between the normative and epistemic perspectives of various stakeholders. The example of the PRODUS research program on the effects of seabed mussel spat collection illustrates this point. This research project was criticized by environmental protection NGOs for being too one-sidedly formulated from a fisheries perspective and for being biased, in the sense that it was allegedly aimed at legalizing the conventional mussel fishery. For these reasons, the program was

never fully accepted as a legitimate source of knowledge for the mussel transition by all of the parties involved. This clearly contrasts with the research program on ecology-oriented sand nourishment, in which the coordinators managed to achieve legitimacy, for instance by securing the sustained and iterated involvement of the interested NGOs in the formulation and execution of the research. One factor that explains this contrast is that in the sand nourishment case the concerns of the NGOs and the governmental department of Rijkswaterstaat could be reconciled relatively easily, whereas in the mussel fishery case the concerns of the mussel sector and the NGOs were more polarized. This polarization made it more difficult to achieve legitimacy with respect to all concerns.

The case of recreational boating provides a somewhat different perspective on the issue of legitimacy. Unlike the other two cases, in this case environmental protection NGOs and recreational boating CSOs have not primarily been involved as the principals of research efforts or the recipients of the results of these efforts; in this case, the interested parties have been more actively involved as the creators and disseminators of knowledge. This is illustrated by various interactive and self-governance arrangements in which societal organizations have played a key role in the dissemination of knowledge on responsible beaching and in collaborative monitoring of sailing activities on the Wadden Sea. This case suggests that the active involvement of stakeholders in knowledge creation efforts such as participatory monitoring is conducive to the legitimacy of those efforts as it provides a way of including their concerns and perspectives.

The notion of salience signifies the relevance of knowledge to the needs of decision-makers; this may include the responsiveness of knowledge creation to policy- or management-related needs and the capacities to inform or influence policies and management practices. The case studies indicate that in the context of collaborative environmental governance, salience is a broad and multifaceted notion because there are many ways in which knowledge can be relevant to decision-makers or decision-making. For instance, in the mussel fishery case the salience of the monitoring program has been crucial because the decision-making on the advancement of the transition process has depended on ongoing insight into the natural mussel stock and the yield of mussel spat in mussel spat collection installations (MZIs, see also chapter 2). Moreover, the monitoring of invasive exotic species has been crucial for the decision-making on shellfish transports. In the case of recreational boating, the salience of monitoring also played an important role, for instance because closing off areas under the Nature Conservation Act has depended on up-to-date information on the locations of birds and seals. These two cases suggest that salience is

a particularly important requirement in adaptive governance processes that are contingent upon ongoing feed-back between knowledge creation and decision-making. In the sand nourishment case, salience was a key requirement because the research in this case was to provide knowledge on the optimization of the sand nourishment practice with respect to nature conservation.

The sand nourishment case also indicates that salience can be a fluid and negotiable attribute. In this case, the notion of salience in the domain of coastal engineering was reframed by redefining what the decision-making concerning sand nourishments is about; the NGOs introduced ecological considerations that are to be taken into account in addition to geomorphological considerations. Furthermore, this case indicates that in an interactive governance context a substantial overlap between legitimacy and salience can come about, for instance because addressing the concerns of stakeholders may simultaneously improve the substantive underpinning of decision-making and management.

The cases also suggest that the salience of knowledge for interactive governance does not only entail relevance for decision-making, but also practical relevance. In other words, salience does not only encompass the capacity to inform decision-making, but also the capacity to inform practice. This is illustrated by the governance of recreational boating, in which knowledge that enables sailors to sail around on the Wadden Sea in a way that does not disturb wildlife has played a crucial role. This knowledge includes practically applicable knowledge about the behavior of birds and seals, the vulnerability of particular areas at particular times, and ways to prevent disturbances.

The credibility of knowledge creation efforts, like legitimacy, appears to be particularly at stake in cases in which a strong conflict between the perspectives of stakeholders plays a role. Of the three cases covered by this thesis, the controversy on mussel fishery in particular has been a setting in which the credibility of various research projects, reports, and experts has been strongly debated and contested. Such a contestation of credibility also occurred in earlier Wadden Sea-related controversies such as the one regarding the cockle fishery. In the mussel fishery case, credibility became a key issue for several reasons. For instance, the continued existence of the mussel fishery strongly depended on knowledge about its ecological impact, the parties involved had conflicting assessments and interpretations of this impact, and a polarized and politicized situation existed in which scientific experts played prominent and sometimes contested roles. This case suggests that a combination of joint knowledge creation and the involvement of trusted experts can help to deal with such credibility-

related issues. In the sand nourishment case, a somewhat different dynamic emerged with respect to credibility. In this case, credibility was not contested like in the case of the mussel fishery, but it came under pressure due to a strong focus on achieving legitimacy and salience. This case suggests that credibility may be achieved by keeping sufficient focus in order to ensure depth of inquiry; moreover, it may be achieved by making a clear distinction between applied research questions that can be answered in a management-oriented setting, and fundamental research questions that should be addressed in academic research that is more independent of the context of application.

