CHALLENGING BARRIERS IN THE GOVERNANCE OF CLIMATE CHANGE ADAPTATION

G. Robbert Biesbroek

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Abstract

Adaptation is considered to be a necessary response to manage the unavoidable impacts of climate change. Even though societies have always adapted to socio-ecological changes, climate change is expected to require additional adaptation efforts. Examples from policy practice demonstrate that adaptation is not a straightforward, barrier-free process. Removing these barriers is considered a precondition to ensure successful societal adaptation. The burgeoning literature on climate change adaptation has been unable to move beyond itemizing the barriers to adaptation and has developed static and linear views on how to overcome them. This thesis seeks to open-up the black box of barriers in the governance of climate change adaptation by cycling between the empirical manifestation of barriers and the conceptual understanding of barriers so as to develop a meaningful way to analyse them. To this end, a combination of theories is used in a mixed method research design allowing for a robust and diverse exploration of the barriers to adaptation.

To assess what policy actors consider to be important barriers to adaptation, a systematic review method was used to identify what the existing literature describes as barriers to adaptation. Identification of these barriers provided the input for the design and implementation of an online survey to test whether there were similarities and differences in what policy actors considered as most important barriers to adaptation in the Netherlands and United Kingdom. Qualitative comparative analysis was used to formulate and test hypotheses about the role of institutional context in what actors consider as important barriers to adaptation. The results of the surveys show high agreement about the most important barriers, with the discordance between long term impacts and short term politics being the most important in both countries. The other barriers are not specific to adaptation but are considered important because of the conditions that the additionality dimension of adaptation creates.

To unravel the barriers to adaptation conceptually a number of steps was taken. The systematic review results showed that in the adaptation literature there is one dominant set of assumptions about the barriers, what we have called the problem solving lens. The influence of this dominant framing was explored by developing and adopting three alternative theory-driven and empirically-validated lenses to analyse the process of dismantling the Dutch inter-ministerial program 'Spatial adaptation to climate change'. The results demonstrate that different lenses result in both complementary and conflicting views about the barriers to adaptation and the influence barriers had on the process. We adopted the so-called realist perspective and conceptualised barriers to adaptation as simplified social constructs that are created by both academics and policy makers in order to better understand and evaluate the complexities in the governance of adaptation.

By adopting a realist-analytical view, this dissertation also argues that the concept of barriers is of limited value when aiming to explain outcome patterns arising from the implementation of adaptation policies. Recognizing the descriptive limits of existing frameworks on barriers to adaptation, this dissertation proposes a mechanismic framework - consisting of impasses, mechanisms, context, and interventions - that allows for plausible causal explanations about how impasses are reached in the governance of adaptation. To empirically test the framework, process tracing methodology was used in studying the implementation of Water Plazas in Rotterdam. The framework revealed three operative mechanisms that were necessary to explain the occurrence of the observed impasse; the risk-innovation paradox, conflict infection, and frame polarization.

The proposed framework is an important contribution as it offers researchers a way to move away from simply describing the challenges of governing adaptation to explaining those challenges. Additionally, by understanding the operative mechanisms, it open ups new possibilities for practitioners to make strategic interventions.

- I hope this makes you proud -

Acknowledgements

It would be too much of a cliché to begin a dissertation on barriers to adaptation by arguing that completing it has been a journey characterised by encountering and overcoming barriers. So I won't. Instead, I would like to take this opportunity to thank a number of persons who in tangible and intangible ways contributed to this dissertation. Of course, writing a dissertation is a highly individual process that is intended as first step in becoming an independent academic researcher, but it could not have been completed without the invaluable collegial friendships which created an intellectually inspiring environment to work in.

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Over the past five years I have been in the fortunate position to work in two chair groups at Wageningen University: the Earth System Science group and the Public Administration and Policy group. I genuinely believe this collaboration helped me to become a better scientist and I would urge every new PhD candidate to explore similar possibilities. Working in two chair groups also means that there are many colleagues to whom I owe a 'thank you'.

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Writing a dissertation can become all absorbing but who better to remind you of the other important things in life than your family and friends. You have always been there when I needed you most. Special thanks to Mathijs Heitkamp for trying to keep our sports activities part of the weekly routines even when my time was scarse at best.

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CHAPTER 1

General Introduction

1.1. Background and problem outline

In the last decade policy debates about climate change shifted from seeing it as a greenhouse gas emission problem towards the acceptance that some climate change impacts are inevitable and require adaptation (Klein et al. 2007; Swart and Raes 2007; Biesbroek et al. 2009; Jordan et al. 2010; Moser 2011). Although one might argue that societies have adapted to environmental change throughout history, thereby making adaptation nothing new, the current "deliberate and self-conscious" focus on adaptation has created a new political and scientific discourse in responding to future climate change risks (Adger et al. 2009a, p336; Bassett and Fogelman 2013).

Many of the climate risks society faces today, such as extreme floods, droughts and erratic weather events, already demonstrate the recurrent failures in the way existing climate variability is governed (Burton 2004). Arguably, society is even worse prepared for the new risks as a consequence of anthropogenic contributions to climate change. Within the emerging discourse on adaptation, it is argued that "...formidable environmental, economic, informational, social, attitudinal and behavioural barriers to the implementation of adaptation" hamper progress towards the normatively defined goal of successful adaptation to climate change (IPCC 2007c, p19). Barriers are expected to obstruct societal adaptation to such an extent that many efforts might fail altogether. As the World Economic Forum's Global Risk 2013 report observes, global failure to adapt to climate change is the second most important environmental risk and has the highest disruptive societal impact (WEF 2013).

Barriers to climate change adaptation have already been reported from policy practice. For example, international policy debates on climate change have centered around the most vulnerable groups and regions that are unable to adapt to climate change impacts due to low-adaptive capacity (Oxfam 2011). In Europe, the recently launched adaptation strategy (CEC 2013) and background reports (SWD 2013) identify numerous sectoral barriers that might hamper the European Member States

to adapt (EEA 2013). National governments themselves have undertaken efforts to identify barriers to adaptation and have begun to seek ways to overcome them. The Australian Government, for example, issued the Productivity Commission "...to assess regulatory and policy barriers to effective adaptation" and "...to identify reforms that are likely to increase community wellbeing by addressing barriers to effective climate change adaptation." (Productivity Commission 2012, p33 and p36). Especially at local and regional levels where adaptations are developed and implemented in practice the discussions on barriers have gained prominence (ESPACE 2005, 2007). All over the world, governments, public sector agencies, businesses and individuals are starting to use multi-stakeholder platforms, workshops, and participatory methods to raise awareness and identify the barriers to adaptation (Barnett et al. 2013; Mukheibir et al. 2013).

In parallel to these policy responses, the discourse on adaptation has enthused scholars to study the many dimensions on adaptation to climate change, including the barriers to adaptation. However, emergent scholarship has thus far hardly been able to progress beyond describing barriers as isolated entities, or black boxes, in the process of developing and implementing climate change adaptation policies and measures. Important questions about what these barriers are or how barriers are conceptually linked to the decision making process, remain unanswered. Answers to these questions are vital to provide meaningful policy to overcome the barriers and progress in the adaptation process (Willows and Connell 2003; Clar et al. 2013) and will also support studying the policy dimensions of adaptation. Opening up the black box of barriers to adaptation is the objective of this dissertation. The remainder of this chapter presents the research strategy adopted in this dissertation, which cycles between empirical evidence on barriers to adaptation and existing theories on governance, public policy, and complex decision making. Section 1.2 discusses the key concepts used in this dissertation: the governance of adaptation, the current conceptualization of barriers to adaptation, and two types of frameworks that have been used to analyse barriers in governance processes. Section 1.3 expands on the objective of this dissertation and presents the research questions. Section 1.4 provides an overview of qualitative and quantitative methods that have been used to better understand the barriers to adaptation. This is followed by section 1.5 describing the structure of this dissertation.

1.2. Barriers in the governance of climate change adaptation: key concepts

Adaptation to climate change can be defined as the "…adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities" (McCarthy et al. 2001, p982). Adaptation includes physical measures and social change, may be purposefully planned or may evolve autonomously, can be localized or widespread, can focus on short term decisions or can have a long term scope (Smit et al. 1999). In the past, adaptation has predominantly been investigated as technical and natural scientific problem which is assessed through deterministic methods aiming to quantify climate change impacts and vulnerabilities (Pielke Jr 2005; Pielke Jr and Sarewitz 2005). It is

increasingly recognized that adaptation is as much a social process (Wolf 2012); people adapt in diverse and complex ways depending on their subjective, situated, and normative interpretations of climate change as problem, how they believe climate change threatens what they value, whether they are enabled or constrained by the situated context, if they believe to have the capacities and skills, and if they are willing to meaningfully engage in climate change adaptation (O'Brien and Wolf 2010; Adger et al. 2012). Significant differences in the perception of actors may exist which is, in turn, influenced by social networks and formal institutions. In understanding adaptation as social process there is an important role for governance (Dovers and Hezri 2010).

1.2.1. Conceptualizing the governance of adaptation

Governance can broadly be understood as ways of steering and management of parts of society in response to the emergence of societal problems (Pierre and Peters 2000; Rhodes 2007; Torfing et al. 2012). Governance has a long history and, over the years, the term has collected a wide variety of meanings. The term governance is often used as it has a positive connotation to which high expectations are easily attached. It is considered to be a modern concept that increases public legitimacy (Pollitt and Hupe 2011; Torfing et al. 2012).

Broadly speaking, two main understandings are present in the literature on governance: the mono-centric and polycentric types. Mono-centric governance refers to the process in which the state as a functional unit is dominant in hierarchically controlling and steering society, setting the societal and policy agenda, managing public goods through providing resources and legislation, and implementing top-down policies (Termeer et al. 2010; Aligica and Tarko 2012). This is sometimes called command and control governance (Kooiman 1993), or state governance (Considine and Lewis 2003). Mono-centric governance is frequently found in adaptation practices; Castán Broto and Bulkeley (2013, p100) found that 66 per cent of the 627 analysed urban climate change experiments were initiated by governments and more than half of these initiatives were undertaken by a government without other partners. Contrastingly, polycentric governance refers to situations where many different centers of decision making exist that, although independent from each other, are connected by shared institutional settings (Ostrom 2010). This view is central in the theories on policy networks (Börzel 1998), network governance (Torfing 2005), and multi-level governance (Hooghe and Marks 2003). Proponents argue that states nor markets are able to resolve the increasingly complex and multi-layered societal problems on their own and both become increasingly dependent on non-governmental actors (Pierre and Peters 2000). Governments still play an important role, for example by initiating, coordinating or facilitating the governance of adaptation (Lund et al. 2012). Governance studies have not produced a generally accepted model for studying policy processes but rather consists of a large body of literature divided into many schools and sub-schools (Torfing et al. 2012). This dissertation therefore refers to governance as the empirical observation of mono-centric or polycentric ways of steering and managing society towards adaptation.

Literature on governance explores the substantial challenges that emerge as a result of how governance is arranged. Mono-centric studies stress, amongst others, the challenges of authoritative decision making, technocracy and bureaucracy, and the inability of governments to innovate and change society (Pierre and Peters 2000). Polycentric studies stress, for example, the challenges caused by interdependency of decisions across levels of governance, or the unclear division of tasks and responsibilities between actors (Jessop 1998; Koppenjan and Klijn 2004).

The new scientific discourse on climate change adaptation considers the governance of adaptation to be particularly challenging. This is a consequence of the additionality dimension of climate change adaptation: those additional efforts that are intentionally made due to the projected impacts of the anthropogenic contributions of climate change (Dupuis and Biesbroek 2012). This suggests that, in addition to "ordinary" barriers in the governance process, specific barriers to adaptation might arise as consequence of the attributed uniqueness of climate change risks. Four characteristics of climate change adaptation are important to consider:

1. *Climate change adaptation is a way to respond to a scientifically constructed societal problem.* This is based on the understanding that only through model projections we are able to assess the scope, rate and direction of future long term climate change and to take into account the anthropogenic contributions to climate change (Demeritt 2001; Jasanoff 2010). This makes climate change adaptation ontologically complex and epistemologically distant (Carolan 2004; Esbjörn-Hargens 2010). Anticipative and planned adaptation is, therefore, dependent on the trustworthiness of knowledge; yet there remain inherent uncertainties in climate change projections that in many cases are perceived as a barrier to adaptation, but see Dessai et al. (2009). Such a knowledge driven topic can result in controversies about the legitimacy and credibility of the scientifically constructed knowledge (Hulme 2009; Weichselgartner and Kasperson 2010; Hoppe et al. 2013). Moreover, the understanding that there are limits to scientific projections implies that flexibility as well as robustness are important criteria to deal with unknowable unknowns (Pawson et al. 2011; Termeer and van den Brink 2013).

2. *Climate change has the characteristics of a 'wicked' societal problem.* Climate change risks cannot be solved through science or technology only, because of the contested nature of the problem. There are no agreed-upon framings of the problem as these are ingrained in, and the consequences of, dynamic, multi-layered social and cultural processes. For problems such as climate change, any action taken to address the problem inherently means changing the problem definition, thereby creating a continuous spiral of change (V. A. Brown et al. 2010). Because of the impact of each decision and the fast changing context, learning from past solutions through trial and error becomes nearly impossible. There cannot be a best or optimal solution, only hints of better or worse responses. These problem characteristics make decisions about adaptation notoriously difficult (Weber and Khademian 2008; Lazarus 2009; Levin et al. 2012; Termeer et al. 2013).

3. *Adaptation is a boundary spanning issue that is characterized by fragmentation and multifacetedness.* The impacts of climate change cross traditional boundaries, existing institutional structures, routines, policy arena's, networks, scales, and jurisdictions (Jochim and May 2010; Juhola and Westerhoff 2011). Governance of adaptation involves many different actors and becomes fragmented because of self-regulating tendencies of the existing institutional setting. This is strengthened by the advocated mainstreaming approach in existing, vulnerable policies and practices, where concerns are raised about fragmented responsibility and authority to engage in adaptation across sectors and scales (Yamin 2005; Kok and de Coninck 2007). These in turn incite new interdependencies between sectors and institutions and construct new partnerships, governance arrangements, and instruments to govern adaptation, therewith creating a complex institutional setting (Adger et al. 2009b).

4. *Adaptation is a continuous process of change without a clear goal or end state.* Adaptation is dependent on and adjusted through the properties emerging from the problem while the problem itself is displayed in an erratic and situated fashion. As such, there is no clear beginning or end nor a single pathway to achieve the normative goal of successful adaptation (Adger et al. 2005). Moreover, what terms like well-adapted, robustness or climate proofing mean is hardly explicit. Adaptation essentially means to bring about change, but most societal systems are renowned for their resistance to change, especially in situations where the reasons for change are not self-explanatory or even controversial (Duit and Galaz 2008). In the absence of goals the direction of change also becomes problematic. Consequentially, decision making on adaptation is suggested to focus on short term decisions that take into account the long term perspective (Underdal 2010), whilst simultaneously trying to prevent that the measures are maladaptive (Barnett and O'Neill 2010) and to prevent future lock-ins in decision making.

The characteristics of the governance of adaptation and the observations in policy practice that adaptation is no barrier free process has already induced several other studies into the barriers to adaptation.

1.2.2. Conceptualising barriers and limits to climate change adaptation

The literature on the governance of climate change adaptation is rather ambiguous in terminology; for example, many studies use the terms "limits" and "barriers" interchangeably although differences also exist in the literature. Limits can refer to either the biophysical limits that are insurmountable and inherent to the system (Dow et al. 2013), or to social limits that emerge from within the social system that are "mutable, subjective and socially constructed" (Adger et al. 2009a, p338). Social limits are "...the conditions or factors that render adaptation ineffective as a response to climate change' (Adger et al. 2007, p733; Hulme et al. 2007). They constitute the physical or social thresholds, or tipping point, beyond which intolerable losses are expected or experienced (Dow et al. 2013) and require more than incremental changes in the physical or social systems (Kates et al. 2012; Rickards, 2013). Barriers can be defined as the consequence of "...action in financial, cultural and policy realms that raise questions about the efficacy and legitimacy of adaptation as a response to

climate change" (Adger et al. 2007). What is considered to be a barrier ultimately depends on the goal of adaptation. Because each context will bring its own goals and contextual conditions, barriers are expected to differ from place to place, from sector to sector, and change over time (Barnett 2010). It is argued that barriers can be overcome if sufficient skills, creativity, resources are available or when sufficient efforts are made.

Chapter 17 of the IPCC-AR4-WGII provides several examples of barriers to adaptation. At the level of the individual, emphasis is on the cognitive, motivational, and behavioural constraints that persons encounter and that, in their opinion, hamper meaningful engagement in climate change adaptation (Grothmann and Patt 2005; Lorenzoni et al. 2007b; Swim et al. 2009). On the one hand, if people do not feel that climate change threatens what they value, there is no incentive to adapt. On the other hand, too much perceived climate change risks may also lead to fatalism and inaction (Weber 2010; Gifford et al. 2011; Stern 2011). At the governance level, various examples of barriers are identified as well; for example, existing institutional structures can constrain the efforts of those that are willing to adapt; considerable uncertainties and knowledge gaps exist in climate projections which hampers decision making; limited awareness of the public and policy makers exists about long term climate change risks; a lack of government involvement in coordination and support of adaptation can limit progress.

Thus far scholarship on barriers to adaptation has not been able to go beyond the shorthand descriptions of barriers presented above, which only scratch the surface of the complex and dynamic underlying social processes. Few studies exist that conceptualize barriers in the governance of adaptation in more detail or that try a thorough empirical analysis of barriers that goes beyond the situated and inductive.

1.2.3. Conceptualizing the policy process: stage models and processual models

At the start of this dissertation, in 2008, no frameworks to study barriers to adaptation existed. Frameworks are important instruments in the study of governance as they constitute a means for simplification of complex reality by capturing and connecting all aspects of inquiry in a unifying set of visible and invisible components (Ostrom 2005). Explicit frameworks are imperative because they capture the basic assumptions of a researcher about the governance process and provide structure and coherence in the analysis. Studies on the policy process have produced a wide arsenal of frameworks, theories and models to analyse decision making processes. To study barriers in the policy process, existing frameworks can generally be classified into stage models and processual models, but see Teisman and Van Buuren (2012) for combinations of both models.

The first comprehensive study to conceptualize and explicate barriers that actors encounter in the decision making process was the seminal study by Bachrach and Baratz (1970) on the anti-poverty program in Baltimore, US. Building on the stage model, the authors demonstrate how an actor can exercise power through regulation and resources, in order to control the policy agenda. In this model, barriers are

consciously built by specific actors. For example, actors can suppress the proposal of other policy options so that it seems that no conflict has emerged around their preferred option (Bachrach and Baratz 1963). The authors argue that actors can mobilize their resources to either initiate or prevent directional change at each stage of the policy process. They identify specific barriers that will have to be overcome to continue to each next stage of the policy process. Disentangling the process into stages of agenda setting, enactment, implementation and evaluation might be useful in the study of well-defined problems and mono-centric processes. Despite the recognized benefits of the stage model (Jann and Wegrich 2007), I agree with several other authors that the "…stage heuristics has outlived its usefulness and needs to be replaced with better theoretical frameworks" (Sabatier 2007, p7). This judgment stems from observations that the stage heuristics are descriptively inaccurate (i.e. real processes never proceed this orderly), they do not include causal drivers, and neglect the complexity, unpredictability and dynamism of the policy process. The rationalist and structuralist assumptions underlying stage heuristics are inadequate for capturing the essence of decision making on complex issues such as adaptation to climate change.