In the environmental management literature that uses the triad of legitimacy, salience, and credibility, the latter term often refers to the scientific quality of the evidence and arguments (Cash et al., 2003: 8086). My findings suggest that credibility may also pertain to whether insights and beliefs are commonly recognized as being factual and valid by the various parties who are involved in collaborative governance. Consequently, building and assessing the credibility of knowledge in collaborative governance arrangements may not only involve considering scientific quality; it may also involve considering whether the knowledge that is produced matches the experiences and factual beliefs of interested societal actors.

### **6.1.3 The coproduction of knowledge and governance**

In this thesis, coproduction has served as a guiding concept in the analysis of the interplay between environmental governance and knowledge. The term coproduction has different denotations in the literature; in this thesis it signifies the ways in which knowledge and governance are created together and have a mutually constitutive relation. In this section I will elaborate on the insights that my research has provided on the coproduction of knowledge and governance in the context of collaborative governance arrangements.

#### 6.1.3.1 SHIFTING GOVERNANCE, SHIFTING KNOWLEDGE SYSTEMS

The results of this research indicate that shifts towards new modes of governance may bring about shifts of knowledge systems in various ways. For one thing, shifts of governance may bring about shifts in the knowledge systems of particular groups or coalitions of actors. A clear example of this is the way in which the knowledge system of the mussel fishery community has shifted over the years. This knowledge system used to have a



strongly traditional and experiential character; it has gradually become more formalized and science-based due to the implementation of fisheries policies and regulations and concomitant research, monitoring, and impact assessments. Moreover, the introduction of the mussel transition has given a new impulse to the mussel fishery knowledge system as it has incited the mussel sector to experiment with new methods of mussel collection and cultivation.

A second way in which shifts of governance and shifts of knowledge systems may go together is that new governance arrangements can set the stage for new modes of creating and mobilizing knowledge that take place in the context of those arrangements. For instance, the mussel transition has provided a setting in which new forms of knowledge creation have emerged such as learning-by-doing and joint monitoring and research that is executed in collaboration between experts, the mussel sector, and the NGOs involved. Moreover, the mussel transition has introduced new research themes such as the impact of new mussel collection methods on the Wadden Sea ecosystem. In the case of recreational boating, a shift towards interactive and self-governance has enabled knowledge exchange between the various actors involved and has brought about an increased prominence of joint knowledge creation efforts such as collaborative monitoring of recreational boating activities on the Wadden Sea. In the sand nourishment case, the collaborative agreement has introduced ecology as a new research theme in the domain of dynamic coastal preservation and has introduced research collaboration between NGOs, experts, and government officials as a new mode of knowledge creation within this domain. In conclusion, the cases suggest that shifts towards interactive governance may both give rise to new themes and avenues of research and constitute shifts to more interactive and participatory forms of knowledge creation. At the same time, these new forms of knowledge creation have also enabled these interactive governance arrangements.

#### 6.1.3.2 MANIFESTATIONS OF KNOWLEDGE AND EXPERTISE IN A GOVERNANCE CONTEXT

The case studies suggest that interactive governance arrangements are not only associated with particular ways of creating and mobilizing knowledge, but also with particular forms and manifestations of knowledge. In the first place, in all cases the creation and mobilization of knowledge have been primarily directed towards political and strategic aims such as improving regulation, executing nature management, settling conflicts between adversarial actor coalitions, and working towards shared objectives

with respect to nature. Therefore, the knowledge creation that takes place in the context of interactive governance arrangements can be understood to be essentially a political and strategic process. Creating knowledge in such a context is primarily aimed at informing practice and getting things done. Consequently, the knowledge that is produced in and informs such governance arrangements has a strongly political-strategic and practice-oriented nature. This form of knowledge differs from much of the knowledge that is produced in academic research, which often has a less explicitly political and practice-oriented nature.

In the second place, much of the knowledge that has informed these arrangements has a local and temporal nature, in the sense that it often encompasses place- and time-specific data, insights, and experiences. For instance, in the context of the mussel transition knowledge has been produced on the development of mussel beds in closed nature restoration areas and on the suitability of specific locations in the Wadden Sea for cultivating mussels and for collecting mussel spat in MZIs. Creating such local knowledge about the development of the mussel stock and the characteristics of particular areas has played a crucial role in the transition process. In the case of recreational boating, creating and disseminating time- and place-specific knowledge about for instance the locations of seal and bird populations and the vulnerability of particular locations in the Wadden Sea area to disturbances has been indispensable for performing adaptive management and self-governance. In the sand nourishment case, the research program focused on local effects of sand nourishments near Ameland; also in this domain, local knowledge has played a crucial role because the adaptive execution of sand nourishments requires ongoing place-specific insight into the erosion of the Dutch coast.