New frameworks have been developed that aim to capture the complexity of dynamism decision making, also referred to as processual frameworks (Pettigrew 1997). The study by Pressman and Wildavsky (1984) is a good example that departs from a processual framework in explaining barriers in policy implementation (O'Toole 2011). Their study on the plan of the Economic Development Administration (EDA) to hire the hard-core unemployed minorities of Oakland demonstrated that even under the most promising conditions, well designed policies and programs are still likely to fail. One of their observations is that failure is a consequence of the "complexity of joint action": large projects in which multiple actors are involved have too many decision points, and this substantially increases the chance of failure. Another noteworthy study is the work by Koppenjan and Klijn (2004) who hypothesize that uncertainty is one of the key sources to explain the erratic patterns of decision making on wicked problems. Substantive, strategic, and institutional sources of uncertainty cause cognitive, social, institutional and management barriers that lead to policy stagnations and deadlocks (van Bueren et al. 2003). Still more scholars are trying to move from simple processual models to complex processual models, for example by integrating concepts and findings from complexity literature (Klijn 2008; Teisman and Klijn 2008; van Buuren and Gerrits 2008).

Despite these and other efforts, capturing the chaotic and erratic governance processes of the real world into analytical frameworks still remains a challenge for political science and public administration theorists (Nowlin 2011). So far, the efforts have not resulted in a commonly accepted framework and so there is no obvious choice how to study barriers in a governance process. The broad range of frameworks and theories is illustrative for the many perspectives of how barriers in governance processes can conceptualized and studied. Therefore, this study will use several perspectives, assuming that this will lead to a richer picture of what the barriers to climate change adaptation are.

1.3. Objective and research questions

The previous sections argued that barriers play an important role in the newly emerging scientific and policy discourse on climate change adaptation. In their efforts to adapt to climate change governments, NGO's, and private actors recognize that adaptation to climate change is not a barrier free process. Many actors are therefore vigorously trying to identify and overcome these barriers. Scholarly debate about barriers in the governance of adaptation still is in its infancy and has hardly been able to explain the emergence of the barriers observed; there is limited knowledge on what these barriers actually are, what causes barriers to emerge or disappear, what the important barriers to adaptation might be, and how barriers can be studied systematically. Current understandings of barriers result in overly simplified and optimistic ideas on how to overcome the barriers in policy practice. The research objective of this dissertation therefore is:

- *To increase the understanding of the barriers in the governance of adaptation in order to support policy practice in overcoming them.*

This dissertation aims to contribute to the theory on the governance of adaptation in general and, more specifically, to the research on barriers to adaptation by developing a conceptual framework from which to study barriers in the governance of adaptation. A better conceptual understanding of barriers contributes to many areas of research on adaptation in which barriers play an important role, including studies on evaluating policy efficiency and effectiveness, measuring progress and outcomes of adaptation processes, and assessing patterns of policy diffusion (Craft and Howlett 2013; Ford et al. in press; Massey et al. submitted). This research also aims to be practically relevant. A thorough understanding of the barriers to adaptation is an important step in formulating strategic ways to overcome barriers which, in turn, will be important to prevent future failures in adapting to climate change. Based on the considerations above, three research questions have been formulated:

RQ1. *How can barriers in the governance of adaptation be defined and conceptualized?*

The analytical question posed here is to unravel the conceptual meaning of barriers from different theoretical angles and perspectives. The focus will not only be on how the adaptation literature has conceptualized barriers; we extend the analysis to contemporary theories of policy and decision making. Insights from these theories are expected to conceptualize barriers as complex phenomena emerging in and as consequence of the governance of adaptation. Answers to this research question will outline what meaningful ways there are to capture and conceptualize the properties of barriers in a complex governance process.

RQ2. *What barriers to adaptation do actors encounter in policy practice?*

This research question aims to delve deeper into to the empirical manifestation of barriers to adaptation and to provide insights in how policy actors experience and give meaning to barriers in policy practice. In doing so, the findings to bring out which barriers to adaptation are perceived as the most important ones and demonstrate how

the articulation of barriers in the scholarly literature is represented in policy practice. This question seeks to address how often well-known barriers generally encountered in decision making processes emerge in adaptation processes, and which barriers can be attributed to the additionality dimension of climate change adaptation. Answers to this research question will provide a deeper understanding of the specific aspects of barriers in the policy practice of adaptation to climate change.

RQ3. *How can these theoretical and empirical insights be used to develop a conceptual framework to analyse barriers in the governance of adaptation?*

The newly gained, in-depth understanding of barriers in the governance of adaptation will be used to build a conceptual framework to capture the underlying processes and mechanisms, the nuanced linkages between causes and effects and the influence of the wider institutional context. the framework should be helpful for policy actors to deal with barriers, and, simultaneously, should provide support to scientists for a continued, systematic analysis of barriers in the governance of adaptation.

1.4. Research approach

As explained above, this dissertation aims to open up the black box of barriers to adaptation by exploring empirical reality as well as theoretical perspectives on complex governance processes. This objective has led to an iterative research design in which each research outcome aimed to inform the next step, and in which several different methods and theoretical perspectives were used. This section describes the research perspectives , the multi-method research design to answer the different research questions, and the way this approach was operationalized.

1.4.1. A realist perspective in studying barriers to adaptation

This dissertation departs from a realist research perspective in studying barriers to adaptation (Brewer and Hunter 2006). Realism is the middle ground between the positivist paradigm) and interpretative research in which social reality is seen as locally constructed and in which all research findings are considered to be situated rather than universally true (i.e. the constructivist paradigm). Rooted in the ideas of pragmatism, realists use both inductive and deductive logic and acknowledge subjectivity as well as objectivity in the study of governance (Pawson 2006). They thereby defy the flattened and reductionistic conceptualizations that are inherent to positivist logic in the search for nomothetic explanations. Realists recognize the complexity of social phenomena and value the interpretation of meaning and action in understanding social life. They accept the fallibility of scientific models as they often are insensitive to the contextuality, erraticism and contingency that are inherent to studying and explaining social processes. At the same time, realism discards the interpretivist claims that, because humans can think, reflect and change their behaviour when being observed, thus creating an inextricable loop of causes and effects, there is no certainty or regularity that would allow for generalizable knowledge claims (Sayer 2000). Realism assumes that although knowledge is subjective, socially constructed and situated, patterns can be identified and described that help to make sense of social reality. Realism occupies the middle ground between these two paradigmatic positions and, in doing so, has become an important

perspective in many social scientific realms (Sayer 2000). It is considered to be of particular value in the study of public administration because it aims to be both theoretically and practically relevant (Hildebrand 2005; Shields 2008; Whetsell and Shields 2011).

1.4.2. Multi-method research approach

Since this dissertation contains mostly published or submitted articles, each chapter contains a section that explains the method in detail. In this introduction, the key aspects of the overall design are highlighted to explain how the different methodologies adopted relate to each other.

In congruence with the realist perspective multiple methods have been applied to investigate barriers to adaptation theoretically as well as empirically. According to the literature, there can be five principle reasons for adopting a multi-method approach, see Greene et al. (1989). Four of these form the combined rationale for adopting the multimethod approach in this dissertation. First, multiple methods are used to be complementary. It is assumed that findings of a single method may lead to valid and empirical descriptions about parts of the social world, but that generalized inferences are uncertain at best (Johnson and Onwuegbuzie 2004; Brewer and Hunter 2006). Every scientific method is fallible and by employing only one method the likeliness of measurement errors increases; it is always possible that other methods might have resulted in a better or deeper understanding of the problem at hand. The solution to the imperfection of each method is to systematically combine methods, thereby compensating the weaknesses of one method by the strengths of another method (Johnson et al. 2007). The choice for each method is based on 'what works' and which research questions are addressed (Tashakkori and Teddlie 1998; Creswell 2003). Therefore, to understand the multiple dimensions of barriers to adaptation, a range of different methods was employed in this dissertation. Qualitative methods were used to assess how actors interpret and give meaning to barriers, to provide in-depth understanding of the dynamics of barriers in contextualised processes, and to unearth underlying social mechanisms. Quantitative methods were used to compare and search for generalizable insights about barriers to adaptation across different contexts. Second, multiple methods were used to achieve triangulation, or corroboration of the findings, thereby increasing confidence in the validity of the findings (Onwuegbuzie et al. 2011). In chapter 4, for example, a literature review, expert interviews, quantitative survey analysis, and a survey feedback workshop were used to assess what actors perceived as key barriers to adaptation. Third, the results from one method are used to develop and inform the method for the next step in the research. This requires a certain degree of flexibility in the research approach. Particularly chapter 3 has been imperative in informing the methodological choices in the following chapters. Fourth, the multimethod research design allowed for the exploration of different theoretical perspectives. This has led to a more complete understanding and explanation of barriers to adaptation (Brewer and Hunter 2006). Moreover, multi-method approach is used so that collectively these insights might initiate a new perspective on barriers in the governance of climate change adaptation.

Case study research: single-n, comparative case, and case selection
The case study approach serves as methodological principle in five of the six chapters. The methodological principle of a case study is to study a phenomenon in its situated context. Within a case study, different theoretical or analytical frames can be used, and multiple quantitative and qualitative methods can be employed that determine how the case is studied (Thomas 2011). This dissertation uses both the single case and the comparative case method.

The single case study method allows to engage in an in-depth, longitudinal examination of the complexities and relations of multiple variables. The single case approach is particularly useful in the study of barriers, because the cause and effect are nonlinear, the boundaries between the phenomenon and its context are not self-evident, and multiple variables are often in play (Gerring 2004; Thomas 2011). By carefully selecting a case, the single case approach can be a powerful method to find compelling insights about patterns and processes which allow for generalizations about a wider class of cases, or at least result in critical knowledge about the studied case (Flyvbjerg 2001; George and Bennett 2005). In this dissertation, three chapters are based on single case research. Chapter 3 uses a mixture of quantitative and qualitative methods to assess which barriers actors perceive as the most important barriers to adaptation in the Netherlands. In chapter 4, the Dutch ARK program is explored qualitatively through four analytical lenses. Chapter 7 uses the theory building process tracing method in a community level case study to unearth recurring patterns and mechanisms in order to explain the causes and effects of barriers in the governance of adaptation (Beach and Pedersen 2013).

The comparative case method is "...the non-statistical comparative analysis of a small number of cases" (George and Bennett 2005, p151). The comparative case method is considered to be different from the single case study method discussed above, because the aim is to explain variation, that is the similarities or differences, in how barriers in different contexts are addressed and understood. This dissertation uses cross national comparative case analysis as a specific type of the comparative case method. The focus is on comparing variation in national approaches to climate change adaptation and the resulting variation in the barriers that governance actors encounter. Chapter 2 compares one component of the national governance arrangements, namely the National Adaptation Strategies. Qualitative methods (interviews, desk study) are used to assess the barriers to the development and implementation of a national adaptation strategy across EU member states. Chapter 5 compares similarities and differences in the governance arrangements on climate change in the Netherlands and the United Kingdom, and how this influences what policy actors perceive as barriers to climate change adaptation. It uses quantitative (survey methodology) and qualitative methods of data analysis (document analysis and semi-structured interviews).

Case selection
Although each paper has its own specific criteria to select cases, the overall set of cases is based on the notion of *additional efforts* to adapt to future climate change risks. In other words, adaptation had to be the explicit and primary goal in each case

to identify the barriers to adaptation (Dupuis and Biesbroek in press). Cases that were 'relabeled' as climate change adaptation or cases that adopted adaptation as an additional goal were not considered for analysis. Collectively the selected cases aimed to include local as well as national levels and to represent programmatic and operational types of adaptation. The principle focus of this study is related to the Dutch adaptation setting for pragmatic reasons as parts of the dissertation were financed by the Dutch research program "Climate changes spatial planning", project IC 12. The Netherlands is a worthwhile case because it is considered to be a forerunner in climate change adaptation science and policy and has taken early action to adapt (EUROSAI 2012). The United Kingdom was selected as well because of their forerunner role and the differences in how adaptation is governed, compared to the Netherlands.

The multimethod research design was operationalized by iterating between the theoretical (RQ1) and the empirical (RQ2) realms whereby each outcome provided input for the next iteration. Each step is described in section 1.5 and presented in fig. 1.1.

1.5. Structure of the dissertation

The main body of this dissertation consists of six papers, all published or submitted to academic journals. Each chapter addresses a part of the research questions. Chapter 2 analyses how eight EU Member States have developed their national adaptation strategies by comparing them across 6 dimensions. It identifies a number of shared barriers across countries. Chapter 3 reports on the results of a systematic literature review of 81 studies on barriers to adaptation in an attempt to identify the nature of barriers to climate change adaptation. Chapter 4 uses the results of the systematic review to design a survey that tests which of 67 barriers to adaptation were perceived to be the most important barriers to adaptation by policy makers, scientists, NGOs and consultants in the Netherlands. Chapter 5 compares Dutch and UK survey results to understand if and how different modes of governance affect what actors from different countries perceive as the most important barriers to adaptation. Chapter 6 further builds on the results of the systematic review of Chapter 3 by using four analytical lenses through which the governance of adaptation can be conceptualized. These insights are used in Chapter 7 where the realist perspective was adopted and an alternative conceptualization of barriers to adaptation is proposed by introducing the mechanismic view. This conceptual framework is employed in analysing the development and implementation of the innovative adaptation measure 'Water Plaza' in the Dutch city of Rotterdam. Chapter 8 synthesizes the results of all previous chapters and discusses the theoretical and practical outcomes of this dissertation.

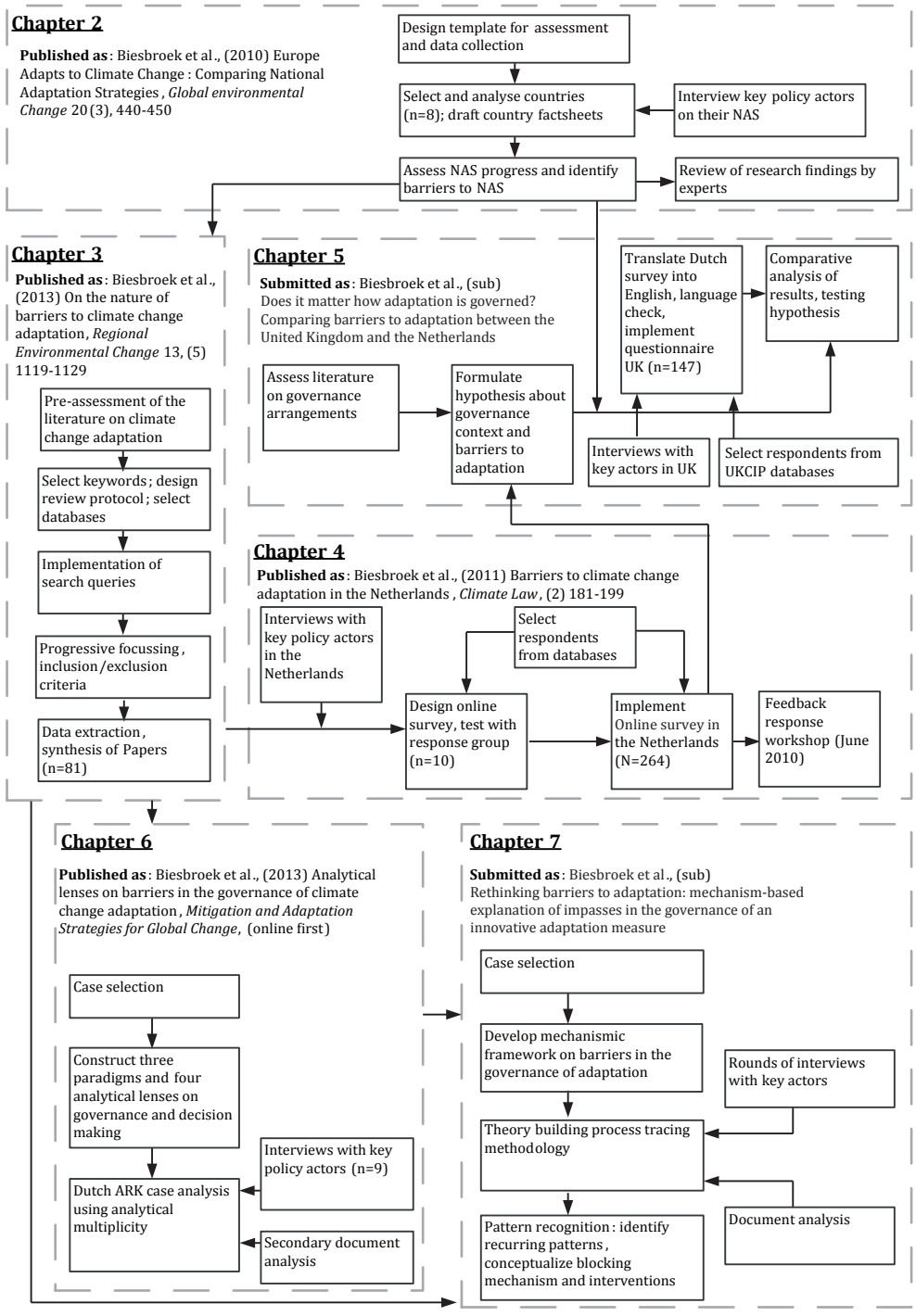

Figure 1.1. Summary of multimethod research design

CHAPTER 2

Europe adapts to climate change: comparing national adaptation strategies

ABSTRACT For the last two decades, European climate policy has focused almost exclusively on mitigation of climate change. It was only well after the turn of the century, with impacts of climate change increasingly being observed, that adaptation was added to the policy agenda and EU Member States started to develop National Adaptation Strategies (NASs). This paper reviews seven National Adaptation Strategies that were either formally adopted or under development by Member States at the end of 2008. The strategies are analysed under the following six themes. Firstly, the factors motivating and facilitating the development of a national adaptation strategy. Secondly, the scientific and technical support needed for the development and implementation of such a strategy. Thirdly, the role of the strategy in information, communication and awareness-raising of the adaptation issue. Fourthly, new or existing forms of multi-level governance to implement the proposed actions. Fifthly, how the strategy addresses integration and coordination with other policy domains. Finally, how the strategy suggests the implementation and how the strategy is evaluated. The paper notes that the role of National Adaptation Strategies in the wider governance of adaptation differs between countries but clearly benchmarks a new political commitment to adaptation at national policy levels. However, we also find that in most cases approaches for implementing and evaluating the strategies are yet to be defined. The paper concludes that even though the strategies show great resemblance in terms of topics, methods and approaches, there are many institutional challenges, including multi-level governance and policy integration issues, which can act as considerable barriers in future policy implementation.

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2.1. Introduction

It is now widely recognised that even if stringent global emissions reductions and mitigation efforts over the next decades prove to be successful, further climate change seems to be inevitable (IPCC 2007b; CEC 2009a). The impacts of changes in current climate have been well documented and a growing body of scientific studies anticipate that nearly all European regions will be affected by future impacts of climate change (Parry and Carter 1989; Rotmans et al. 1994; Beniston et al. 1998; Parry 2000; Kundzewicz et al. 2001; EEA 2006; e.g. Adger et al. 2007; Alcamo et al. 2007; EEA 2008; CEC 2009a). These impacts will be unevenly distributed over European regions and climate-sensitive sectors and will put additional pressures on the existing social–ecological structures and functions (Folke et al. 2005; Eakin and Luers 2006; Folke 2006).

Until recently and for a variety of reasons, the primary response to climate change has been mitigation through reduction of greenhouse gas emissions. Since the late 1980s, the European Union has played a prominent role in the international arena to reduce greenhouse gas emissions, particularly through the research and ambitious policy emission reduction targets of several frontrunner EU countries (Schreurs and Tiberghien 2007). Only with increasing evidence of climate impacts occurring (e.g. with Arctic sea ice and mountain glaciers melting, permafrost thawing, extreme heat waves, floods, storm damage) has adaptation climbed the political agenda. No longer was adaptation regarded as a 'fatalistic strategy' (Schipper 2006; Biesbroek et al. 2009) but as an explicit policy response to manage the unavoidable impacts (EEA 2008). Until the last couple of years, the European Union with the primary focus on delivering the Kyoto targets and mechanisms has played a rather limited role in adaptation. However, with the publication of the European Commission's Green Paper 'Adapting to climate change in Europe– options for EU action' June 2007 (CEC 2007) and the subsequent White Paper 'Adapting to climate change: Towards a European framework for action' in April 2009 (CEC 2009b), the European Commission acknowledged the need for comprehensive adaptation strategies in Member States. In addition, the Commission stressed the importance of an integrated impacts assessment and comprehensive adaptation strategy at the EU level by 2013. But even before activities started at the European level, since the turn of the century, policy makers at national and lower levels of governance have begun to initiate dedicated adaptation practices to counter adverse impacts. Initially the most vulnerable cities, regions and sectors started to include resilience into their planning activities. These adaptation practices are anticipatory and planned (Smit et al. 2000; Smit and Wandel 2006) and include both national and regional adaptation strategies as well as practical steps at community level or by individuals. With the science pushing the policy agenda on adaptation, from 2005 onwards EU Member States started to develop and adopt comprehensive National Adaptation Strategies (NASs) to further encourage, facilitate and co-ordinate adaptation within countries.

There are many definitions and characteristics of adaptation strategies (Carter et al. 1994; Burton et al. 2005). For the purpose of this paper, adaptation strategies in general are defined as '…a general plan of action for addressing the impacts of climate

change, including climate variability and extremes. It will include a mix of policies and measures with the overarching objective of reducing the country's vulnerability. Depending on the circumstances, the strategy can be comprehensive at a national level, addressing adaptation across sectors, regions and vulnerable populations, or it can be more limited, focusing on just one or two sectors or regions' (Niang-Diop and Bosch 2005, p186). In this paper, the focus is on formalised and comprehensive NASs that have been developed by governments for adoption by national policy makers. The structure and focus of the NASs differs between countries, but often they provide a comprehensive overview of the main impacts and vulnerabilities in a country and propose measures to adapt to the projected impacts. This paper critically analyses the recent developments of those NASs, based on a study performed by six research institutes of the Partnership for European Environmental Research (PEER1) (Swart et al. 2009). The following section describes the data gathering methods and the analytical framework to analyse and compare the different NASs. Then we discuss the various themes that are covered by NASs in the subsequent six sections. Finally, we synthesise the results in a number of key findings.

2.2. Method

The main goal of the study was to assess the current status and rapid developments of NASs in Europe, which up until then had only been assessed in a superficial manner (EEA 2006; Massey and Bergsma 2008). To compare the efforts of the different countries, a simple inductive framework of themes was applied that were shared in most of the analysed NASs. The project was also intended as a first step in further collaborative research in this emerging area, giving recommendations to improve exchange of experience, establishing a dialogue between countries and enhancing social learning amongst them (Swart et al. 2009). The country selection was limited to European countries with relative high adaptive capacity (Haddad 2005), which had developed national adaptation policy or were in the process of doing so (Massey and Bergsma 2008). In addition, the selected countries represent the geographical spread of different types of climate impacts in Europe (EEA 2006; Alcamo et al. 2007). Several pragmatic criteria were established to select countries, of which the access to primary data sources was most important. Contributing researchers were asked to analyse their own country and select, on the basis of the above mentioned criteria, at least one additional country to analyse in further detail. Table 2.1 shows an overview of the NASs that were analysed.

By early 2009, nine EU Member States had developed a National Adaptation Strategy, whilst several others were in the process of developing one. The draft NAS versions of the UK and Germany were used in the analysis and updated after they received governmental approval. Two countries, Romania and Hungary, have developed a strategy but were not analysed in this study because we were not able to access all of the necessary information. In addition, the study is limited to the comprehensive NASs at national level. In various European countries a variety of plans exist alongside the NAS which focus on specific vulnerable sectors or regions, such as flood risk or heat wave plans. Sometimes such plans are inspired by the NAS development process, sometimes the NASs build on them. Although we acknowledge their importance they

Table 2.1. Overview of the National Adaptation Strategies in Europe. After Swart et al. (2009).

Country	National Adaptation Strategy (NAS)	Year	Responsible for the development of the NAS
Denmark	'Strategi for tilpasning til klimaændringer i Danmark' (Danish Energy Agency 2008)	2008	Ministry of Environment, shifted in 2008 to Ministry of Climate and Energy
Finland	'Finland's National Strategy for Adaptation to Climate Change' (Marttila et al. 2005)	2005	Working group for preparing the NAS under the Ministry of Agriculture and Forestry
France	'Stratégie nationale d'adaptation au changement climatique' (ONERC 2007)	2007	National observatory dedicated to the effects of climate warning (ONERC); Interministerial delegate for sustainable development
Germany	DeutscheStrategie zur Anpassung an den Klimawandel' (BMU 2008)	2008	Environmental Ministry supported by the Federal Environmental Agency
Hungary	'Nemzeti Éghajlatváltozási Stratégia'	2008	Not included in study
Netherlands	'Maak ruimte voor klimaat!' (VROM 2007a)	2007	Adaptation to climate change in spatial planning (ARK) programme, coordinated by the Ministry of Housing, Spatial Planning and the Environment
Romania	'Ghid privind Adaptarea la Efectele Schimbărilor Climatice'	2008	Not included in the study
Spain	'Plan de nacional de adaptición al cambino climático' (PNACC 2006)	2006	Environmental Ministry; National Office for Climate Change
United Kingdom	'Adapting to climate change in England. A framework for Action' (DEFRA 2008)	2008	Department for Food, Rural Affairs and the Environment (DEFRA)

were not included in this study. The issue of mainstreaming climate change concerns in non-climate policy sectors in Europe is discussed by Mickwitz et al. (2009).

Primary data were gathered through policy document analysis, including the National Adaptation Strategies (NASs), sectoral adaptation strategies, impact and vulnerability assessments, third and fourth national communication reports to the UNFCCC, and communication strategies. The policy document analysis was complemented by several semi-structured interviews with government representatives who had been selected because of their active role in developing and/or implementing the NAS.2 Preliminary results from the inventory and comparative analysis were presented during 2008–2009 at various national and international meetings, providing valuable feedback to improve the analysis. A draft of the full report, including the preliminary findings and conclusions, was scrutinised by 32 international reviewers from the different countries – varying from government and EPA representatives (n = 17) to climate change scholars (n = 15). Finally, the results of an international workshop on "Science–policy interactions in national adaptation policy" held in September 2009 in Netherlands were used for this paper.

2.2.1. Comparative framework: six key themes in the NAS

Comparing the adaptation strategies from different countries is challenging because of the institutional, legislative, political and cultural differences which are reflected in, for example, the timing, structure, focus and legal status of the NAS and possible follow-up strategies. These differences determined the methodology to compare countries and to interpret the results (Landman 2000). Because existing frameworks (Burton et al. 2005; Massey and Bergsma 2008) were found unsuitable for a comprehensive comparison in a specific European context we undertook an initial analysis of the NAS which identified six themes or issues common to all the NASs. The themes were selected after the preliminary policy document analysis to match different stages of the policy process and links with recent discussions in scientific literature on climate adaptation: (1) the motivation behind establishing NASs; (2) the interaction between science-policy and research co-ordination; (3) approaches to communication and knowledge transfer; (4) the ways in which tasks and responsibilities are distributed between different levels of governance; (5) the institutional arrangements for incorporating adaptation into sectoral policies; and (6) whether and how countries ensure that their adaptation strategies are implemented and reviewed.

2.3. Factors driving the development of a National Adaptation Strategy

Several supportive or contrasting factors explain why countries decided to develop a National Adaptation Strategy that can be identified based on both document analysis and interviews with policy makers and experts who have taken part in the formulation of NASs. We distinguished between factors that were motivators, levers or drivers in the development of a strategy, and those that were required to facilitate the development processes (Fig. 2.1). Motivating factors include any pressures, compelling information or key events that in combination persuaded governments and other influential stakeholders of the need for action. These included on-going international climate negotiations, EU policies such as the EU Green and White papers on adaptation, experience of extreme weather events, examples of adaptation actions in other countries, economic costs of inaction or, in some cases, recognition of the opportunities presented by climate change (Tompkins and Amundsen 2008). In the UK, Tompkins et al. (2009) identified a large list of climate and non-climate triggers and drivers that directly or indirectly support the development and implementation of an adaptation strategy.

In practice, it is often a culmination of different factors that triggers the development – a common hierarchy could not be established. Moreover, the underlying motives to develop adaptation strategies are not always explicitly mentioned. As a result, comparing the motives of the countries becomes difficult since the emphasis of these factors varies by country: for example, the projected impacts on water resources are emphasised in almost all countries, but recent actual drought events were the prime motivator for action in southern European countries, whereas high profile flooding had a comparable galvanising effect in central and northern Europe. Some countries lean heavily on knowledge developed internationally, or are influenced by international policy processes, while other countries are motivated mainly by domestic concerns. As been highlighted in most interviews, the projected and

experienced impacts of the extreme events in combination with the rapid increase in knowledge on region-specific vulnerabilities and impacts have been a major trigger in all countries to develop their NASs.

Equally important, but often poorly understood, are key facilitating factors without which it is unlikely that the motivating factors would be acted upon. These include, for example, political will, human and financial resources, good co-ordination between key actors in different sectors and at different administrative levels, and compatibility with other policies. The timing of the development of NASs may be influenced by other items on the political agenda, and if these are pressing issues, progress on adaptation can be sidelined or delayed. While several strategies cite the possible economic damage of unavoided climate change as a major motivating factor for action, no strategy actually presents an analysis of the costs of adaptation but some refer to general assessments such as, for example, the Stern review (Stern 2006). Also, suggestions from aggregate model studies that the costs are likely to outweigh the benefits appear to suffice to start adaptation policy development. There is as yet no systematic and reliable method to estimate the costs of adaptation for most adaptation options, partly because it is often difficult to separate climate concerns from other factors that influence adaptation actions. While the motivating and facilitating factors determine if and when a National Adaptation Strategy is developed, the design of the strategies also depends on other influences, described here as framing factors, which affect the eventual identification, evaluation, prioritisation and implementation of appropriate adaptation measures.

Five framing questions are identified here: (i) how are future developments characterised (e.g., through scenarios)? (ii) which vulnerable sectors are highlighted?

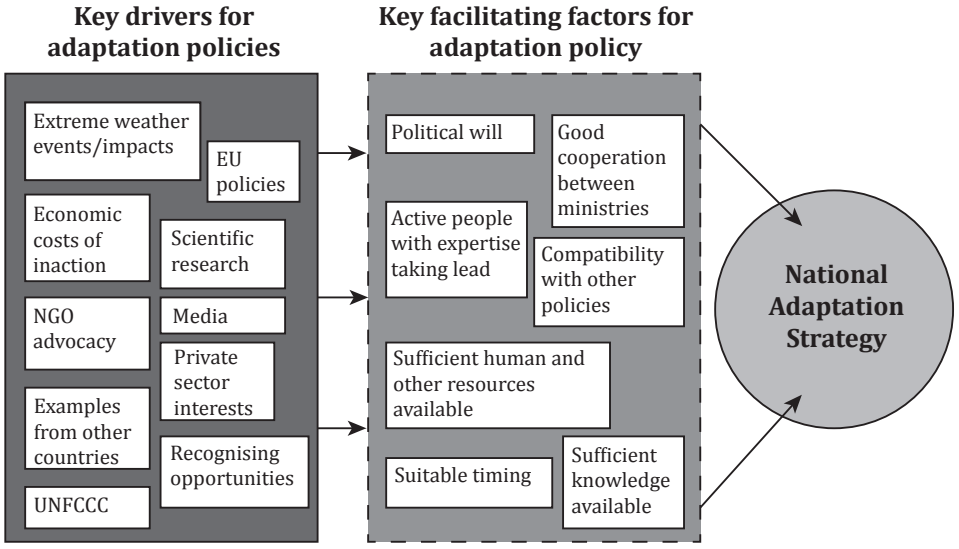

Figure 2.1. Key drivers and facilitating factors for the development of National Adaptation Strategies. After Swart et al. (2009)

(iii) is climate change primarily perceived as a risk or also as opportunity? (iv) is adaptation framed as a local, national or international problem? and (v) is there an overarching paradigm which dominates the adaptation debate?

Most national strategies appear to be based on a rather general notion of vulnerability derived from international and national assessments, making use of whatever information is available. We did not find any consistent and systematic use of scenarios across the countries studied. As to the sectoral focus, there are a wide range of topics and vulnerable sectors covered in the NASs, and many of them are common to all of the countries analysed. Some countries have identified a few key sectors while others do not attempt to prioritise (table 2.2.). Some strategies also address inter-connections between sectors. For example, the Spanish strategy notes that water resources, biodiversity and coastal zones have a major impact on other sectors, such

Table 2.2. Vulnerable sectors that are or will be dealt with in the National Adaptation Strategies. Key sectors or cross-cutting issues that have clearly been prioritised by some of the countries are marked with two crosses. Sectors above the horizontal line are addressed in at least four of the seven countries.

Vulnerable sector	DE	DK	ES	FI	FR	NL	UK
Agriculture	X	X	X	X	X	X	X
Biodiversity/nature conservation	X	X	XX	X	XX	X	X
Energy, electricity supply	X	X	X	X	X		X
Finance and insurance	X	X	X	X	X	X	X
Forests, forestry	X	X	X	X		X	X
Human health	X	X	X	X	XX		X
Water resource management	X	X	XX	X	XX	XX	X
Construction and buildings	X	X	X	X	X	X	X
Fisheries	X	X	X	X			X
Coastal management	X	X	XX			X	X
Tourism and recreation	X		X	X	X	X	X
Spatial planning, land use	X	X		X		XX	X
Transport	X	X	X	X	X	X	X
Communications and infrastructure	X	X		X		X	
Industry	X		X	X	X		X
Emergency and rescue services	X	X					
Soils	X		X				
Foreign policy	X						
Hunting				X			
Mountainous zones	X		X				
Reindeer husbandry				X			

as agriculture, forestry and tourism, whose development is to a large extent dependent on adaptation possibilities in the key sectors (PNACC 2006). In a slightly different vein, the French NAS makes a distinction between cross-cutting issues like water, health, biodiversity and prevention of risks, and sectoral approaches, such as agriculture, energy and industry, transport, building and housing, tourism, banks and insurance (ONERC 2007). The table indicates that some countries have opted for a thematically very comprehensive strategy while others have decided to concentrate on a smaller number of key sectors. Some of the topics are more country-specific than others, reflecting local geographical conditions, natural resources and sources of livelihood.

While generally the emphasis is on responding to a risk rather than exploring opportunities, a small number of countries, mainly in western and northern Europe, explicitly take potential benefits into account, such as export of knowledge on water and coastal engineering (Netherlands), reduced winter mortality (United Kingdom), new opportunities for tourism (Netherlands, United Kingdom, Sweden, Finland), increased growing season and yields in agriculture (Sweden, Denmark, Finland, Germany, Latvia), and improved conditions for hydro- and wind power (Sweden, Finland, Latvia, Denmark). These issues can make a difference in transforming barriers to enablers and enhancing public and political action (Burch 2010b).

Interestingly given the historical ties of many European countries with other parts of the world, there is only superficial treatment of the implications of climate change impacts occurring outside Europe, which can have important implications for European economies. Several projects around the world have started working on this topic, including the UK "Foresight project on International Dimensions of Climate Change". Four different areas in which the international implications of climate change may become manifest are economy and trade, security, development co-operation and international policy making (Carter and Kankaanpää In press). Although work is being done at this subject, the NASs make little reference to the international or European level, focussing primarily on local and regional actions.

Finally, the manner in which adaptation policies are designed and implemented depends on the underlying philosophy or paradigm, which varies between countries. Several attempts have been made to categorise the different approaches to adaptation. Amongst others, Eakin et al. (2009) have identified three approaches to adaptation and categorise them as the social vulnerability approach (addressing underlying social vulnerability), the resilience approach (managing for enhanced ecosystem resilience) and the targeted adaptation approach (targeting adaptation actions to specific climate change risks). The UK Climate Impacts Programme identifies four categories: living with risks and bearing the losses, preventing effects by reducing exposure, sharing responsibility (e.g. by insurance schemes), or exploiting opportunities (UKCIP 2005). In the National Strategies, different paradigms remain implicit, but it is likely that in the implementation phase they will emerge as important factors shaping and prioritising different adaptation options.

2.4. Science, policy and societal interactions in the development and implementation of NASs

The development of NASs is triggered and supported by scientific information about the climate system, the potential impacts of climate change in vulnerable regions and sectors, and possible measures to manage the unavoidable impacts through adaptation strategies. There is a need for both fundamental scientific knowledge on the climate system and context-specific knowledge of impacts, vulnerabilities and adaptation options. In general, three phases of research focus can be distinguished across EU countries, each phase building on the previous one in the following sequence: (1) climate system research; (2) impacts and mitigation research; (3) vulnerability and adaptation research (see also Fig. 2.2.). Inevitably, there are exceptions and overlaps, but this framework serves the purpose of demarcating a step change in the programming of climate change research, linked to political developments.

Until the mid-1990s, research on climate change focused almost exclusively on understanding of climate system dynamics, detecting climate change, the attribution of climate change to natural and anthropogenic causes, the sources of greenhouse gas emissions and on modelling of future climate. We refer to these types of programmes as climate system research. Most European countries continue to actively develop this type of research. Examples mentioned by the NASs include the Swedish SWECLIM research programme (SWECLIM; 1996–2003) and the more recent programme in the United Kingdom 'Quantifying and understanding the Earth System' (QUEST; 2003–2009). Scientific progress in climate systems has been, and remains, the main motivating factor for (inter-)national action on climate change mitigation and the scientific foundation for other types of research programmes.

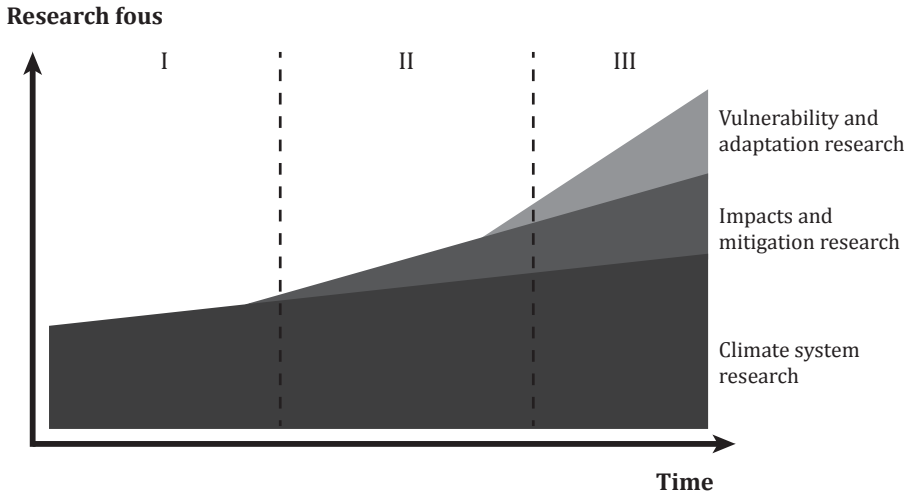

Figure 2.2. Increase in climate change research over time, from approximately 1980 onwards. Note that this is a stylised diagram as we are not able to quantify the balance between the different types of research with data available to us.