An issue that relates to this prominence of local knowledge is that in the governance arrangements I have studied it has been difficult to produce or apply more generic or fundamental environmental knowledge. The case studies suggest various reasons for this difficulty. For instance, the research on the ecological impact of the conventional mussel fishery in the Wadden Sea has been subject to conflicting interpretations of its relevance, quality, and results. Therefore, it failed to become an undisputed source of knowledge for the mussel transition. In the case of recreational boating there has been an ambition to identify more generic insight into causal relations between recreation, the disturbance of wildlife, and the development of wildlife populations. However, creating such generic knowledge has been hampered by a deficiency of data and a lack of an integrated monitoring system that connects the monitoring of recreational boating to the monitoring of bird and seal populations. In the sand nourishment case, involved

experts have stressed that fundamental research on the ecology of the fore-shore is needed; however, the research program on ecology-oriented sand nourishment has focused on relatively practical and local issues for various reasons. These reasons include a pressure to address a broad variety of stakeholders' concerns, a demand for practically applicable knowledge among involved organizations, and limited time and resources.

A third manifestation of knowledge that has emerged in the three case studies relates to how expertise takes shape in governance arrangements. In all three cases, establishing interactive forms of governance has entailed a manifestation of expertise as something that is not reserved to a select group of scientific experts, but something that is dispersed among the various actors involved. The latter include researchers, civil servants, and the representatives of societal organizations. In all three cases, shifts towards interactive governance have resulted in more active roles of stakeholders in the coordination and execution of monitoring and research efforts; the governance arrangements on which this thesis has focused in part depend on the substantive input of the stakeholders involved. It may therefore be argued that the establishment of interactive governance arrangements has brought about a democratization of expertise; at the same time, the expertise of a diverse group of stakeholders has enabled these arrangements as it has served as an important source of knowledge.

#### 6.1.3.3 KNOWLEDGE AS A CONSTITUENT OF GOVERNANCE CAPACITIES

Chapter 5 has distinguished three types of capacity that are needed in order to perform collaborative environmental governance: regulatory capacity, adaptive capacity, and integrative capacity. Regulatory capacity is the capacity to structure or steer collective action with respect to the environment in desired directions. The case studies suggest various ways in which knowledge may play a role in building and putting into action such capacity. First of all, the knowledge requirements posed by nature conservation legislation may serve as a regulatory instrument in conflicts regarding the utilization and conservation of nature. Of the studied cases this notably has occurred in the mussel fishery and sand nourishment cases. In the former case, a coalition of nature conservation NGOs successfully challenged the mussel fishery permit regime by contesting the ecological impact assessments that supported the fishing permits. This provided them with a strong position of power to instigate a transition towards a mussel fishery with a lower ecological impact. In the latter case a coalition of NGOs incited the governmental department of Rijkswaterstaat to comply with the Nature Conservation Act, which imposed the requirement

to make ecological impact assessments and to use those assessments in the decision-making on the execution of sand nourishments. In this case, ecological research has been used as an instrument to steer the sand nourishment practice in an ecologically more feasible direction. In both these cases, ecological research and impact assessments have been used as regulatory tools for attuning human activities to the objectives of nature conservation. Furthermore, my findings suggest that joint knowledge creation may constitute regulatory capacity for environmental governance. In all three cases, joint knowledge creation has served as a mode of conflict-settling and collaboration that has enabled actors to work together towards shared objectives such as ecologically feasible forms of mussel fishery and sand nourishment. In this sense, joint knowledge creation has been instrumental in governing collective action towards desired directions. Besides joint knowledge creation, monitoring may also serve as a regulatory tool in a collaborative governance context. This is exemplified by the crucial role of the monitoring of invasive exotic species in regulating mussel transports between the Eastern Scheldt and the Wadden Sea. Finally, knowledge may constitute regulatory capacity in the sense that raising knowledge and awareness may serve as a steering mechanism. In the recreational boating case this form of regulation played an important role, as disseminating knowledge among recreational sailors has served as a way of preventing the disturbance of wildlife.

Adaptive capacity is the capacity to gain insight into environmental dynamics and use this insight to adapt or review governance in order to reach desirable human-environment interactions. Adaptive capacity is required in order to deal with the uncertainty and dynamics that are associated with complex and constantly changing natural systems such as the Wadden Sea. One way in which adaptive capacity has been built and put into action in the cases covered by this thesis is by means of processes of experimentation and learning by doing. Examples of such experimental governance include various self-governance pilots and experiments in the recreational boating case and the application of learning by doing as a central principle in the mussel transition. Experimental governance may both enable the renewal and improvement of governance arrangements, and enable achieving a shared goal under conditions of uncertainty and lacking knowledge about how that goal may be reached. The case studies suggest that building adaptive capacity requires flexibility, iterativity, and feed-back loops between knowledge creation and decision-making. Furthermore, the recreational boating case suggests that adaptive capacity may come in the shape of a long-term learning process in which a

sequence of temporary governance arrangements and evaluations results in the renewal of governance.