From the mid-1990s onwards, climate system research expanded by including research on ways to mitigate climate change to satisfy the greenhouse gas emissions reduction aspirations of the UNFCCC Kyoto Protocol and European Union targets. Initial observations on the potential impacts of the projected climate changes on social–ecological systems began to appear in the scientific literature around this time. As time progressed and more results on the magnitude of potential impacts became available, research programmes with a strong focus on national impacts were established, amongst others the French 'Gestion et impacts du changement climatique' (GICC1; 1999–2003) and the Portuguese 'Scenarios Impacts and Adaptation Measures' (SIAM 1; 1999–2002).

Following the recognition that mitigation alone is insufficient to prevent impacts, after the turn of the century several national research programmes have been developed that give more prominence to studies of vulnerability and adaptive capacity and associated adaptation options, measures and strategies, including local, regional, and sectoral studies. The nature of the question at hand requires a new type of research programmes in which the relation between science and policy has intensified. This also paved the way for more social science research on, for example, values, norms, institutions, modes of governance, and estimates of the economic costs of implementation, which are increasingly being included in these programmes. This vulnerability and adaptation research includes exploration of the inter-dependencies between climate-sensitive sectors, organisations and other actors, as well as the integration of climate concerns into policy processes at the local and regional scale. The nature of adaptation requires combined efforts of public and private actors at all levels of governance, making it a multi-level governance issue. Examples of vulnerability and adaptation research programmes include the Finnish 'Climate Change Adaptation Research Programme' (ISTO; 2006–2010), the German Klimzug programme (KLIMZUG; 2008–2014), and the Dutch 'Knowledge for Climate' programme (KvK; 2008–2012).

There are strong inter-dependencies between these three broad types of research. Local and regional adaptation options and measures cannot be developed without assessing the vulnerabilities and impacts that can be attributed to changes in the climate system itself. The shift in research focus is accompanied by a shift in approach (from mono-disciplinary to trans-disciplinary), objectives (from scientific understanding to supporting policy making), and ways of funding (from mainly [inter-]national governmental sources to shared funding between [inter-]national, sectoral and regional sources). The new types of research programmes to conduct policy-relevant research struggle with the duality of producing practical results for policy makers at the same time as maintaining legitimacy and scientific credibility, given the risk of politicisation. The demarcation of science and policy, which was relatively clear for climate system research, has changed into an interdependent relationship. This requires a strong change to the traditional modes in which science and policy have operated in the past, since science and policy do not automatically mesh (Niederberger 2005; Sarewitz and Pielke Jr 2007). A common approach to the facilitation of the interactions between science and policy and to cope with this

perceived gap is the development of specialist organisations. The most developed examples can be described as 'bridging' or 'boundary' organisations (Guston 2001; Miller 2001; Hoppe 2005). These organisations (1) work at the boundary of science and policy; (2) fulfil a co-ordinating role; (3) provide advice on adaptation policy making; and/or (4) can be responsible for drafting the NASs. One of the best known examples is the UK Climate Impacts Programme (UKCIP 2005), which has operated at the boundary of science, policy and society since 1997. The success of UKCIP can partly be ascribed to the capacity to redefine itself in response to changing circumstances (Lorenzoni et al. 2007a). Equivalents of the UKCIP example are scarce and their role in designing the NAS has been limited. In most instances new organisations are established or existing ones are given the task to fulfil a co-ordinating role in developing the NAS in an effort to prevent conflicting activities between departments.

There are significant institutional differences in political priority, availability of resources, size and scales of research programmes, institutions and organisations already in place and the external pressures of public and private organisations (Swart et al. 2009). What has become clear, though, is that countries which have contributed substantially to research on the climate system in the past are now taking the lead in climate adaptation research. Particularly the UK, Netherlands and Germany, where adaptation ranks high on the political agenda and many motivational and facilitating factors are in place, large research budgets are made available by governments and public organisations for regional and local vulnerability and adaptation research. Other countries with less financial resources also have dedicated research programs that specifically look at vulnerable sectors or regions and may benefit from EU framework programme projects and research from other countries. However, most NASs have been developed on the basis of national impact and vulnerability studies and did not include the results of the 'third generation climate research'. Many of the adaptation options, measures and strategies presented in the strategies are not a direct response to scientific results but form part of an overall vision of how adaptation could be dealt with. Many of the strategies, therefore, argue for more region- and sector-specific research on vulnerabilities and adaptation but do not commit themselves to financial resources yet.

2.5. Information dissemination and awareness-raising for adaptive practices

In general, NASs are long-term visions that include both hard and soft measures, with the purpose of reducing climate change impacts and vulnerabilities and enhancing the adaptive capacity of society (Kabat et al. 2005; EEA 2008). One of the soft sets of measures proposed is to raise awareness and communicate about the possible individual and collective adaptive actions (Moser 2010a). Lay people often lack a clear understanding of the climate problem and the potential impacts and consequences for their daily routines, something which despite the recent attention on climate change is still seen as a major barrier to adaptation (Lorenzoni and Pidgeon 2006; Lorenzoni et al. 2007b). All strategies emphasise the importance of raising public awareness through information provision, but only a few countries have developed or are

intending to develop a specific national communication strategy on adaptation. In most cases, the NASs propose organisational structures to include the dissemination of adaptation information, measures and strategies, together with other information (e.g. on mitigation and energy efficiency).

The dissemination of climate information, both research and practice, is poorly co-ordinated within countries with a large number of different organisations contributing knowledge in an ad hoc fashion. Most information on climate change adaptation activities is presented by the national government or the ministry responsible for adaptation, often the environmental ministry. Basic information on the challenge of climate change and governmental responses is provided with links to more detailed information sources. More specialised information on national climate scenarios and potential impacts is often made available by meteorological organisations such as the Royal Netherlands Meteorological Institute (KNMI) and the Swedish Meteorological and Hydrological Institute (SMHI). Other sources of detailed information are the various research institutes and programmes (e.g. the UK's Living with Environmental Change Programme and the Dutch Knowledge for Climate Programme). In particular the new types of research programmes on adaptation and vulnerability pay considerable efforts in disseminating their information through stakeholder discussions, workshops, conferences, seminars, publications, newsletters and web pages. In some cases, special organisations are established to make information available in a more coherent manner. The Danish Information Centre on adaptation, established under the Danish NAS and co-ordinated by the ministry of Climate and Energy, has the objective to provide access to scientific information on adaptation, policy strategies, news items and frequently asked questions and is an entry point for citizens, businesses and municipalities. Finally, non-governmental organisations including Friends of the Earth, Worldwide Fund for Nature and Greenpeace make information on climate change available, but these mainly focus on mitigation, with the exception of organisations involved in nature protection.

In addition to disseminating information, NASs refer to raising awareness amongst the public. Suggestions in the strategies include educational programmes, campaigns, stakeholder platforms and events as interactive communication modes which enrich the process of double loop learning in society. One of the main tools mentioned in the NASs of Northern and Western European Countries are web-based tools. As computer literacy in Europe is generally high, information can be cheaply and easily stored and updated, and the Internet is globally accessible. For example, UKCIP provides tools and wizards for regional and local governments and individuals, including information on vulnerabilities and options and government responses. In Finland, the 'Climate Change Community Response Portal' (CCCRP) guides potential users of climate information to the most relevant scientific information and, similar to the UKCIP website, will include tools and wizards to assist local and regional governments and individuals. There are large differences in the way the tools are financed (by government, research programmes, universities), where they are hosted (by government, research programmes, universities), the information they provide (impacts information, adaptation wizards, integrative frameworks), and their intended audiences (local and

regional governments, individuals, private organisations). Although some are perhaps more effective than others, all communication modes play a considerable role in climate adaptation by increasing general understanding of the climate problem, enhancing response capacity and motivating people to actively participate in adaptation practices (Moser 2010a).

2.6. Multi-level interactions in developing and implementing NASs

Adapting to the impacts of climate change is a significant challenge at all relevant administrative, temporal and spatial scales (Adger et al. 2005; Urwin and Jordan 2008). Although climate change mitigation may be suitable for top-down approaches such as the Kyoto targets and other emission reduction objectives (Sovacool and Brown 2009), bottom-up approaches are likely to be more appropriate for adaptation, given the multitude of variables, context dependencies and cultural settings (Hulme 2008). At the same time, it requires the involvement of a variety of public and private actors in the problem-solving debate. Multi-level governance, in the context of climate change adaptation, raises new and important questions about the role, power, authority and responsibility of actors operating at different scales, creating considerable opportunities to learn from earlier initiatives and for the development and implementation of adaptation policies at every governance level (Mickwitz et al. 2009). There is a growing recognition that successful adaptation practices require the integration of adaptation strategies across sectors and within multiple governmental scales in a co-ordinated manner (Biesbroek et al. 2009). This is one of the reasons why comprehensive NASs were developed in the first place. Nevertheless, the NASs offer few clues on how governments can facilitate the multi-level governance of adaptation in practice.

The development of NASs is generally not an inclusive governance approach but most often only involves a small circle of experts, governmental and societal representatives. Although the NAS is a central government document, its ultimate objective is to enable adaptive practices at multiple levels of governance through time and space. Unless they are organised at the national level, local and regional representatives are most often neglected even though there are considerable benefits in including stakeholders in the development of the National Adaptation Strategy for example by: (1) identifying the most appropriate (and desirable) forms of adaptation and their viability; (2) mobilising tacit knowledge and experiences of stakeholders on local vulnerabilities and impacts; (3) analysing the capacity of stakeholders to cope with the impacts of climate change; (4) building shared understanding of the impacts, vulnerabilities and options of adaptation; and (5) enhancing the ability to identify priority areas. For example, in the Netherlands a national programme has been set up in which national, provincial and municipal representatives, together with representatives from water boards and experts regularly discuss the multi-level dimension of adaptation issues. Participatory approaches in implementing NAS have also been mentioned in other strategies (e.g. Denmark, Finland, United Kingdom), but they describe no concrete strategy for action. All strategies stress the importance of taking measures at the most appropriate scale of governance: regional, local or individual. The strategies of Denmark and the Netherlands in particular argue that an

appropriate setting should be created at the local level by stimulating social learning, self-organisation and mobilisation within the given legislative, financial and technological frameworks.

How do the NASs describe the division of responsibility and authority between the various levels? In order to enable lower levels to make effective and efficient adaptation decisions, some strategies foresee an important role for the national government to keep influence and responsibility and provide the right institutional settings. The UK NAS, for example, explicitly mentions the removal of any formal or informal barrier that might hinder the development and implementation of adaptation strategies. Most NASs do not clearly specify the roles and responsibilities at regional and local scales. In the Netherlands, the division of roles and responsibilities for implementation will be included in their follow-up 'National Adaptation Agenda'. Similarly, only a few strategies have attempted to assign clear responsibilities to sectors. Finland by exception has implemented the NAS by drawing up several sectoral adaptation strategies that build on existing institutional settings. Unclear and overlapping division of responsibilities complicates the implementation of the NAS, not only through conflicting incentives, but also through the financial constraints and competition for resources between sectors. Although mainstreaming of adaptation into new and existing policies is proposed by most countries (e.g. Finland and France) and others have opted for a public–private-partnership approach (e.g. the Netherlands), none of the national strategies considers how the implementation of the NAS should be financed, maybe because still little is known about the actual costs and the potential effectiveness of possible financing mechanisms and instruments.

2.7. Policy integration and coherence in NASs

Integration or 'mainstreaming' of adaptation into new and existing sector policies is a common feature found in all adaptation strategies. Creating coherence and integrating adaptation into climate-sensitive policies in and between governmental scales requires an active role for the national government, as most strategies confirm. Another approach, e.g. in Denmark, argues that vulnerable actors have a direct incentive to adapt, and adaptation could be treated as a societal challenge to be left largely to individual actors and free markets. There are several reasons why this market approach could fail (see amongst others Berkhout (2005):

- Lack of knowledge – if relevant actors are not sufficiently aware of the looming environmental changes, of the need to adapt or of the available options.
- Lack of capacity – if the societal actors do not have sufficient capacities for timely adaptation, whether in terms of money or workforce.
- Lack of (self-)interest – if ability and responsibility to adapt do not lie with those who are eventually struck by the negative impacts of climate change, or if long-term effects are not taken into account due to short-term economic dispositions.
- Lack of consensus – if multiple actors have to cooperate in order to achieve effective results.

In these cases appropriate governmental interventions are needed. According to the specific sector requirements government can generate the necessary information and awareness that timely action is needed, support the building of adaptive capacities,

internalise external effects and resolve conflicts by effective regulation, instruments and incentives. The OECD (2002) has defined four prerequisites for effective policy integration for sustainable development. We used this framework in the context of National Adaptation Strategies. First of all, there should be a strong leading department, ministry or institution that takes up the challenge to initiate and develop the National Adaptation Strategy. In almost all Member States this is the ministry that holds the environmental or affiliated portfolio. In some cases this leading ministry is actively involved in writing the strategy or chairing the (inter-ministerial) working group that is responsible for drafting the strategy. However, in some instances it is unclear who leads the adaptation dossier. For example the Ministry of Transport, Public Works and Water Management and the Ministry of Housing Spatial Planning and the Environment in the Netherlands both contributed substantively to the discussions on climate adaptation, leading to political competition. Second, (sub)units on adaptation in leading vulnerable sector departments should be established in order to strengthen the inclusion of adaptation in decision making. Third, interdepartmental units can have a valuable role in managing the integration of adaptation into sectoral policy within the context of comprehensive NASs. Fourth and finally, as discussed earlier, the (bottom-up) input from other scales of governance should be included for coherent and integrated adaptation strategies. All these four organisational issues suggested by the OECD to enhance policy integration are reflected to differing degrees by the NASs: several strategies have indicated new organisations (e.g. Denmark, UK), commitments/legislation (e.g. UK), additional research (e.g. Germany, Netherlands) or policy instruments to strengthen policy integration and coherence (Netherlands). One of the measures to strengthen adaptation in existing policy development (at any level) is to include adaptation in assessment instruments (e.g. strategic environmental assessments, environmental impact assessments) or specific planning instruments (e.g. water assessment tests, building codes). Some strategies, including the Danish and Dutch, suggest revising existing policy instruments to include adaptation. In addition, most of the Adaptation Strategies make reference to spatial planning activities within their countries to operationalise adaptation (e.g. UK, Netherland, Germany, Finland) – most planning activities are also co-ordinated by environmental ministries; spatial planning has a long tradition in weighing different interest between sectors and scales; and many of the adaptations take place in the spatial realm (Campbell 2006; Biesbroek et al. 2009; Davoudi et al. 2009).

2.8. Implementation and review of NASs

Most of the NASs mark the beginning of a process rather than the end, putting the issue on the national policy agenda but often without elaborating concrete proposals or processes for implementation and measuring effectiveness of the NAS. Flexible mechanisms to implement, evaluate and revise adaptation strategies will be required, including metrics to gauge progress and policy effectiveness, as well as sets of regulatory, economic and other instruments.

In order to provide for a regular review, a specific date or time frame can be included in the strategy and the review assigned to a responsible body. Competent bodies need to be established as permanent institutions and sufficiently equipped with resources

and influence. Amongst the countries considered, only Finland, Germany and the UK have set out a time frame for a general revision of their NAS. A mid-term evaluation of the Finnish NAS undertaken in 2009 (MMM 2009), and a more comprehensive evaluation of the strategy and its effectiveness, is proposed to take place within 6–8 years of publication (i.e. 2011–2013). In the Danish NAS it is implicitly assumed that the strategy, which has a 10-year implementation phase, will be thoroughly reviewed and revised before the end of 2018. In the case of the UK (specifically, England), the Climate Change Act states that once a national adaptation programme has been put into place it must be reviewed by parliament every 5 years, taking into account the updated climate change risk assessment that must also be carried out (UK OPSI 2008).

2.8.1. Monitoring, reporting and indicators

Effective and efficient monitoring calls for two basic questions to be answered: What has to be monitored (objects and scope) and who has to monitor it (responsibilities)? Therefore, it becomes important that monitoring objects and responsibilities are identified by the NAS or by a subsequent programme of measures. The NASs included in our study, however, generally include no such monitoring concept or clearly defined responsibilities. The UK perhaps comes closest to defining a monitoring framework in that a legal mechanism has been established to enable it and the Government is required to report to Parliament on progress being made to tackle climate change risks. There is also an Adaptation Sub-Committee under a broader Climate Change Committee to review the progress of the national adaptation programme and provide independent advice on a national risk assessment. The Dutch NAS recognises the need to '…actively monitor the adaptation process; both the decision making process on large spatial investments as well as the physical changes in the Dutch spatial planning' but provides no clues how to undertake this. In Sweden, a country which is preparing adaptation action but does not have a NAS, the Commission on Climate and Vulnerability simply proposes that the Swedish Environmental Protection Agency should be given responsibility for monitoring the adaptation work and reporting without setting stringent timeframes. For the challenges of monitoring climate adaptation, indicators would be useful as yardstick of success or failure of different policies and measures. However, as the challenges are many and varied, it is difficult to develop specific, quantifiable indicators (Eriksen and Kelly 2007; EEA 2008). This is particularly true for the most meaningful type of indicators, the so-called "outcome indicators". The most important measure of policy performance is obviously its final outcome – its effectiveness in meeting the primary objective. Moreover, objectives and indicators directly linked to outcomes are more appropriate for cautious regulation in accordance with the subsidiarity principle, leaving the choice of instruments to the relevant local and societal actors. Within the array of the NASs analysed in this study, only the UK and Finnish strategies acknowledge the need to develop quantitative indicators. In Germany, a consultant has been assigned to propose indicators for the main components of the NAS. Research for functional adaptation indicators is still at its outset. Initial considerations gathered during a 2008 European Environment Agency workshop suggest that progress could be made, concentrating initially on the development of "process indicators" (Harley et al. 2008). Process indicators define and possibly quantify those factual and behavioural changes that – for the time being

– appear as necessary steps towards the ultimate adaptation target, such as the availability of climate change scenarios, vulnerability assessments, adaptation guidance and disaster plans, the identification of cross-cutting issues, and the engagement of stakeholders.

2.8.2. Implementation and compliance instruments

Policy instruments (regulatory, economic, voluntary, and communication-related) are necessary to implement adaptation measures, but relatively little progress has been made towards developing them. Such instruments are particularly necessary where voluntary action is likely to be hindered by conflicting interests of actors. This is to be expected if the negative consequences of mal-adaptation will not affect the responsible actors (external effects). The increased flood risks caused in lower parts of river basins by a narrowing of rivers in their higher sections is one example of such external effects of mal-adaptation. The additional pressures that intensive agricultural land use will put on water availability and quality in periods of drought is another. In such cases, effective compliance instruments will be required in order to implement the necessary adaptation measures. Implementation instruments can take different forms, from softer instruments like financial or other incentives or voluntary agreements, to harder ones such as regulatory measures with sanctions or other enforcement mechanisms. Compensation – and governmental support – for adaptive practices can be another means to realise timely adaptation in cases in which "external effects" are to be prevented. The Netherlands already contributes financially to water storage investments in Germany because this is cheaper than taking measures in Netherlands itself.

Planning obligations and instruments are important tools that can help local, regional and sectoral actors to identify their specific adaptation needs and obstacles and to tailor an adequate programme of measures. Existing or new planning instruments can enable effective activation, information, participation, co-ordination, review and enforcement of adaptation policies and measures. Primarily, existing planning tools with strong relevance for adaptation needs (e.g. spatial planning, urban planning, river basin management, flood-prevention planning) would have to be reviewed as to whether adaptation should be included and related assessment, planning and revision tasks could be incorporated. Strategic Environmental Assessments, Environmental Impact Assessments and building codes are means to incorporate climate concerns in the planning of investment decisions, but also new tools can be developed. According to the Dutch strategy spatial plans will be checked if climate change has been included and if the plan is climate proof. However, most NASs contain no specific suggestions as to whether and how planning instruments could be actively used and converted into effective tools for development, integration, evaluation and revision of adaptation policies and measures.

2.9. Reflections and discussion

In this paper we have analysed the recent, rapid development of National Adaptation Strategies in Europe. The study looks at six cross-cutting themes and shows that EU countries are taking a variety of approaches to developing adaptation strategies, in

part reflecting their own cultural norms, political systems and assessment of climate risks, but also that a number of common themes can be identified across all NASs. A number of general observations can be made.

First of all, there is the issue of timing and scales. Several NASs have been developed well before the EU published its White Paper on adaptation. Some countries, like Latvia, purposefully waited for these European initiatives to conform to future European standards, but most countries clearly preferred to develop a policy framework at an earlier stage. How the European Commission's proposals to mainstream adaptation into EU policies and to push governmental initiatives to start adapting will enable or constrain national adaptive practices remains to be seen. Most strategies, however, pay little attention to the potential role of the EU, focusing on problems within the national borders. In addition, well before NASs were even considered, some vulnerable regions and sectors already started to adapt and learning experiences can be used in other sectors and regions.

Secondly, the NASs show great resemblance in terms of topics, methods and approaches addressed. This can partially be explained by the projected impacts on climate-sensitive sectors, even though the severity might differ between countries. But it is also caused by our current limited scientific and political understanding of what adaptation implies in practice. Knowledge on impacts and vulnerabilities does not necessarily lead to the most cost-effective and efficient adaptation policy decisions, partly due to the context specificity of adaptation which makes detailed planning at national level challenging. The uncertainty that surrounds climate change combined with the long-term time frame and lagging scientific research offers policy makers little guidance for short-term action. Science on adaptation is moving fast, but the governance of adaptation is moving even faster. The strategies therefore remain rather abstract and facilitate a discussion on adaptive practices rather than impose particular solutions.

Financing adaptation in the NASs is most often not addressed, costs being largely unknown for many of the adaptation options, and funding is left to follow-up action. Also financing research, setting up new institutions and organisations, and supporting the continuity of the policy process are issues that yet have to be organised in most countries. One of the causes is the lack of generally accepted instruments to implement adaptation and the lack of indicators to measure the effectiveness of adaptation policy. These observations in this paper raise the question about the role the NAS fulfils in the wider governance of adaptation. Do they really co-ordinate and integrate adaptive practices between various levels of government and do they stimulate and enable local initiatives? Are they strategic policy documents to maintain the political momentum on adaptation? Are they simply there to raise awareness and show that the government recognises the projected impacts? Are they anticipating future EU policy? Are they developed because other countries have them as well? We argue that positive responses to all of these questions suggest valid roles of the NAS in the wider process of adaptation policy – but with a different emphasis between countries.

2.9.1. Strengths, weaknesses, opportunities and threats

Based on the comparison of the six themes we can identify some shared strengths and weaknesses between EU countries. Potential threats and, in many cases, similar opportunities can also be distilled from the analysis (see Table 2.3). To exploit the opportunities and strengths and to reduce the weaknesses and threats within the countries, exchange of experiences and results of adaptation practices between countries can be very useful. Countries can learn from innovative strategies, approaches and measures to cope with the impacts of climate change in other countries. Our discussions about the NASs with various experts and policy makers across Europe suggest that for delivering many adaptation actions, institutional problems such as multi-level governance and policy integration may be a greater challenge than finding technical solutions. It is generally acknowledged that adaptation cannot be delivered in isolation – it must be an integral part of all relevant policies (i.e. mainstreamed) to ensure they remain appropriate as the climate changes. Unlike many other areas of environmental policy, adaptation is likely to be motivated in many cases by self-interest and hence undertaken voluntarily. Although the relevance of improved climate projections is often recognised to enhance effective policy making, most barriers to actual adaptation appear to be related to policy co-ordination and implementation, i.e. pertaining to how adaptation actions can be designed, organised and financed. Hence, not only uncertainty about the substance of the problem becomes important, but also uncertainties regarding the strategies of stakeholders in the adaptation process and the institutions involved (Koppenjan and Klijn 2004). Government is seen as fulfilling three main roles: providing information and raising awareness, supporting the development of adaptive capacity, and ensuring that public goods are integrated into cost–benefit analyses through regulation, instruments and incentives. A crucial challenge still to be confronted in all NASs is policy integration, with few measures yet in place to ensure effective co-ordination of adaptation policy throughout government. Indeed, most strategies can be regarded as

Table 2.3. Generic strengths, weaknesses, opportunities and threats that are typical for several National Adaptation Strategies in EU Member States.

	Contributing significantly to achieving theNAS objectives	Hindering the achievements of the NAS objectives
Related to historical conditions and institutional development of the NAs	**STRENGTHS** - targeted adaptation research - planning for implementation, review and funding - coordinating between sectors	**WEAKNESSES** - lack of coordination between administrative levels - lack of stakeholder involvement - unclear division of responsibilities - lack of specialised knowledge - scientific uncertainties
Related to the current and future conditions and developments external to the NAS	- development and export of knowledge - spill- over of policy integration and multi - level governance for non EU policies **OPPORTUNITIES**	- cross -level conflicts - cross -sectoral conflicts - lack of resources - lack of public support/awareness - global impacts **THREATS**

just the start of a policy process rather than its culmination. Their achievement has been to place adaptation on the national policy agenda. However, most strategies still lack concrete proposals or processes for enhancing adaptive capacity, implementing adaptation actions, ensuring that policy integration actually happens or measuring policy effectiveness. With knowledge of vulnerability and adaptation options increasing over the coming years, effective implementation of NASs will require the deployment of flexible mechanisms to exploit this new knowledge.

2.9.2. Knowledge gaps

It appears from our analysis that there are many knowledge gaps, uncertainties and policy questions related to the six themes of this study. We have condensed these here into ten generic recommendations for the programming of meaningful climate change adaptation research in a European context and the sharing of results with potential users (Swart et al. 2009):

- Carefully design a flexible mechanism for science-policy interactions.
- Connect research to local, regional and national policy needs.
- Analyse the role of institutions in climate change adaptation.
- Exploit different options to share knowledge internationally.
- Develop systematic ways to analyse, manage and communicate relevant scientific uncertainties.
- Analyse options to address mechanisms and responsibilities involved in effective multi-level governance.
- Develop frameworks for evaluating adaptation policies, with a supporting toolbox of methods and metrics.
- Analyse the applicability of different types of policy instruments for adaptation policy.
- Perform comparative analyses of sectoral and cross-sectoral adaptation in vulnerable regional hotspots.
- Analyse national adaptation in the context of European and global developments.

2.9.3. Europe and the wider world

The rapid development of NASs across Europe provides a very valuable first step in managing the unavoidable impacts of climate change both at the national and European level. Moreover, recent developments at the European level, such as the White Paper on climate change adaptation, support these developments and stipulate the need for more research and knowledge exchange with regards to adaptation strategies. We identified a large need and urgency for exchange of knowledge and experiences between countries. At the time of writing this paper, other industrialised countries have also started to develop adaptation strategies, in particular Canada and Australia, which consider themselves very vulnerable. For example, the Council of Australian Governments (COAG) endorsed a National Adaptation Framework in 2007, with a long-term goal to position the country to reduce the risks of climate change impacts and realise any opportunities, and a medium-term goal (5–7 years), to build capacity to deal with climate change impacts and reduce vulnerability in key sectors and regions through targeted strategies. In the USA and Japan, impact assessments are currently paving the way to develop adaptation strategies. Sharing knowledge

between European and these other industrialised countries would provide opportunities for learning from each other's experiences. The rapid pace of policy development suggests that this is urgently needed to decrease the risks of mal-adaptation. Moreover, while acknowledging the vast differences, experiences from the industrialised countries may be useful for furthering the adaptive capacity of the developing countries, who need it most.

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CHAPTER 3

On the nature of barriers to climate change adaptation

ABSTRACT Considerable barriers can emerge in developing and implementing climate change adaptation strategies. Understanding the nature of barriers to adaptation is important so as to find strategic ways of dealing with them. However, our current understanding is limited and highly fragmented across the academic community. This paper aims to bring some conceptual convergence in these debates by applying a systematic review method to assess the current state of knowledge on barriers to adaptation in the peer-reviewed literature. The review results show that: (1) Barriers to adaptation have hardly been defined in the literature and no clear indicators exist so as to identify and assess them systematically. (2) An impressive number of barriers have been reported, but the list of possible barriers is seemingly endless. (3) The most frequently reported barriers relate to the institutional and social dimensions of adaptation. (4) Barriers are identified as configurations of climate and non-climate factors and conditions that emerge from the actor, the governance system, or the system of concern. (5) Barriers are mainly studied in developed countries with a strong focus on water-related domains. (6) The majority of studies on barriers use small-n inductive case approaches while comparative studies across different contexts are limited. (7) Although interventions to overcome barriers are recommended by most studies, empirical studies on interventions are scarce. We present further conceptual clarification and a more precise definition of barriers to adaptation. We conclude that future research should go beyond asking the questions 'if' and 'which' barriers to adaptation exist and begin asking 'how' and 'why' barriers emerge.

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3.1. Barriers to adaptation as an emerging research topic

Since the beginning of this century, the academic literature on adaptation to current and projected impacts of climate change has expanded rapidly (Barnett 2010; Berrang-Ford et al. 2011). Recently these studies started to include questions as to what social factors and conditions hamper our ability to adapt proactively to future environmental changes. Answers to these questions are often labelled as 'barriers to adaptation' (e.g. Amundsen et al. 2010; Jantarasami et al. 2010). Several reasons for the increased attention to barriers to adaptation can be mentioned. First, the recent climate change impacts and catastrophic events throughout the world raised questions if societies have the capacity to adapt to climate change or whether they are somehow constrained (Adger et al. 2009a). Concomitantly, scientific discussions have shifted from *if* there is a need to adapt towards *how* to adapt and what might constrain these adaptive efforts (Dovers and Hezri 2010; Berrang-Ford et al. 2011). In addition, the fourth IPCC assessment report (WG2, Ch.17) synthesised our understanding of the limits and constraints to climate change adaptation and concluded that significant '… research challenges in understanding the processes by which adaptation is occurring and will occur in the future …' still remain (Adger et al. 2007, p737). Moreover, there has been an increased engagement of the social sciences in the rapidly evolving debates on climate change adaptation, including academic fields such as public administration, political science, sociology, geography, and psychology. These social sciences bring new theories, research interests, perspectives, and methods to analyse various aspects of adaptation (Jasanoff 2010; Moser 2010b), including barriers to adaptation. Finally, the number of policy initiatives for adaptation has been increasing, creating a useful substratum to conduct empirical case studies and analyse barriers in practice (Tompkins et al. 2010).

Despite recent understanding that the major challenge for successful adaptation will be our ability to navigate the labyrinth of barriers that emerge in the governance of adaptation (Adger and Barnett 2009; Adger et al. 2009b; Moser and Ekstrom 2010; Rijke et al. 2012), just what constitutes these barriers remains elusive. Perhaps it is sufficient to agree that barriers will always emerge along the way, and leave the details to be defined within the particular context in which they are identified. However, recently scholars have started to explore this concept and propose more generic ideas and principles about such barriers (Burch 2010a; Moser and Ekstrom 2010). A clearer conceptualisation of the nature of barriers plays a pivotal role in understanding the process of adaptation and evaluating climate change adaptation policies and measures. This type of research will be vital for increasing awareness of barriers and for developing ways of dealing with them in effective and efficient ways. Nevertheless, the existing literature on barriers to adaptation is highly fragmented and often very context specific, which complicates any progress on fully understanding their nature.

This paper aims to fill this gap by critically reflecting on the existing knowledge on barriers to adaptation with the purpose of extending our conceptual understanding. Systematic review methods will be used to assess the current state of this nascent research topic, to identify established ideas and principles, and to identify crucial knowledge gaps for future research. Specifically, the paper examines four research

questions: (1) What are considered to be the key barriers to adaptation? (2) How are barriers defined, conceptualised, and categorised? (3) Which methods and theories underlay the assessment and evaluation of barriers? (4) Are there linkages between types of barriers and ways to overcome them?

The chapter is structured as follows. Section 3.2 describes the systematic review methodology used to collect the empirical data. Section 3.3 presents the synthesised results. In Section 3.4, we discuss the results, provide some conceptual convergence on the nature of barriers, and make recommendations for further research. The paper ends with concluding remarks in Section 3.5.

3.2. Systematic review methodology

Several studies use traditional literature review methodology to identify barriers to adaptation (Ekstrom et al. 2011), including reviews for specific domains such as health (Huang et al. 2011), for specific levels such as the individual (Gifford et al. 2011), or specific entities such as cities (Fünfgeld 2010). Traditional literature reviews are known to be vulnerable to intentional and unintentional bias in the selection, interpretation, and organisation of content. Therefore, systematic review methods are increasingly used to create a comprehensive assessment of the current state of knowledge by applying rigorous, objective and transparent steps, and criteria for reaching conclusions from a body of scientific literature (Petticrew and Roberts 2006). Although these systematic review methods are commonly used in other domains, most noticeably health research, systematic reviews have been used sporadically in environmental studies. Studies on adaptation that did use this method demonstrate its value in synthesising the state of knowledge, for example, by assessing the progress on climate change adaptation (Berrang-Ford et al. 2011; Ford et al. 2011) climate change vulnerability in the Western Canadian Arctic (Ford and Pearce 2010), and adaptation to health impacts of climate change (Lesnikowski et al. 2011).

3.2.1. Data sources and review protocol

The first step was to design review protocols to ensure a transparent and rigorous selection of eligible cases and to structure the analysis. The review was limited to social barriers to adaptation, thereby excluding a number of other technical and biophysical limits to adaptation beyond which adaptation is no longer deemed feasible (Adger et al. 2009a). Because the scientific discussions on social barriers to adaptation are still in their infancy, and no previous attempts have been made to conduct a systematic review of the literature on barriers, the review began with a broad focus on barriers to adaptation; barriers to adaptation were defined as those factors and conditions that hamper the process of developing and implementing climate change adaptations. The definition of climate change adaptation provided by the IPCC-AR4-WG2 was used to focus the search.[1] Eligible literature was selected using three main inclusion criteria: (a) peer-reviewed papers, published and online first, to ensure the quality of the included papers; (b) papers explicitly designed to identify social barriers

[1] 'Adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities. Various types of adaptation can be distinguished, including anticipatory, autonomous and planned adaptation'

to climate change adaptation; (c) papers on the governance of climate change adaptation in which barriers are included. While the search was not limited to a specific time period, the papers ranged from 2000 to 2011. Non-English written papers were excluded from the analysis. The review includes empirical studies and theoretical papers to get a complete assessment of the existing knowledge on the nature of barriers. Scopus (Elsevier) and Web of Science (Thomson), the two largest scientific databases for the social sciences and environmental sciences were selected to perform the search and collect the data. These databases were carefully chosen to prevent European bias (Scopus) or North American bias (Web of Science) in the selection of papers (Falagas et al. 2008).

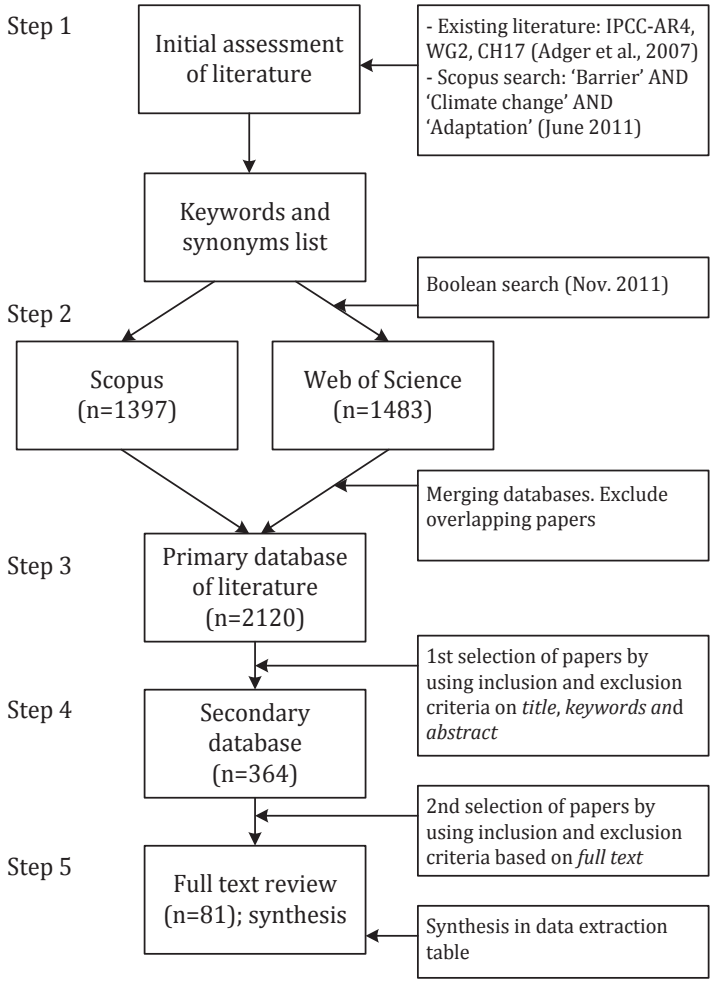

Figure 3.1. Schematic representation of the systematic review process.

3.2.2. Data collection and analysis

The data were collected in several steps, see Fig. 3.1 and Supplementary Material A. First, a list of initial keywords and synonyms of barriers to adaptation was constructed by analysing the terms used in the IPCC-AR4-WG2-CH17 (Adger et al. 2007). Additionally, a simple query was used to perform an initial assessment of the literature. This search yielded 154 papers. Screening the material provided a comprehensive list of search terms to conduct the meta-review. The search terms were kept broad to capture the full bandwidth of studies that address barriers to adaptation. In the second step, combinations of search terms were inserted into Scopus and Web of Science in November 2011. Two separate primary reference databases were constructed using EndnoteX4. Overlapping papers were removed and a new dataset constructed that included 2120 papers. In the third step, the review of title, abstracts, and keywords reduced the number to 364 eligible papers. This step removed papers that were not related to the study topic, for example, studies related to climate change impacts on the Great Barrier Reef. In the fourth step, the full texts of these papers were collected and read by the researchers. Using the assessment criteria, progressive focussing yielded 81 papers that were considered eligible for further analysis. The full texts of all 81 papers were carefully re-read and analysed. A data extraction table was designed to systematically collect quantitative and qualitative data from the literature. The table was designed to provide data to answer the research questions and included the following categories: bibliographic information, focus of the study, methodology, theoretical orientation, identified barriers to adaptation, and interventions strategies. The data extraction table presents the results literally, without the interpretation of the authors. Information on non-quantitative issues was abstracted and summarised for presentation and discussion, see Section 3.3.

3.2.3. Limitations

Although systematic reviews are designed to be as comprehensive and transparent as possible, there are some limitations to this approach that need to be considered (Petticrew and Roberts 2006). First of all, only peer-review publications were included to ensure scientific and methodological rigour in the analysed studies, but including grey literature might have yielded additional insights. Second, the review only included two scientific databases: Scopus and Web of Science. Other databases could have provided additional papers. To ensure that no key papers were missed from the analysis, we cross-checked whether the references in each of the 81 papers provided new papers that should, based on the title, be considered for review. No additional papers were found. Finally, the review was limited to English written material only, where more evidence on barriers to adaptation may be available in non-English languages.