A third form of governance capacity that was introduced in chapter 5 is integrative capacity, which is the capacity to gain insight in diverging knowledges and normative perspectives and to bridge, connect, or integrate such perspectives. My findings suggest that such capacity is a crucial element of environmental governance, particularly in situations in which there are strong conflicts between the normative and epistemic perspectives of various interested actors. In the cases I have studied, one key way of building and putting into action integrative capacity has been to engage in interactive processes of creating and exchanging knowledge. For instance, in the case of the mussel fishery joint fact finding has produced knowledge that meets the requirements of both the mussel sector and the NGOs involved. In the case of recreational boating, the knowledge exchange and interactive map-drawing in the context of the Pact of Rede have contributed to developing a shared perspective on combining recreation and nature conservation. In the sand nourishment case, joint research with the iterated involvement of NGOs has enabled the integration of an ecological perspective on coastal protection in the domain of dynamic preservation. In all three cases, building integrative capacity started with the acknowledgement that conflicting perspectives existed between interested actors and that it was desirable to reconcile these perspectives. Subsequently, interactive knowledge processes have produced shared knowledge or a shared perspective that bridges or incorporates the concerns of the actors involved. Furthermore, independent experts may play a role in building integrative capacity, for instance by providing reflections on issues and conflicts regarding nature conservation or by reviewing existing knowledge creation efforts. This is exemplified by the review of the PRODUS research on the ecological impact of mussel collection on the seabed (see chapter 2). In this review, an expert committee provided a reflection on the clashing perspectives of the mussel sector and the NGOs involved, and used this reflection to give advice on future avenues of knowledge creation that would meet the concerns of these parties. In sum, my findings suggest that integrative capacity for environmental governance may be constituted both by reflection and interactive knowledge processes among interested actors and by the involvement of independent experts who are able to bridge the perspectives of the involved actors. These findings match those of Termeer et al. (2013) who have argued that organized reflection on the diverging frames of involved actors is essential for building governance capacity.

## 6.2 TOWARDS WELL-INFORMED GOVERNANCE ARRANGEMENTS

From the findings described above it may be inferred that there are some key challenges that need to be dealt with in order to enable well-informed environmental governance arrangements. One of these challenges is to achieve collaboration and collective action towards sustainability in complex social settings that are often characterized by diverging or conflicting perspectives of interested actors. A second challenge is to achieve desirable ecological states in natural systems that are characterized by complexity and dynamics; the impact of human interventions in such systems is often uncertain. Consequently, the question is how to bring about linkages between knowledge and action under conditions of both social and ecological complexity. In other words, the question is how to organize governance arrangements in such a way that they can both accommodate a diversity of perspectives and deal with ecological dynamics and uncertainty. In sections 6.2.1 up to and including 6.2.3, I will formulate recommendations on how to deal with these issues. In section 6.2.4, I will reflect on the contribution of my findings to some current diagnoses and recommendations on knowledge-policy interactions.

### 6.2.1 Use knowledge creation as a key to dealing with conflict

Knowledge disputes often play a central role in conflicts about nature conservation and natural resource management. Consequently, knowledge may also serve as a key to dealing with such conflicts:

- Bringing together the diverging perspectives of various interested actors calls for building awareness of and insight into these perspectives. Consequently, reflecting on diverging knowledge and values with respect to nature should be an organized activity that the participants in a governance arrangement actively engage in. A task for coordinators or facilitators is to see to it that such reflection is built into the governance process as an iterative element.
- Interactive knowledge processes may help to settle conflicts between the actors involved in a governance arrangement. Such processes include the joint creation of new knowledge and the integration and exchange of existing knowledge.
- Legitimacy is a key requirement to knowledge creation for collaborative governance; it is enhanced by giving interested parties active

roles in various phases of the knowledge creation process. These phases may include: formulating research questions, executing research or monitoring, discussing results, and planning and performing evaluations.

- Successful joint knowledge creation requires a pluralistic notion of credibility. It is advisable to look beyond scientific considerations in assessing the factuality and validity of knowledge claims, and to involve the experiences and factual beliefs of the various interested actors in making such assessments.
- Trust and distrust in experts may play crucial roles in interactive knowledge creation. Dealing with knowledge-related disputes between various groups of actors may require the involvement of individual experts that are trusted by all parties involved; alternatively, it may require the involvement of expert committees in which the various backgrounds, worldviews, and knowledge systems of involved actors are sufficiently acknowledged or represented. In either case, it is advisable to involve experts that are empathic to a variety of values and perspectives.