3.3. Evidence synthesis: what we know about barriers to adaptation

The synthesised results of the 81 papers show that the number of studies on barriers to adaptation has increasing rapidly; two thirds of the analysed papers were published after 2009, see Fig. 3.2a. This is in line with the observed scientific progress on climate change adaptation (Berrang-Ford et al. 2011). The results show a variety of analytical

scales, but most studies focussed on local or regional levels (Fig. 3.2b). In addition, the majority of papers were inductive, small-n qualitative case studies that used interviews, workshops and surveys as primary data sources (Fig. 3.2c). The majority of studies assessed barriers in the context of water management, coastal zone management, or considered multiple sectors (Fig. 3.2d). Studies on barriers in other vulnerable sectors, including biodiversity, infrastructure, information and communication technology (ICT), tourism, or engineering, were hardly identified. The majority of studies implicitly refer to barriers to adaptation in explaining adaptation processes. About half of the empirical studies were explicitly designed to analyse barriers. The remainder of this section identifies eight important observations that characterise our current knowledge.

What is meant by barriers to adaptation is hardly defined

Although all 81 studies discussed or analysed barriers to adaptation, only seven studies provided a clear definition of what barriers to adaptation are (H. Boer 2010; Moser and Ekstrom 2010; Eisenack and Stecker 2011; Huang et al. 2011; Jones and

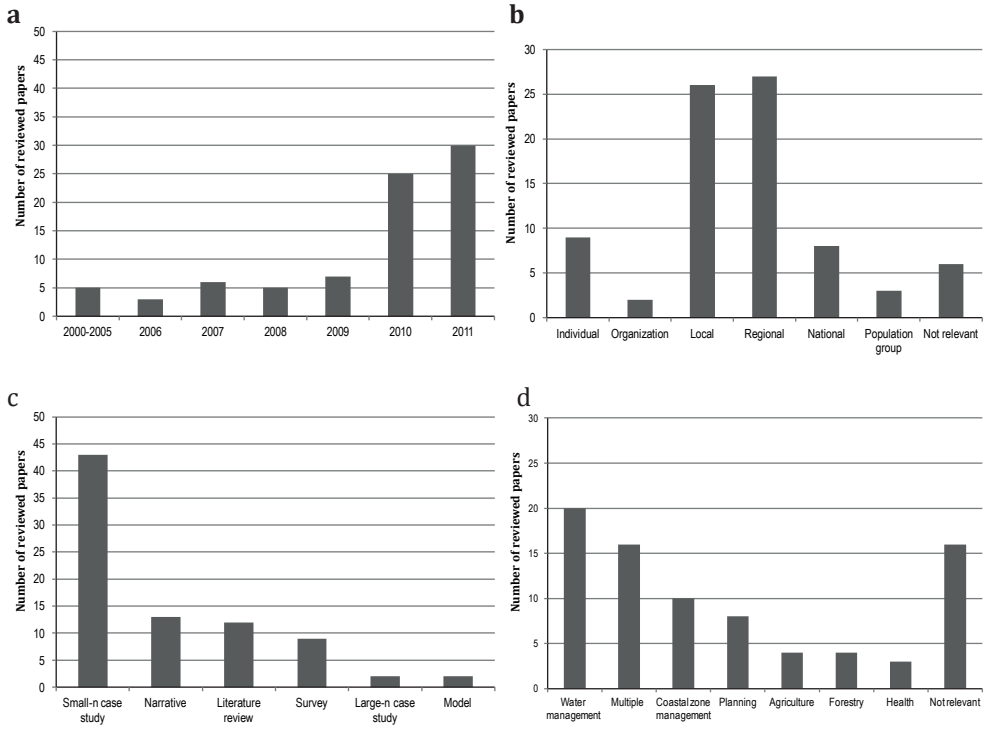

Figure 3.2. **a** *The total number of papers per year illustrates the substantive increase in papers that analyse barriers to adaptation since 2009.* **b** *Level of analysis of reviewed papers. Most studies started from a local or regional level empirical analysis. 'Not relevant' refers to theoretical and conceptual papers in which no scale was identified.* **c** *The majority of the papers use small-n qualitative case studies. 'Narrative' refers to a conceptual or theoretical contribution.* **d** *Sectors addressed in the reviewed papers. The majority of papers are related to water management and coastal zone planning. 'Not relevant' refers to theoretical and conceptual papers in which sectors were not addressed specifically.*

Boyd 2011; Storbjörk and Hedrén 2011; Sutton and Tobin 2011). The remaining 74 papers were either abstract or implicit in how they defined barriers to adaptation. Although there is no shared definition of barriers across the seven studies, each study tried to capture the essence of something being a barrier by referencing intrinsic features. In some instances, reference is made to a relation between a barrier and the desired outcome to alleviate ambiguity and place the concept of barriers in the context of climate change adaptation. For example, Huang et al. (2011, p185) refer to a barrier as '… any condition that makes it difficult to achieve progress towards adaptation'. However, what is meant by adaptation is unclear and can include barriers that prevent building adaptive capacity, prevent mobilising adaptive capacity, hinder implementation of adaptation measures, slow down the uptake of adaptation in policy, lead to policy failure, constrain individual engagement or action, or prevent the uptake of new frameworks and tools to support adaptation. Other studies emphasised the operative part of barriers, that is, the negative effects of barriers on the outcome, by suggesting that barriers will increase the overall duration of the governance process; increase the costs in terms of manpower, financial resources, or acquiring additional skills; make adaptation less effective and efficient thus leading to missed opportunities (Moser and Ekstrom 2010). Barriers have also been conceptually distinguished from limits with the argument that the ephemeral trait of something being a barrier is that it can be overcome. Moser and Ekstrom (2010, p22027), for example, refer to barriers as '… obstacles that can be overcome with concerted effort, creative management, change of thinking and related shifts in resources, land uses institutions etc.'. Moreover, Sutton and Tobin (2011, p895) differentiate between subjective and objective constraints to stress the different sources of barriers that constrain the engagement of individuals in adaptation. In a similar vein, Jones and Boyd (2011, p1264) define barriers as to 'how each … [cognitive, normative, institutional]… facet … restrict individuals or groups from seeking the most appropriate or most sustainable forms of adaptation action'. They provide a more comprehensive description of the characteristics for each of the three facets. These results provide some conceptual clarification of the meaning and intricateness of 'barriers to adaptation', but no 'if-and-only-if conditions' were found in the studies to determine when something is a barrier to adaptation.

Institutions and social dimensions are key categories of barriers to adaptation

The 81 papers included in this review mention more than 200 context-specific barriers to adaptation, see Supplementary Material A. Fig. 3.3. synthesises the results into the categories presented by the IPCC-AR4 (Adger et al. 2007). At an aggregate level, institutions and social dimensions are most frequently mentioned. Although the IPCC categorisation provides a useful starting point to synthesise the barriers to adaptation, other dimensions can be identified in the literature that could be considered as categories as well. For example, Eriksen and Lind (2009) stress the importance of political barriers to adaptation in their study on adaptation to drought in Kenya. In fact, any kind of categorisation is rather arbitrary and signals our lack of understanding what barriers really are. Many papers recognise the limitations of standardised categorisations and propose alternative categories that fit the objectives and theoretical perspectives of the study at hand. Supplementary Material A highlights

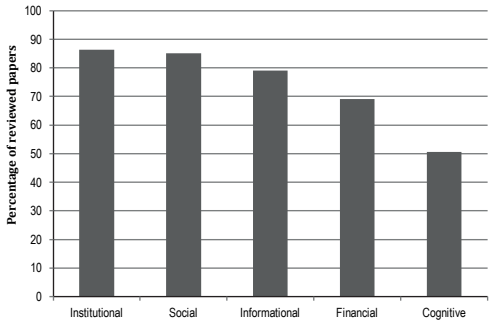

Figure 3.3. Categories of barriers to adaptation, after Adger et al. (2007)

these alternative categories in Italics. Falaleeva et al. (2011), for example, use stability, credibility, adaptiveness, and inclusiveness as categories of the Earth System Governance framework to categorise barriers emerging in the implementation of coastal zone management in Ireland. Crabbé and Robin (2006) distinguish between external and internal institutional barriers for municipal adaptation. Moser and Ekstrom (2010) categorise barriers according to three temporal stages in the planning process. Although categorisations provide a useful structuring heuristic to guide scientific inquiry, empirical studies often refer to combinations of specific barriers for which the source and origin can hardly be attributed to one category of barriers. For example, financial resources is used as a broad category by Adger et al. (2007) but also includes more specific combinations of factors that are reported as barriers, for example, lack of funding from central government, lack of institutions that facilitate financing adaptation, limited access to financial resources, lack of resources to monitor progress, or lack of political willingness to mobilise financial resources. Moreover, these barriers are often combined with contextualised conditions (see section below), thereby constructing a potentially endless list of context specific barriers to adaptation.

Reported barriers differ between contexts

One third of the 81 papers analyse barriers to adaptation in low-income developing countries. Studies from these countries predominantly identify barriers related to high vulnerability, low levels of adaptive capacity, weak institutional environments, and low priority of adaptation compared to other pressing societal issues. Especially non-climatic socio-economic factors, such as inequality, inequity, religious tensions, and poverty, are mentioned as conditions that influence social vulnerability and constrain adaptive practices in low-income countries, see for example Adger (2000) or Nielsen and Reenberg (2010). Around half of the studies (57 %) focus on middle- and high-income countries. These studies consider barriers to building adaptive capacity, with emphasis placed on institutional and societal barriers that prevent the mobilisation of adaptive capacity. Furthermore, the results emphasise that barriers are context specific across sectoral, spatial, and temporal scales. Each study identifies a unique configuration of factors and conditions that pose barriers to adaptation in their

specific context, making generalisation a challenge. For example, barriers in the water sector, such as variation in flood protection standards (McNeeley 2012) or limited exposure to hydrological modelling (Hamlet 2010) are very different from the barriers identified in the public health sector. Ford et al. (2010a), for example, mention 'low ranking of climate change impacts to other health challenges' and 'jurisdictional conflict over health care provision between scales' as important barriers to health, see also Huang et al. (2011) for similar conclusions. Yet, they share several similar barriers, including unclear responsibilities, lack of skills, and rigidity of existing institutional arrangements. In a similar vein, barriers can be specific to the local context. Barriers to adaptation in Sweden, such as unfamiliarity and unawareness of climate change (Amundsen et al. 2010), are different from barriers reported by Næss et al. (2005) in their study on Norwegian adaptation at the local level. In Norway, political costs and the role of powerful individuals were identified as key constraints in local adaptation. Even within countries there is some variation in results; Storbjörk and Hedrén (2011) identify tensions and trade-offs between policy agendas and political priorities as important barriers for local coastal zone management in Sweden, which are not found by Amundsen et al. However, as Glaas et al. (2010) show, both studies also mention many shared barriers of local level adaptation in Sweden, including an unclear division of responsibilities, and limited national involvement in coordinating adaptation efforts at the local level.

Most barriers are not specific to climate change adaptation

Only three barriers were found in the studies that were specifically and directly related to climate change adaptation: the long-term impacts of climate change versus the short-term dynamics of politics and decision-making; the reliance on scientific models to identify, understand, and communicate the problem and propose solutions; and the inherent uncertainties and ambiguities of climate change. The remaining barriers are not directly climate specific but can also be identified in many other complex environmental problems and general policy implementation studies (O'Toole 1986). These barriers emerge in the context of climate change adaptation as they would in any other policy arena. For example, Ford et al. (2010a) show how non-climate-specific barriers such as high turnover of personnel, resulting in challenges of institutional knowledge and capacity assessments, poses a barrier to the implementation of measures that favour effective adaptation for the Canadian Inuit population. Hence, as several authors put forward, the nature of climate change itself can make some barriers more tenacious, accentuate other barriers, and/or trigger the emergence of new barriers (Crabbé and Robin 2006; Brown and Farrelly 2009; Bunce et al. 2010; Burch 2010a; Moser and Ekstrom 2010).

Individual actors that experience barriers to adaptation are central to the analysis

All studies place actors or groups of actors that have experienced barriers to adaptation central to their analysis. Several studies argue that what actors value as barriers depends on their roles, values, interests, and ideas; actors interpret and give meaning to events in different ways and therefore can have conflicting ideas about what the real barriers to adaptation are and which barriers should be given priority,

see for example Burch (2010a) and O'Brien et al. (2006). Broadly speaking, these studies are guided by the question: what is a barrier to whom reaching what in the governance of adaptation. The actor level focus allows for a more fine-grained perspective on the priority of barriers and allows for the measurement of the relative importance and severity of barriers in an adaptation process. For example, (Mozumder et al. 2011) use a survey to assess what federal, state, and local decision makers consider to be important institutional and social barriers to adaptation in the Florida keys.

Governments are considered key in creating and removing barriers to adaptation

The results suggest that the role governments play is key in the governance of adaptation and understanding many of the reported barriers; governments at the local, regional, or (supra)national level are considered to constrain, enable, and stimulate adaptation. For example, several studies argue that the lack of policy guidance, the limited coordination between levels, and the lack of available governmental resources constrain adaptation at all administrative levels (Crabbé and Robin 2006; Tryhorn and Lynch 2010). The government driven, top-down approach is reported to constrain local, bottom-up initiatives on adaptation (Amundsen et al. 2010; McNeeley 2012), and mask local vulnerability (O'Brien et al. 2006). Simultaneously, governments are seen as key actors that can intervene and confront existing barriers by changing legislation or providing additional resources (Ford and Pearce 2010; Measham et al. 2011a; Mozumder et al. 2011). Other studies suggest that governmental institutions enable adaptation so that it can occur at other levels (Biesbroek et al. 2010). Several studies suggest that governments stimulate adaptation across scales, for example, through building new institutions or increasing knowledge exchange (Storbjörk and Hedrén 2011).

Conceptual frameworks to analyse barriers to adaptation are limited

Conceptual frameworks, as analytical instruments used by researchers to connect the conceptual ideas and guide scientific inquiry, play an important role in analysing barriers. For example, the earlier example of the difference in barriers identified by Amundsen et al. (2010) versus Næss et al. (2005) could also be explained by their decision to employ different frameworks. Where Amundsen et al. (2010) follow a governance framework, Næss et al. (2005) start from an institutional perspective. Broadly speaking, two types of conceptual frameworks are used in the analysis of barriers in our 81 sample studies; those explicitly designed to address barriers to adaptation and existing conceptual frameworks. The framework developed by Moser and Ekstrom (2010) was the only policy framework purposefully designed to identify and analyse barriers to adaptation. Starting from the existing adaptation cycle (understanding, planning, and managing phase), they categorise barriers to adaptation as being typical for each stage and identify a number of cross-cutting issues, or 'barriers', that they value as being universal in the decision-making process on adaptation (leadership, resources, communication and information, and deeply held values and beliefs). By asking diagnostic questions, this framework allows researchers to trace the origin of barriers and provide a starting point for

interventions. Others have used their categorisations of barriers to guide their inquiry and investigate the barriers in specific case studies, see for example, Jones and Boyd (2011), Burch (2010a), and Sutton and Tobin (2011). A second group of studies argue that barriers are the missing, inefficient or unconnected components of their framework. For example, Eisenack and Stecker (2011) present a framework to analyse adaptation action by looking at the dynamic between actors (receptors and operators of adaptation) and means (resources) within an exposure unit. They argue that missing or an inefficient use of resources, missing operators, and complex actor constellations are the main categories of barriers to adaptation.

Studies about ways to deal with barriers remain limited

Studies typically conclude with short recommendations of possible interventions, for example, to improve social learning, stimulate institutional change, change the modes of governance, or engage in societal transitions. Studies that include interventions suggest that it takes considerable efforts to overcome barriers (Storbjörk 2010). However, many of the suggestions are not made to actually intervene in a faltering process, but to improve future governance of adaptation and prevent barriers from re-appearing. There are some noteworthy exceptions. Burch (2010b), for example, explored the practical strategies municipal actors in two Canadian cities can use to transform barriers into enablers of adaptive action. The recommended interventions are more theory driven than empirically rooted or tested in practice. Lebel et al. (2011) identify institutional traps for reducing vulnerability in Vietnam and formulates five intervention strategies, such as expanding public participation, building adaptive capacity at multiple levels, and linking knowledge and practice, as general ways to overcome the institutional traps. As the last column in part C of Supplementary Material A shows, the proposed intervention strategies are often solutions that counterpoint the identified barriers (Brown and Farrelly 2009). For example, when a lack of financial resources is identified as a barrier to adaptation, the intervention of making more financial resources available is often advised. Burch (2010b), however, finds that more financial resources are not necessarily needed when existing resources are better used. The proposed interventions generally provide little guidance for action; proposing that more resources are needed hardly seems to help overcoming the barrier. Some conceptual progress on interventions should be mentioned. Moser and Ekstrom (2010) argue that in order to understand the direction for finding suitable interventions, two variables can be considered: the actors' capability to deal with a barrier and the origin of the barrier, which is influenced by the spatial jurisdictional and the temporal dimension of the barrier. Burch (2010b) provides five steps to overcome barriers and produce a robust programme of climate change action (evaluate the system, identify goals, strategically tackle sources of path dependency, evaluate progress, adaptively manage).

3.4. Discussion: on the nature of barriers to adaptation

Empirical evidence on the existence of barriers to adaptation is growing rapidly and despite the relative newness of the topic, an impressive number of barriers have already been reported. The review results show that barriers emerge from different angles and directions but three levels are most often considered: the individual actor,

the policy or governance process of developing and implementing adaptations, and the enabling and constraining context in which adaptation takes place, see also Ekstrom et al. (2011). The reported barriers themselves can be different things depending on the goal of adaptation and the context in which adaptation takes place (Adger et al. 2009a); ranging from cognitive and motivational barriers to systemic and institutional barriers. Despite the empirical progress in identifying barriers and the first steps in exploring what constitutes 'barriers', we found few attempts to define the concept of barriers, to develop indictors to identify and distinguish them from non-barriers, to identify and prioritise the importance and severity of barriers, and to identify interventions to deal with them. In addition, positive features of barriers as healthy selection mechanisms have hardly been explored. Thus far, discussions on barriers have generally been normative in their implicit assumption that there is such a thing as 'barriers', that these barriers are bad and need to be overcome in order to adapt successfully. These are all indications of a research field that is still in its infancy. Papers reviewed in this study are part of the first generation studies on the governance of adaptation, thereby providing an important empirical foundation on which the research field of barriers to adaptation can evolve, see Ford et al. (2011).

Synthesising this literature allows for further debate about the nature of barriers to adaptation. First of all, we postulate that the term 'barrier to adaptation' is used as a metaphor, or analytical construct, created by researchers or practitioners with the intention to point to the climate and non-climate-specific events, factors, and conditions that negatively influence the process of successful adaptation to climate change. They are constructed to make sense of complex situations, see also Checkland et al. (2007) for similar conclusions on barriers in medical practices. What factors and events are considered as barrier is determined by how actors interpret and value past events, which ultimately depends on personal values, ideas, and interests (Bailey 2008); what might be considered a barrier to one actor could be an opportunity to other actors (Burch 2010b).The importance and severity of each barrier supposedly differ between actors and context and are likely to change over time. Scholars have begun to argue that barriers are perceptions of reality, putting up for debate if such things as 'real' barriers to adaptation exist (Adger et al. 2009a). However, not all barriers are in the eye of the beholder; our results suggest that, at aggregate levels, barriers can be shared across contexts, see for example the paper by Glaas et al. (2010).

In addition to the analytical challenges that the concept 'barriers' pose, the definition of adaptation further complicates our understanding. Despite the broad consensus on the definition of adaptation to climate change (e.g. Smit and Wandel 2006), there still are some considerable conceptual gaps in what the act of adapting actually entails. This makes it very difficult to define and synthesise the conceptual boundaries of a barrier to adaptation (Dupuis and Biesbroek 2012). Deconstructing adaptation or reframing it towards a more definable problem (e.g. water safety) might be more constructive than continuing to use the broad term of climate change adaptation (O'Brien et al. 2007; Head 2010).

The concept 'barriers' is often used interchangeably with synonyms and other concepts, including 'hindrance', 'constraint', or 'obstacle', and is used in combination with their mirror images of 'opportunity', 'driver', and 'stimulus'. We propose further conceptual clarification by positioning these concepts on the continuums of process and outputs, see Fig. 3.4. In this framework, 'barriers' can be seen as parts of the governance process that influence the output and, in the end, outcomes of the governance of adaptation. On the continuum of output, we can make the classical distinction between 'success' and 'failure' although we acknowledge that there are many grey areas in between (McConnell 2010). In such a view, barriers are valued by actors as having increased the chances of failure and reduced the chances of successful outputs. In contrast to barriers, 'opportunities' positively contribute to the process by increasing chances of success and reducing chances of failure. The interaction between barrier and opportunity suggests that the influence of 'barriers' on the output can be countered by the influence of 'opportunities' and vice versa. Failure to adapt has hardly been discussed explicitly in the adaptation literature but it can be argued that failure is an aspect of the discussions on social limits to adaptation (Adger et al. 2009a) and maladaptation (Barnett and O'Neill 2010). Several attempts have been made to define successful outcomes (Adger et al. 2005). For example, Doria et al. (2009) asked experts in the field of adaptation to define what they considered successful adaptation. Their study shows that even experts with substantive expertise required several iterations to define what is meant by success. Like failure, different actors have different conceptions and assumptions of what is success in the context of climate change adaptation (Marsh and McConnell 2010). The conceptual distinction presented in Fig. 3.4 considers barriers as variables to explain the output.

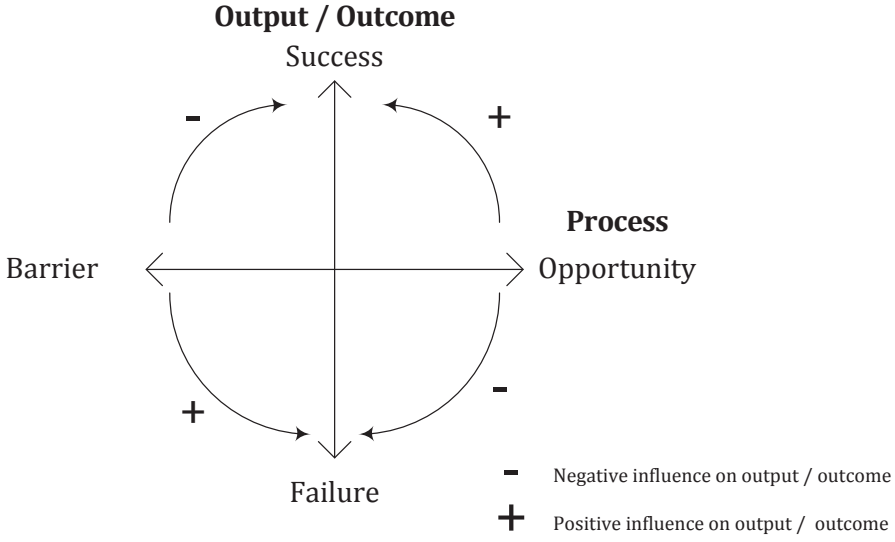

Figure 3.4. 'Barriers' on the continuum of process and output/outcome

However, when barriers are considered to be sets of interacting factors and conditions that culminate into a barrier, barriers themselves could be seen as a dependent variable. By analysing barriers in such a way, the question is not only geared towards identifying which barriers influence the outcome, but what caused the barriers in the first place. Following from the above, we can define barriers as (1) the actors' subjective interpretations or collective understanding of (2) sequentially or simultaneously operating factors and conditions that (3) emerge from the actor, the governance system, or the system of concern, (4) which the actor values as having a negative influence on the process and reduce the chances of successful outputs, but (5) that are manageable and can be overcome with concerted efforts, or (6) by creating and seizing opportunities.

Further reflection on what we currently know about barriers allows for two more critical notes. First of all, after reading the 81 papers, we observed that there is one dominant analytical frame in the scientific discussion on barriers to adaptation; studies are guided by the explorative question 'which' barriers have emerged. The implicit conception underlying these analyses is that identifying the 'right' or 'most important' barriers allows for better or more effective strategies to overcoming these barriers. Studies therefore tend to itemise and reify barriers and treat them as static one-dimensional entities in a dynamic governance process. As amongst others, Adger et al. (2009b) and Burch (2010a) argue that this results in barriers being described and analysed in isolation from each other, and in isolation from the socio-political goals or the goals of adaptation. Dominance of this frame is also reflected in the oversimplified ways in which the dynamic governance process is depicted. The explorative 'which' question leads to categorising barriers in arbitrary ways; all this in an effort to grasp the complex reality of numerous barriers. The dynamic nature of barriers is hardly captured in these frameworks, with the illustration by Burch (2010b) as noteworthy exemption. This frame is of course legitimate for answering the question 'which' barriers have emerged but of limited value to explain the subsequent question of 'how' and 'why' barriers have emerged or how to overcome them. One of the characteristics of any matured research field is the large range of perspectives that become available over time. We postulate that studying barriers to adaptation is, as many complex societal issues, one of the theoretical pluralisms; using a range of existing theories will help to understand the relationships between a large number of factors within nested levels of interactions (O'Brien and Hochachka 2010). Several competing hypotheses, alternative explanations, and a variety of theories about barriers to adaptation are needed to assist in understanding the concept more deeply (Esbjörn-Hargens 2010). Introducing alternative frameworks and explanatory theories from other research fields can prove to be a useful strategy.

Second, the strong inductive orientation of the first generation of small-n descriptive case studies has provided some empirical leverage, but has been of limited influence in advancing scientific debates about barriers. Most studies on barriers suffer from what Goggin (1986) refers to as the 'too few cases, too many variables' problem. The emphasis on contextuality in future adaptation research might prove to be an intellectual challenge for the next generation of studies on barriers. An increasing

number of second generation studies is emerging as results of the contextual turn in adaptation studies, as originally pointed out by O'Brien et al. (2007) and later by Ford et al. (2010b). The questions 'why' and 'how' barriers emerge are closely related to this generation of research on adaptation. In addition to theoretical pluralism, this requires methodological variety by including quantitative large-n studies, longitudinal studies on the dynamics of barriers over time, and comparing barriers across contexts. The review also highlights a number of things we do not yet know about barriers to adaptation but which are important to understand and explore in future studies. These include the possible drivers and triggers that cause barriers to emerge, persist, and reinforce each other. Furthermore, in order to progress, we should develop indicators to systematically identify barriers to adaptation; investigate the influence of barriers on the course and outcome of the adaptation process; examine more closely the relationship between barriers and opportunities and between barriers and interventions; extend the analysis of barriers beyond the domains of water management, coastal zone management and urban planning; intensify the analysis of barriers in the most vulnerable low-income countries; and conduct empirical studies on different types of intervention strategies that could be used to deal with barriers.

3.5. Conclusion

Our findings show that debates about barriers to adaptation are still in their infancy but are rapidly evolving; the inductive orientation in studies on barriers to adaptation has resulted in long lists of possible barriers to adaptation. The results confirm the ideas that adaptation to climate change is not a straightforward task, that context plays an important role in understanding barriers, and that actor centred approaches are necessary for analysing barriers to adaptation. This is where we feel the biggest challenge for future research on barriers to adaptation lays; to change from the inventory questions of 'if' and 'which' barriers to adaptation exist towards more analytical questions as to 'why' and 'how' these barriers emerge. Several studies have already shown promising starts. If we accept that adaptation to climate change is a variable-rich, multidimensional, and perhaps chaotic process, then our understanding of barriers to adaptation must evolve as well to give it scientific legitimacy. This means raising new questions about the meaning of barriers and will require new methods and theories to investigate barriers empirically. Going beyond inductive and explorative assumptions of barriers and dealing with the analytical challenges that contextuality will pose, is vital to mature scientific debates and gain insight on the nature of barriers to adaptation. Not only is this key for scientific progress, it will be a vital step to support politicians and decision makers in preparing for and managing barriers to enable timely and effective adaptation to climate change.

Acknowledgments

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CHAPTER 4

Barriers to climate change adaptation in the Netherlands

ABSTRACT Review of recent literature on adaptation to climate change and general literature on policy processes shows that there are a large number of barriers that hamper the development and implementation of climate change adaptation strategies. To reduce and manage the number of barriers and combine both streams of literature, we propose seven clusters of barriers to adaptation. Little is known, however, about the relative importance of these barriers to climate change adaptation policies and practices. An online survey was conducted between May 2010 and July 2010 among 264 scientists, policymakers, and private actors from different sectors and levels who are involved in climate change adaptation projects and programmes in the Netherlands. The survey aimed to gather their experiences with, and perceptions of, the barriers identified in the literature and encountered in their daily work. Both climate-related and non-climate-related barriers were included in the survey. Data were subjected to both qualitative and quantitative analysis. A survey feedback workshop was organized to discuss the results with several of the survey respondents. Results of this study revealed that respondents considered conflicting timescales as the most important cluster of barriers to adaptation. Other highly ranked barriers include conflicting interests; lack of financial resources; unclear division of tasks and responsibilities; uncertain societal costs and future benefits; and fragmentation within and between scales of governance. Furthermore, the analysis demonstrated that scales matter in understanding the barriers to adaptation: actors from low levels of governance seem to consider the barriers as more severe than actors from high levels of governance.

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4.1. Introduction

It is now widely accepted that both variability of the natural system and anthropogenic forcing contribute to observed and projected climate change (IPCC 2007b; EEA 2010). Mitigation strategies are still the dominant policy approach to climate change, but even if greenhouse gas emissions would be stabilized or reduced substantially through aggressive mitigation strategies in the next few years, some impacts of climate change will occur as a result of inertia in the climate system. Managing these unavoidable impacts of climate change through adaptation strategies has become a complementary policy strategy to deal with climate change. With the growing consensus about the need to adapt, recent discussions are shifting their focus by asking how to operationalize adaptation in policy practice. With this question, new policy challenges have emerged (Dovers 2009; Smith et al. 2009). One of these challenges is how to deal with the various barriers to adaptation. In this article we want to contribute to this discussion by investigating the relative importance of different kinds of social barriers.[1] Social barriers are difficult phenomena to research because, in contrast to biophysical or technical barriers, they cannot be observed or measured directly; they can only be reported by people who encounter them in their daily work. For the purpose of this paper, we define barriers to adaptation as those conditions and factors that actors experience as impeding, diverting, or blocking the process of developing and implementing climate change adaptation strategies. By adaptation strategies we mean all proactive and planned adaptation policies, measures, and options to manage the impacts of climate change, for example by reducing vulnerability, enhancing adaptive capacity, or benefitting from possible opportunities (Swart et al. 2009; EEA 2010). Actors, both individuals and organizations, involved in the governance of adaptation are confronted with these barriers and need to manage them in order to develop and implement the adaptation strategies in practice (Moser et al. 2008). The experiences of these actors can, therefore, provide us with valuable insights about, and advance our understanding of, those conditions and factors that hinder adaptation to climate change (Lowe and Lorenzoni 2007; Mozumder et al. 2011).

Several authors, conducting case studies throughout the world, have begun to identify barriers that actors can encounter when adapting to climate change. Examples of these barriers include uncertainty, the cost of adaptation measures, fragmentation, rigidity, unawareness, lack of data, lack of national attention to climate change, pre-existing beliefs, and poor understanding of the possible effects of climate change. For an overview recent social barriers to adaptation, see Biesbroek et al. (2013). These case studies took place in all kinds of vulnerable sectors and regions. Authors chose different levels of analysis and used different research methods and theoretical perspectives for their analysis. Thus the barriers identified in these case studies are often difficult to compare, highly context-specific, and difficult to use for a more generalized understanding of barriers to adaptation. Next to these case studies, several surveys have been conducted to quantitatively assess the perceptions of key

[1] Literature on barriers to adaptation generally distinguishes between social barriers (institutional, cultural, political and informational dimensions) and biophysical barriers (physical/technical dimensions). When referring to barriers to adaptation in the remainder of this paper, we refer to the social barriers to adaptation.

actors about adaptation to climate change, and some of these surveys included one or two questions on barriers to adaptation (Bryan et al. 2009; Amundsen et al. 2010; Krysanova et al. 2010; Simonsson et al. 2010; Mozumder et al. 2011). Although both types of studies conclude that barriers to adaptation exist, they do not provide detailed insight of how barriers arise, what different kinds of barriers exist, how barriers influence the governance process, or how the importance of barriers differs from one situation to another. In this paper we address some of these questions more thoroughly, by providing an overview of the barriers reported so far in the literature and conducting a survey in which we ask respondents involved in climate adaptation what they have experienced as barriers to adaptation and which of the barriers from the literature they perceived to be the most important.

The two main questions in this paper therefore are: (1) What barriers to adaptation can be identified from the literature? (2) What do actors in the governance of adaptation experience as the most important barriers to adaptation? The second question is addressed through a large cross-sectoral and cross-scale online survey conducted between May and July 2010 in the Netherlands, as well as several expert interviews and a survey feedback workshop. The Netherlands is considered to be among the forerunners in climate change adaptation research and policy; therefore, this country may be considered as an instructive case study into barriers to adaptation (Biesbroek et al. 2010). The Netherlands is especially vulnerable to sea-level rise, saltwater intrusion, changing river discharge, changing precipitation patterns, decreasing freshwater availability, and increasing drought (PBL 2009b), but is also considered to have high adaptive capacity (Haddad 2005), with a variety of hard and soft measures and options available to adapt (Kabat et al. 2005; de Bruin et al. 2009), and broad historical experience in adaptive water management and land-use planning (Van Koningsveld et al. 2008; Kabat et al. 2009; Veraart et al. 2010). Section 4.2 of this chapter describes the barriers that were identified in recent adaptation and governance literature. Section 4.3 describes the methodological approach and considers some limitations affecting the research and the interpretation of the results. Section 4.4 presents the main results of the survey. In section 4.5, we discuss how the insights from the literature review, the expert interviews, the online survey, and feedback workshop contribute to the understanding of barriers to adaptation. The paper ends with some conclusions.

4.2. Literature review: clusters of barriers to adaptation

There are numerous climate- and non-climate-related factors and conditions that influence the policy process on climate change adaptation, see for a complete overview of the barriers to adaptation (Biesbroek et al. 2013). Several scholars have proposed ways to cluster these variables into a smaller set (Adger et al. 2007; Burch 2010a). We identified a large number of barriers in the recent literature on adaptation to climate change, as well as in literature on complex policy issues and in a series of qualitative interviews conducted in 2009. We propose seven clusters of barriers that combine the barriers from the aforementioned streams of literature. By clustering the barriers we are able to go beyond the influence of individual barriers in the interpretation of the survey results. The clusters are: (1) conflicting timescales; (2)

substantive, strategic, and institutional uncertainty; (3) institutional crowdedness and institutional voids; (4) fragmentation; (5) lack of awareness and communication; (6) motives and willingness to act; and 7) resources.

4.2.1. Conflicting Timescales

In the first cluster we placed the barriers that result from conflicting timescales. The long-term changes in the climate system and the rate of projected and observed impacts are difficult to relate to the dynamism of societal changes and short-termism in decision-making and policies (Adger et al. 2009b). For example, climate change competes with other issues for an already limited amount of political attention. Other issues often have a more pressing nature, more certain impacts, or more visible short-term results than adaptation to long-term climate change. An example of timescale conflict is the difference in the traditional long-term planning found in strategic policy documents (20 to 30 years) and the long-term impacts of climate change (100 years or more). Conflicting timescales make it difficult to mainstream adaptation in new and existing policies and practices, even though adaptation may require our immediate attention; for example, large infrastructural works need to take account of the long-term impacts of climate change in order to construct the infrastructure in a climate-proof way (e.g. Stern 2006).

4.2.2. Substantive, Strategic, and Institutional Uncertainty

Uncertainty plays a prominent role in the scholarly literature on climate change. This stream of literature identifies various forms and sources of uncertainty in the understanding of the climate system and the possible impacts of climate change, including uncertainty about our knowledge (epistemic uncertainty), uncertainty about the variability of the natural systems (natural stochastic uncertainty), and uncertainty about the reflexive behaviour of humans in this system (human reflexive uncertainty) (Dessai et al. 2009). Koppenjan and Klijn (2004), writing from a governance perspective, group these three kinds of uncertainty under the heading of substantive uncertainty: uncertainty about the quality and quantity, availability and accessibility, legitimacy and credibility of data and information that is used in decision-making. They identify two other forms of uncertainty, often neglected in the adaptation literature: strategic uncertainty, which is caused by the strategic behaviour of actors in decision-making processes; and institutional uncertainty, which refers to a difference in institutional background of the actors participating in policymaking processes. All of these types of uncertainty can be reasons why policy processes are hampered (Koppenjan and Klijn 2004). Examples of barriers in this cluster include uncertainty about the hidden agendas of politicians, uncertainty about the differences in understanding of the problem, and uncertainty about the rate and speed of climate change.

4.2.3. Institutional Crowdedness and Institutional Voids

In the third cluster we group barriers related to the institutional environment: the set of formal and informal rules, norms, and values that influence actors in their decision-making on adaptation. Two types of barriers may occur, with an opposite character: institutional void and institutional crowdedness. The term “institutional void” (Hajer

2003) refers to a lack of institutions enabling, facilitating, or stimulating adaptation to climate change. For example, the Netherlands has no formal legislation that obliges actors to include adaptation in their activities (de Gier et al. 2009; Swart et al. 2009). An institutional void can make communication among actors more difficult, because there are no shared rules, principles, values, or norms about adaptation. There is often no shared understanding of what an adaptation strategy should include, there are no mechanisms or instruments for adaptation, and there is no shared sense of urgency to start adapting. "Institutional crowdedness" refers to the opposite situation: a plethora of (related) institutions exists, which influences the decision-making process on climate change adaptation. Examples include European legislation, such as the Water Framework Directive, the Birds and Habitats Directives, and the Common Agricultural Policy; they also include national legislation, such as the Dutch National Water Plan and the Dutch Spatial Planning Act (de Gier et al. 2009; Swart et al. 2009). A large number of old institutions competing with new institutions on adaptation can be the cause of confusion about tasks and responsibilities, unclear or conflicting goals, and divergent perceptions about what the problem is and how it should be solved.

4.2.4. Fragmentation

Any governance process that addresses a difficult and complex policy problem is confronted with fragmentation (Biermann et al. 2009). Fragmentation refers to a lack of connection and coordination among institutions, organizations, individuals, and policies, at different levels and scales. Because climate change adaptation is a multi-level and multi-sector issue, fragmentation problems could be expected to be even more severe. Fragmentation can emerge in different forms; for example, knowledge could be diffuse, or only partly accessible; responsibility about adaptation could be divided across different organizations; or decisions may have to be made at different levels, with decisions on one level having a negative consequence on other levels.

4.2.5. Lack of Awareness and Communication

This cluster includes barriers related to awareness and communication. Communication is important to increase public consciousness about the impacts of climate change, the levels of vulnerability, and the need to start adapting (Moser 2010a). Without communication, the public remains uninformed about its role and the collective (governmental) efforts on adaptation. Social and political awareness is considered to be an important condition in the literature on climate change adaptation. Public opinion and the people's level of awareness are influenced through various media, which at times can be negative; for example, recent news items on errors in the IPCC assessment reports have influenced public opinion on climate change negatively (Leiserowitz et al. 2010). A lack of communication between science, policy, and society on climate change adaptation can result, for example, in a low level of awareness, scepticism, overconfidence, or denial.