### 6.2.2 Use learning as a key to dealing with ecological complexity and dynamics

My findings suggest the following ways in which knowledge may serve as a key to dealing with the complexity and dynamics of natural systems and with the associated uncertainty of knowledge:

- Dealing with complexity and uncertainty requires environmental governance to be a learning process. One way in which such a learning process may come about is through adaptive management, in which governance is updated and revised on the basis of ongoing monitoring. Adaptive management may come in a variety of shapes and forms, such as adaptive zoning of protected areas, incremental transition processes, and coastal management according to the principle of building with nature.
- A second way of enabling learning is by organizing environmental governance as an experimental process in which new or revised technologies, modes of regulation, or interventions in nature are tested and evaluated before they are fully implemented.
- Both adaptive and experimental forms of governance require the flexibility of governance arrangements and the willingness to reconsider existing ways of governing among interested conservationists,

resource users, and policy-makers. This flexibility may for instance pertain to the methods of transition processes, the way regulations are implemented, and the focus and approach of research and monitoring efforts.

- Adaptive and experimental governance are strongly contingent upon well-functioning feedback loops between knowledge creation and action. Such feedback loops may be constituted by executing pilot projects, performing monitoring that is closely connected to the governance arrangement, using iterative process designs such as stepwise transitions, and building and maintaining networks that facilitate flows of information between researchers, policy-makers, and stakeholders.

### 6.2.3 Build capacity for interactive and adaptive forms of governance

A central theme of this thesis has been how interactive and adaptive governance arrangements emerge and what the roles of knowledge are in this process. My findings indicate that a shift towards such forms of environmental governance is a change process that can be enabled and given shape in the following ways:

- Shifting towards interactive and adaptive governance arrangements requires a reflexive approach to governance. This reflexivity entails the reflection on and scrutiny of the workings and effects of governance and the according re-thinking, renewal, and improvement of governance. In practice, such reflexivity may be enabled by a combination of deliberation, organized reflection, monitoring, knowledge exchange, and evaluation.
- The renewal of governance may also be stimulated by learning from experiences with previous governance arrangements. It is advisable to organize evaluations in which all of the interested actors are involved in both formulating the evaluation questions and in discussing the results and consequences of the evaluation.
- Existing legislations may play crucial roles in enabling changes of governance. For one thing, legal procedures may provide the leverage for starting new governance arrangements and shifting to new modes of governance. Furthermore, the design and implementation of regulations should provide room for flexibility and experiment.
- Engaging in interactive governance may require dealing with power asymmetries between policy makers, conservationists, and the users



of natural resources. This may for instance involve finding a power balance that enables the participation of the various interested actors and the collaboration of these actors towards shared objectives. Collaborative arrangements in which the involved parties agree to refrain from legal actions and to use deliberation to settle conflicts can help to find such a balance.

#### **6.2.4 Reflection on existing diagnoses and recommendations**

I am neither the first to investigate the interactions between knowledge and management of the Dutch Wadden Sea, nor am I the first to formulate recommendations on improving them. As indicated in chapter 1, knowledge management in relation to the conservation and public administration of the Wadden Sea area has been the topic of various advisory and research reports (Adviesgroep Waddenzeebeleid, 2004; Toonen & Staatsen, 2004; Kabat et al., 2009a; Klostermann et al., 2009). Central recommendations in these reports are that the knowledge infrastructure and monitoring of the area should be strengthened, that scientific knowledge lacunae regarding the Wadden Sea should be identified, and that these lacunae should be addressed by programming and executing new scientific research. Moreover, it has been recommended that the coordination, exchange, and interdisciplinary integration of scientific knowledge and research should be improved (Kabat et al., 2009a). In 2008, the Wadden Academy was installed with the task of stimulating the improvement of the Wadden Sea knowledge infrastructure along these lines. Moreover, initiatives have been taken to improve and integrate monitoring in the Wadden Sea area.

The contribution of this thesis to the existing diagnoses and discussions is that it provides an in-depth investigation of how to improve knowledge management in an interactive and adaptive governance setting. My findings suggest that the emergence of such modes of governance necessitates a shift of emphasis in how knowledge management in the Wadden Sea area is reasoned about and organized. Firstly, a shift is needed from a dominant focus on natural scientific knowledge to a more pluralistic notion of the knowledge and expertise that are relevant for the governance of the Wadden Sea. This pluralistic notion includes scientific, local, experiential and practical knowledge, and recognizes the expertise of a variety of actors such as researchers, civil servants, conservationists, and actors who use the resources of the Wadden Sea. Secondly, my findings suggest that the primary focus in knowledge management should not be on what

science may have to offer, but on what governance arrangements need. The latter includes local and practically applicable knowledge and strong feedback loops between knowledge creation and governance. As for this, my findings endorse the necessity of a monitoring system that is tailored to the needs of management practices. Thirdly, attention is needed to the various types of knowledge creation and exchange processes and how such processes may be of value to governance. Such processes include participatory research and monitoring, joint fact finding, and experimental and adaptive management. Knowledge management in the Wadden Sea area may be improved by building the capacity of interested actors and organizations to perform such processes. Finally, the improvement of governance requires reflexivity. The Wadden Sea knowledge infrastructure can facilitate such reflexivity by inventorying and exchanging experiential, reflective, and evaluative knowledge about governance processes.

My recommendations partly correspond with the recommendations of other authors on how to enable joint knowledge creation. For instance, they partly match the recommendations of Regeer & Bunders (2007), who have argued that joint knowledge creation (“knowledge cocreation”) may be enabled by a combination of flexible processes, monitoring, reflection, exchange of experiences, and capacity building for interactive forms of research. Moreover, both Regeer & Bunders and Hegger et al. (2013) have emphasized that creating common ground on problem definitions and frames of reference is conducive to joint knowledge creation. Compared to the work of these authors, my research more prominently spotlights different forms of adaptive and experimental governance as ways of dealing with ecological complexity and dynamics. Moreover, my findings and recommendations more strongly emphasize that processes of joint knowledge creation often take place in regulatory and political settings; accordingly, rules, agreements, legislations, and power dynamics are often influential factors in joint knowledge creation.

Furthermore, my recommendations partly tie in with those of other authors on how to enable the utilization of scientific knowledge and expertise in policy-making. Meffe & Viederman (1995: 331) have for instance argued that scientists who want to translate their knowledge to environmental policy development must adopt a “postnormal approach”, which entails pragmatism, pluralism, the inclusion of social perspectives on nature, and the acceptance of dynamics and uncertainties. Slob & Staman (2012) have urged scientific experts to take account of the diverging values and interests that exist in the social-political settings in which they operate. The recommendations of both Meffe & Viederman and Slob & Staman relate to settings in which clear divisions of roles between experts and

decision-makers exist; the latter authors argue that such divisions should be reinforced. My findings provide a different perspective on the relations between knowledge and policy-making, as they indicate that in an interactive governance setting both expertise and decision-making have a diffuse character and are dispersed among experts, stakeholders, and policy-makers. Consequently, my findings suggest that knowledge creation, deliberation, decision-making, and reflection should be seen as collective actions that take place within governance arrangements and that are performed by heterogeneous groups of interested actors.

### 6.3 CONCEPTUAL AND THEORETICAL REFLECTION

In order to analyze the regulatory and policy-related aspects of the cases, I started out with the concept of policy arrangements as an analytical tool. The policy arrangements theory distinguishes between four dimensions of policy: actors, rules, discourse, and power and resources (Arts et al., 2006). Chapter 2 used these four dimensions somewhat loosely as a heuristic and interpretive framework in order to prevent them from overly pre-structuring the analysis. Given the aim and focus of my research, a drawback of the policy arrangements theory is that it provides little analytical sensitivity to the roles of knowledge in policy or governance. Like other authors before us, this incited us to add concepts pertaining to knowledge to the analytical framework (see also Seijger et al., 2013; Janssen et al., 2015). In this thesis the notion of the knowledge system has served as such a concept. The combination of policy arrangements and knowledge systems has proven useful in analyzing the case of the mussel fishery because it has enabled us to gain insight into both the diverging perspectives of actors involved and the factors that were influential in the establishment of the mussel transition. However, a drawback of this analytical approach is that it fosters a schematic way of thinking in which knowledge and policy are principally treated as separate rather than intertwined entities. In order to overcome this drawback I added the notion of coproduction to the analytical toolkit. Moreover, in the subsequent case studies I shifted to a conceptualization of the governance arrangement as the stabilization of the content and organization of a governance domain. I found this concept to be more useful for studying the roles of knowledge in governance than the concept of the policy arrangement. The latter also focuses on the content and organization of policy, but operationalizes these two elements into four dimensions that make little explicit references to knowledge and how knowledge and policy may be related. Because the concept of the

governance arrangement as the content and organization of governance does not include such an operationalization, it has better suited my objective to do exploratory research on the various ways in which knowledge may be related to governance. A contribution of this thesis to theory development on governance arrangements is that it has provided a detailed account of the various ways in which knowledge may constitute the capacities to perform environmental governance, and therefore may constitute environmental governance arrangements.

A second drawback of the policy arrangements theory from the perspective of my research is that this theory does not distinguish between types of governance. Therefore, an additional analytical lens is needed in order to investigate how ways of governing may shift from one to the other. For this reason I added the framework of modes of governance, which includes centralized, decentralized, interactive, and self-governance, to the analytical framework (Driessen et al., 2012).

This research has focused on collaborative governance arrangements that are related to the Dutch Wadden Sea. These arrangements, notably in the domains of the mussel fishery and recreational boating, have a strongly regional orientation. At the same time, national and international policies and regulations may play crucial roles in the emergence of collaborative environmental governance. The case studies suggest that a multi-level perspective on governance is needed for understanding the emergence and functioning of collaborative governance in protected nature areas. Such a multi-level perspective includes local, regional, national, and international actors, policies, and regulations.

The concept of the knowledge system has been applied in this research as a way of capturing the ways in which knowledge is embedded in social settings and practices. Over the course of the research the conceptualization of knowledge systems has shifted somewhat. In chapter 2 I used the concept to identify how particular communities and groups of actors create and exchange knowledge, and I focused on the content of such knowledge systems in terms of the propositions and truth claims that these groups of actors adhere to. Used in this way, the notion of the knowledge system is useful for gaining insight into knowledge-related controversies between adversarial actor groups by highlighting the different perspectives of these groups. Subsequently, I shifted the focus to the ways in which governance arrangements are informed by particular forms of knowledge and are connected to specific ways of creating and mobilizing knowledge. In chapter 3, I argued that such ways in which governance arrangements are informed can also be seen as knowledge systems.

The case studies suggest that in a domain of environmental governance a multiplicity of knowledge systems may exist that are rooted in communities, coalitions, and governance arrangements. My findings indicate that such knowledge systems may overlap and be interconnected. This is exemplified by the mussel fishery case, in which I identified both community-based knowledge systems and a knowledge system that is embedded in the governance arrangement of the mussel transition. The knowledge systems of the NGOs and the mussel sector feed into the joint knowledge system of the transition, while the latter also provides new insights that feed back into these communities. Consequently, new governance arrangements may both constitute new knowledge systems and create linkages between already existing knowledge systems. From this can be inferred that the knowledge systems in an interactive governance context are likely to be entangled in knowledge networks rather than strictly divided. Furthermore, the findings suggest that such knowledge systems are dynamic, as they for instance may change due to the implementation of new regulations or policies. Finally, the results confirm the idea that knowledge systems in an environmental governance context may comprise various forms of knowledge, such as scientific, experiential, and local knowledge. The implication of my findings for theory development on knowledge systems is that the latter should not be conceptualized as systems that are by definition confined to a homogeneous group of actors; my findings suggest that knowledge systems may be embedded in governance arrangements or other social practices or structures in which strongly heterogeneous groups of actors participate.

The multiplicity of knowledge systems and governance arrangements I have encountered implies that knowledge and governance can be interrelated in various ways. I have for instance identified various forms of knowledge-governance interfaces, such as science-based, adaptive, integrated, and participatory interfaces. My findings indicate that a governance domain may encompass a multitude of knowledge-governance interfaces that accumulate, interchange, and shift in the course of time.

This thesis has employed the concept of coproduction in order to gain insight into the intertwinements of environmental knowledge and governance. Jasanoff has argued that coproduction is not a “fully fledged theory, claiming lawlike consistency and predictive power”, but “far more an idiom – a way of interpreting and accounting for complex phenomena [...]” (Jasanoff, 2004: 3). The open and flexible nature of this idiom has matched my ambition to avoid overly structuring preconceived categories and to attune the conceptual framework to the particularities of cases in order to gain new insights. At the same time, using this idiom of coproduction in

such a flexible way poses the risk of conceptual vagueness and confusion. In the environmental management literature the term coproduction has various distinct meanings. Like me, some authors have used the notion to signify the combined production of knowledge, values, and social order that takes place in the context of governance arrangements or practices (e.g., Muñoz-Erickson, 2014; Wyborn, 2015a); others have used it to signify processes in which actors with different backgrounds collaboratively produce knowledge (e.g., Berkes, 2009; Armitage et al., 2011). It has been argued that these two denotations are quite similar, as the collaborative production of knowledge can be seen as a process in which knowledge and social order are produced together (Hegger et al., 2012). However, I would like to argue that mixing up these two meanings of the term coproduction is uncalled-for because they pertain to distinct phenomena. Rather, it is advisable that research employing the notion of coproduction clearly states which denotation of the term it uses and is specific about what the entities are that are coproduced.

In the introductory chapter, I have distinguished between two theoretical approaches to the interrelations between knowledge and governance. Theories and concepts within the category of divisions predominantly reason about knowledge-governance relation in terms of differences and boundaries; those within the category of intertwinements reason about environmental knowledge and governance as intertwined, amalgamated, or hybrid entities. From my findings it may be inferred that in order to gain insight into the interrelations between environmental knowledge and governance, susceptibility to both divisions and intertwinements is needed. For instance, my findings indicate that dealing with the divisions between knowledge systems and normative perspectives is a central issue in interactive governance arrangements. At the same time, they indicate that knowledge may form an intrinsic and constitutive element of governance in various ways. I would therefore like to argue that further research and theory development should take this duality of knowledge-governance relations (i.e. the combination of divisions and intertwinements) into account.

#### **6.4 IMPLICATIONS AND DIRECTIONS FOR FUTURE RESEARCH**

This thesis has argued that there may be several advantages to interactive forms of environmental governance. For instance, my findings indicate that interactive governance arrangements can be instrumental in settling conflicts between various groups of actors with respect to the environment.

Moreover, such arrangements may enable actors to work towards shared objectives that harmonize the conservation of nature and the utilization of natural resources. Therefore, my findings may be interpreted as recommendations for the promotion and wider implementation of the forms of interactive governance that this thesis has studied. However, there are two issues that call this interpretation into question. Firstly, to what extent are my findings generalizable to other contexts and settings? Secondly, how to assess the desirability of this promotion and wider implementation of interactive governance in protected nature areas?

The issue of generalizability concerns two sets of outcomes in particular. The first set encompasses the insights that this research has produced on the factors and conditions that may be influential in dealing with conflicts and establishing collaborative governance arrangements (see section 6.1). My findings on this matter are likely to be of interest for environmental management practices in various settings. However, the specific context within which the arrangements in the case studies emerged limits the generalizability of my findings. For instance, these arrangements came about in a setting in which both a strong legal nature conservation framework and an extensive research infrastructure were already in place. Moreover, they emerged in a setting that is characterized by a strong tradition of deliberation and network-building between governmental and non-governmental organizations. In settings that lack these contextual factors it will probably be much more difficult to establish the kinds of knowledge-intensive and collaborative forms of regulation and management I have studied. Consequently, a direction for future research would be to investigate what such contextual factors are, how they influence the emergence of governance arrangements, and how they differ between national contexts.

A second set of outcomes that raises questions with respect to generalizability encompasses the recommendations on enabling well-informed governance arrangements (see section 6.2). These recommendations on joint knowledge creation and adaptive and experimental governance may be applicable to a variety of environmental governance domains and practices. However, this applicability is limited by some preconditions. The kind of governance recommended in the above requires a multi-actor setting in which collaboration and deliberation between groups of governmental and non-governmental actors are practically and politically feasible. Moreover, they require room for adapting governance practices and experimenting with new ones. There may be settings in which the existing power structures, policies, and regulatory frameworks do not allow for such adaptation and experimentation.

The issue of desirability concerns both the positive outcomes and the possible downsides of interactive governance arrangements. In this thesis, I have used the notion of well-informed governance as a positive normative concept that refers to governance arrangements that are able to connect knowledge and action in such a way that the sustainable management of nature and natural resources is promoted. However, my findings indicate that it is difficult to say unequivocally whether such governance arrangements are actually able to achieve sustainability. The arrangements I have studied can be argued to promote sustainability in the sense that they have enabled adversarial actor coalitions to work towards shared sustainability objectives concerning the utilization and conservation of nature. However, it remains to be seen whether these objectives will be met in the long run. For instance, the ecological effects of interactive governance arrangements on complex natural systems are highly uncertain. Producing insight into such effects will require sustained monitoring and research.

Some aspects and possible downsides of interactive governance arrangements are in need of further investigation and reflection. Firstly, the case studies illustrate that a tightened up nature conservation legislation in combination with an increasingly interactive governance have put environmental protection NGOs in powerful positions with respect to nature management and have incited governmental organizations to play more facilitating roles. It remains to be seen whether this development is desirable from the perspective of accountability and the democratic legitimacy of nature management. Secondly, the arrangements I have studied rely on the agreement between involved actors to refrain from using legal means in settling disputes. However, there may be several weaknesses to such arrangements, for instance because external actors who do not participate in the arrangement may still take legal steps against decisions made by the participating actors. Thirdly, each of the interactive governance arrangements I have studied focuses on a particular sector and involves a select group of interest organizations that are connected to that sector. Consequently, such sectoral arrangements may induce administrative fragmentation and hamper the integrated management of nature areas. Fourthly and finally, the arrangements on which this thesis has focused display a preference for participatory, negotiated, and management-oriented forms of knowledge production. This raises questions about quality control and the role of independent academic research in environmental governance. For instance, are the independence and quality of knowledge production for interactive governance sufficiently warranted, and what roles can or should academia play with respect to such forms of governance in order to advance its societal relevance?



Consequently, a second direction for future research would be to investigate the sustainability and desirability of interactive governance arrangements from a variety of perspectives that include ecology, legal and democratic legitimacy, the quality of public administration, and the quality and independence of scientific research. Such multidisciplinary research is needed for investigating whether interactive environmental governance will live up to the expectations it has aroused concerning its ability to harmonize society and ecology.