4.2.6. Motives and Willingness to Act

Barriers concerning people's willingness to act have only recently been discussed in the literature on climate change adaptation (Blennow and Persson 2009; Tompkins et al. 2010). Central to these discussions are the psychological attributes of cognitive

decision-making processes on adaptation; in other words, factors such as attitudes, ethical beliefs, norms, and values that explain why individuals choose to engage in adaptive behaviour, and factors that lead to, or constrain, their adaptive behaviour. For example, several studies suggest that the most effective motive leading to adaptive behaviour is the occurrence of an extreme event (although this is contested by others) (Whitmarsh 2008). A lack of leadership, or a lack of policy entrepreneurship, may be a motivational barrier keeping others from engaging in adaptive behaviour.

4.2.7. Resources

The last cluster of barriers is derived from several studies arguing that resources are an important factor in adapting to climate change. According to these studies, a lack of resources, or the inaccessibility of resources, can be a profound barrier to climate change adaptation (Moser and Luers 2008; Amundsen et al. 2010). Important tangible and intangible resources include human resources (availability of staff, time to become informed, managerial support, skilful and qualified individuals), financial resources (process finance, finance for implementing adaptations), information resources (fundamental and applied research on adaptation, tacit and local knowledge, data availability, credibility and legitimacy of information), physical resources (technological measures), and natural resources (availability of land). Resources are considered to be key components of adaptive capacity (Füssel 2007).

4.3. Survey methodology

4.3.1. Survey Design

The survey design drew on three sources of information: (i) studies of adaptation to climate change mentioning social barriers (Biesbroek et al. 2013); (ii) existing surveys and survey results on climate change adaptation; and (iii) eleven semi-structured interviews with policymakers (n=9) and scientists (n=2) working in the field of climate change adaptation in different sectors and administrative levels in the Netherlands in 2009. The interviews were transcribed, and barriers that were mentioned by the interviewees were collected using open coding techniques and qualitative software (Atlas-ti 6.0). The lists of barriers from the literature review, surveys, and interviews were merged, resulting in a list of 67 possible barriers to climate change adaptation.

The survey was designed to identify those barriers that actors encountered in their work on adaptation, and, based on their experience with them, analyse their perceptions of the relative importance of various barriers to adaptation. Self-administrated online questionnaires were selected as the method of data-gathering for reasons of easy accessibility to a large sample of respondents and efficiency in collecting and analysing responses. The questionnaire included closed as well as open-ended questions. The questionnaire included four sections: (i) the respondent's general opinion about climate change; (ii) ranking barriers to adaptation; (iii) an assortment of statements about barriers to adaptation inviting a reaction by the

respondent; (iv) general information about the respondent.[2] The barriers in the questionnaire were categorized into the seven clusters described above and coded before they were randomly distributed in the questionnaire. Qualitative interviews were used to formulate the questions in ways that matched the language of the targeted response groups. Pre-tests were done using a small response group (n=9) for validation of the content and clarity and precision of the questions. On average, it took the test-respondents between fifteen and twenty minutes to complete the questionnaire, which is considered rather long for a self-administered survey (Dillman 2007).

4.3.2. Selection of Respondents and Data-Collection

List-based sampling techniques were used to select respondents for the survey. Email lists from the two largest research programmes on climate change adaptation in the Netherlands were used.[3] Respondents from both databases may be considered well informed and knowledgeable about climate change. The level of detail in the survey required some experience with, and prior knowledge of, the subject.[4] In total, 890 respondents were selected for the survey. In March 2010, potential respondents received an email asking them to participate in the study. Two weeks later, a reminder email was sent, and two weeks after that the survey was closed. In total, 49 per cent of respondents started taking the survey (n=432), and 30 per cent completed the survey (n=264).

4.3.3. Data Analysis

The survey results were analysed using statistical data-analysis software (SPSS 17.0). Basic descriptive statistics (frequency tables, cross-tabulations), chi-square tests, and Kruskal-Wallis test-analysis of variance were used to assess the statistical significance of variation. Open-ended questions were analysed using open coding by qualitative data-analysis software (Atlas-ti).

4.3.4. Limitations of the Study and of the Interpretation of the Research Results

The survey was lengthy and detailed. It demanded considerable time and effort from the respondents. Although several techniques were used to make the survey as interesting and accessible as possible (Andrews et al. 2003), and the response rate of

[2] The first section of the survey aimed to get a general opinion of the respondents' ideas about climate change and climate change adaptation. Respondents were also asked to identify three barriers which they considered to be the most important barriers to climate change adaptation (open ended question). The second section included three lists of barriers (two lists of 22 barriers and one of 23 barriers). The barriers from the list were categorised and coded in clusters of barriers before they were randomly distributed to one of the three lists. Each of the barriers could be ranked using a four point scale: "very large barrier" (4), "large barrier" (3), "small barrier"(2), "no barrier" (1) and "no opinion" (0). The third section included five statements about barriers to adaptation with the aim to gain insights how barriers relate to one another and how they emerge in policy making. In the final section, respondents were asked to provide personal information in order to conduct the comparative analysis, including information on their average time spent on adaptation, their function, sector and organisation.

[3] Dutch National research programs 'Climate changes Spatial Planning' (CcSP) and 'Knowledge for Climate' (KfC).

[4] Respondents from the list were selected when (i) they considered themselves as being involved in climate change adaptation, or (ii) they were actively involved in projects/processes related to climate change adaptation. Respondents were explicitly asked to complete the survey based on their personal experiences.

30 per cent is above average, the non-response bias could be explained by the research design. The sampling of respondents using a list-based sampling technique covered the climatically most important and vulnerable sectors in the Netherlands, in particular water management and land use. However, the sample of respondents lacked significant representation from sectors that have recently started to adapt, including the sectors of tourism, health, nature, and agriculture. Furthermore, most of the respondents in the group "policy" were policymakers rather than decision-makers or politicians (Pielke Jr 1998). The survey was conducted in early 2010, after the disappointing COP 15 Copenhagen meeting and during the public debates on the CRU emails and IPCC errors. This may have caused a more pessimistic assessment by the respondents (Leiserowitz et al. 2010). The data analysis showed that the group of respondents had a very homogeneous opinion about the seriousness and severity of climate change in general and the need for climate change adaptation in particular. In practice, however, policymaking on adaptation to climate change takes place with actors who have conflicting interests, different understandings of the problem, and different conceptions on the best possible solutions or strategies to influence decision making (Biesbroek et al. 2013). Consequently, the results of this survey are representative only of a selected group of highly informed actors involved in the process of climate change adaptation.

4.3.5. Survey Feedback Workshop

To reduce some of these limitations, a survey feedback workshop was organized. Respondents could indicate at the end of the survey whether they wished to participate in the feedback workshop. The purpose of the workshop was (i) to prevent interpretation bias of the results by the researchers; (ii) allow respondents to interpret the results and explain why certain results were different from their expectations; and (iii) to learn from, and exchange experiences with, participants in discussions on barriers to adaptation. The workshop included practitioners from a variety of sectors and levels. In total, 26 respondents participated in the workshop, which was held in June 2010. Results of the preliminary data analysis were presented. In the first session, participants discussed the results in small groups and reflected on results that they found most surprising. The second session offered participants the opportunity to come up with potential interventions to break through, overcome, or avoid barriers to adaptation.

4.4. Survey results

4.4.1. Respondents

Table 4.1. summarizes the characteristics of the survey sample. Of the 264 respondents that completed the survey, 103 respondents were classified as policymakers, 79 respondents as scientists and researchers, 62 respondents as private actors, and 20 respondents as "other". The majority of responses came from individuals working in water management (n=108, 41%), climate and energy (n=42, 15%) and land-use planning (n=32, 12%). Almost half the respondents were engaged in adaptation projects and programmes for one day per week or less. Most respondents considered climate change to be a natural phenomenon that is

Table 4.1. Survey sample characteristics

	Respondents	
Survey invitations (n=)	890	
Returns (n=)	432	
Completed returns (n=)	264	
Response rate (%)	30	
Sample information	**Cases (n=)**	**Valid percentage**
Time spent on adaptation		
<25% (1 day or less)	127	48.10%
25-50% (2 days per week)	56	21.20%
50-75% (3 days per week)	33	12.50%
>75% (more than 3 days per week)	38	14.40%
None[a]	10	3.80%
Response groups		
Policy	103	39.00%
Science	79	29.90%
Private	62	23.50%
Other[b]	20	7.60%
Scales		
International	42	15.90%
National	95	36.00%
Regional (county, province)	51	19.30%
Water board	29	11.00%
Local (municipal)	27	10.20%
Individual	1	0.40%
Other	19	7.20%
Sectors		
Water management	108	41%
Climate and energy	42	16%
Land-use planning	32	12%
Biodiversity and ecosystems	4	1.50%

[a] *This includes respondents that were recently involved with adaptation, but not in their current work.*
[b] *This includes respondents that could not be categorized in either of the three categories, for example respondents from NGOs, commissions, or education.*

exacerbated by human activities (n=253, 96%). Most respondents considered short-term adaptations necessary in order to prepare society for the impacts of climate change (n=234, 89%). More than three-quarters of respondents argued that actors could encounter as many barriers as opportunities (n=209, 80%) in the governance of adaptation. These results show that the respondents have homogeneous opinions about climate change and the need to adapt.

4.4.2. Importance of Barriers to Adaptation

Respondents were asked in an open question what they considered to be the three most important barriers to adaptation, based on their personal experiences. The responses were collected, categorized, and analysed using Atlas-ti (6.0). The most frequently mentioned barriers were "no sense of urgency" (n=52) and "insufficient financial resources" (n=51), followed by short-termism in politics (n=31), insufficient knowledge about adaptation (n=28), and asymmetric distribution of costs and benefits of adaptation (n=23). Respondents were then asked to rank each of the 67 predefined barriers as presented in the survey. Table 4.2. provides the top ten of barriers that scored highest with the respondents. These results correspond with the most frequently mentioned barriers in the open questions. Respondents ranked the barrier "difference in short term thinking of politicians and long term impacts of climate change" as the most important barrier to adaptation. There is a significant difference in score between this first barrier and the next most highly ranked barrier, whilst the differences between the rest of the barriers in the top 10 are considerably smaller. When workshop participants were asked to reflect on these results, one participant noted that "the results are what I would expect and experience in my daily work ... I continuously need to convince others about the need to start adapting, even though climate change might seem uncertain and far into the future ... but ultimately I

Table 4.2. Ten highest ranked barriers to adaptation

Rank	Description of barrier	N[a]	Mean	Std. dev.
1	Difference in short term thinking of politicians and long term impacts of climate change	261	3.26	0.79
2	Conflicting interests between involved actors	260	2.88	0.73
3	Unclear societal costs and benefits of adaptation measures	259	2.87	0.81
4	Little finance reserved/available for implementation	256	2.81	0.86
5	Lack of awareness of the need to adapt	262	2.78	0.83
6	Short term attention to other urgent policy issues	258	2.78	0.87
7	No safeguarding of adaptation for future policymaking	247	2.71	0.89
8	Dependency in decision making on other actors	255	2.66	0.77
9	Existing policies do not include the long term impacts of climate change	259	2.65	0.83
10	Passive attitude of many policymakers	258	2.63	0.77

[a] *Note: those cases that scored "no opinion" were excluded from the analysis. We interpreted scores >3 as very important barriers; 3-2.5 as important barriers; 2.5-2.0 as moderate barriers; and <2.0 as small or not important barriers to adaptation.*

depend on them [other actors] to make these [adaptation] decisions and to get funding for my projects".

Table 4.3 presents the barriers to adaptation that were ranked lowest by the respondents. These barriers are mostly related to the availability of resources, the number of people involved in making decisions on adaptation, and the availability of adaptation options.

4.4.3. Barriers to Adaptation: Response Groups, Governance Levels, and Policy Stages

We expected to find differences between response groups from different sectors and domains and their ranking of the barriers. However, testing revealed only a few statistically significant differences between response groups. A number of these differences were found between respondents from the private sector and respondents from scientific and policy domains. For example, respondents from the private sector considered the unclear division of responsibility for climate change adaptation to be a more important barrier than scientists ($p<0.05$) and policymakers ($p<0.05$). Little coordination between governments from different levels is considered to be an more important barrier by policymakers than actors from the private sector ($p<0.005$).

Table 4.3. Ten lowest-ranked barriers to adaptation

Rank	Barrier	N[a]	Mean	Std. dev.
58	Labelling traditional measures as climate adaptation strategies	237	1.89	0.79
59	Climate change adaptation is dominated by water management and land use planning	248	1.88	0.92
60	Little confidence that climate adaptation will prove successful	241	1.82	0.76
61	Insufficient scientific research on climate change adaptation	257	1.75	0.82
62	Many people think they are climate experts	256	1.73	0.78
63	Insufficient time to get involved in climate adaptation	252	1.73	0.74
64	Too many people are involved in developing adaptation strategies	251	1.67	0.70
65	Only few adaptation options available	256	1.57	0.69
66	People with different backgrounds participate in adaptation discussions	255	1.48	0.71
67	Few technological measures available to adapt	255	1.41	0.64

[a] *Note: those cases that scored "no opinion" were excluded from the analysis. We interpreted scores >3 as very important barriers; 3-2.5 as important barriers; 2.5-2.0 as moderate barriers; and <2.0 as small or not important barriers to adaptation.*

Several workshop participants suggested that some of these differences between groups are the result of pointing fingers at other groups of respondents with other tasks and responsibilities; for example, policymakers considered too little applied research on adaptation to be a more important barrier than respondents from the private sector ($p<0.05$) or scientists.

On average, respondents from the local level scored barriers higher than respondents from the national or international level. For example, respondents from the local level scored the lack of laws and regulations to enforce the development of adaptation strategies as significantly more important barriers than respondents from the national level ($p<0.01$). Respondents from the local level considered the lack of financial resources to be a significantly more important barrier than respondents from the national level ($p<0.005$). Policymakers from different levels show the biggest difference. Policymakers from the local level scored the lack of central-government involvement significantly higher than policymakers from the national level ($p<0.05$). Similar differences between national and local policymakers were found: lack of laws and regulations to enforce the development of adaptation strategies ($p<0.05$); lack of coordination between governments ($p<0.05$); and no safeguarding of adaptation for future policymaking ($p<0.05$).

Some authors suggest that barriers can be characterized by the phase of the policy process in which they occur (Bachrach and Baratz 1970). We wanted to test this proposition by asking respondents to identify, for each of the 67 barriers, where in the policy process barriers are most likely to occur. Respondents could select one or more out of five stages in the policy process for each barrier: agenda setting, policy development, decision making, policy implementation, and policy evaluation. Although most of the barriers were reported to be particularly present at the first three stages, and fewer in policy implementation and evaluation, our test revealed no clear pattern between the ranking of the individual barriers, the clusters of barriers, or the stages at which the barriers were said to emerge. When faced with these results, several workshop participants argued that, since much of the research and pilot projects on adaptation have only recently begun, it should come as no surprise that most barriers are related to the early stages of the policy process.

4.4.4. Clusters of Barriers

Table 4.4. shows the calculated mean for the barriers within each of the seven clusters. Analysis of the results shows that within each cluster of barriers there is at least one barrier with a considerably higher score than the rest of the barriers in that cluster. The ten highest-ranked barriers (see table 4.2) include barriers from six of the seven clusters of barriers, illustrating that several types of barriers are considered to be important by the respondents.

The results show that the cluster of barriers related to dealing with conflicting timescales scored highly compared with the other clusters. Although this cluster is somewhat influenced by the highest-ranking barrier “difference in short term thinking of politicians and long term impacts of climate change”, the four other barriers in the

cluster are also in the top 20 of the ranked barriers. The cluster of barriers on substantive, strategic, and institutional uncertainty ranks as the second cluster. Most of the barriers in this cluster are related to strategic and institutional uncertainty: unclear roles and responsibilities, unclear who has the decision authority, and unclear who is taking the lead on adaptation. Barriers related to uncertainty in knowledge on climate change were ranked considerably lower by the respondents. This is supported by the response to the statement "uncertainty about climate change is often used to prevent making short term decisions", to which most of the respondents agreed (53%) or fully agreed (18%). In the third cluster of barriers, the analysis shows that respondents scored the lack of awareness highest (no. 5, mean = 2.78). The impact of media coverage on mistakes in IPCC reports is considered to be an important barrier (no. 23, mean = 2.40), but general media coverage on climate change is not considered to be a barrier by the respondents (no. 53, mean = 2.01). Respondents did not consider formal rules and regulations (formal institutions) as an important barrier to adaptation. "Existing national and European legislation on climate sensitive policy domains", for example, ranks low. The absence of formal regulations to commence adaptation is considered a moderate barrier to adaptation by the respondents. In general, barriers related to the cluster "motives and willingness to act" score relatively low. However, respondents scored the rarity of policymakers willing to invest time and money in adaptation as an important barrier (no. 16, mean = 2.54). The barrier "too few people take the initiative to start adapting" is considered to be a moderate barrier (no. 31, mean = 2.34). Most respondents agreed (52%) or fully agreed (15%) to the statement that extreme events are needed as motivators for adaptation. In support of these outcomes, one feedback-workshop participant remarked: "considering our current political situation I do not expect that we are able to steer [towards large-scale adaptive measures] ... the only thing we can do is wait for the next [climate] crisis ... and prepare for it". Fragmentation was not considered by respondents to be an important barrier to adaptation. Only the lack of coordination by the national government was considered important (no. 14, mean = 2.58); the other barriers,

Table 4.4. Clusters of barriers

No.	Cluster of barriers	Number of barriers in the cluster[a]	Mean
1	Conflicting timescales	5	2.78
2	Substantive, strategic and institutional uncertainty	9	2.43
3	Awareness and communication	6	2.35
4	Institutional crowdedness and institutional voids	10	2.20
5	Motives and willingness to act	4	2.19
6	Fragmentation	7	2.11
7	Resources	7	2.06

[a] *Note: Of the 67 barriers included in the survey, 48 were clustered into the seven categories. The remaining 19 barriers were labelled as individual barriers to adaptation and not included in this analysis.*

related to fragmented efforts at different sectors and levels, were considered to be minor or not important. Finally, the cluster "resources" ranked lowest on the list. Only lack of financial resources was considered to be an important barrier to adaptation by the respondents (no. 4, mean = 2.81). Other types of resources, such as skills, knowledge, and manpower, scored significantly lower and were considered by the respondents as minor or insignificant barriers to adaptation.

4.5. Discussion

What do the results of our study contribute to our understanding of the barriers to adaptation? First of all, our results suggest that respondents consider the cluster on conflicting timescales to be the most important group of barriers. More specifically, respondents mention the difficulties in dealing with the long-term impacts of climate change and short-termism in politics to be the most important barrier to adaptation. Dealing with different timescales is especially important when it comes to mainstreaming adaptation in other policies and projects (Adger et al. 2009b). Finding ways to manage conflicting timescales therefore seems of vital concern. As one interviewee commented "if it was only climate change, many [decision makers] would have said 'we can wait for a while'. But you need to take into account the long term climate change when making certain choices [on public infrastructure] ... decisions [on adaptation strategies] are only made when these two timescales come together". One interviewee remarked that "apparently some have an interest in turning [climate change adaptation] into an idiosyncratic long-term problem. But there are several solutions to parts of the problem ... and no-regret measures ... that can be taken. By turning it into an idiosyncratic, huge problem you actually create a barrier". When workshop participants were asked why timescale conflicts were considered to be an important barrier, they argued that many other barriers to adaptation are related to the long-term impacts of climate change and the uncertainty it creates in decision-making processes. This suggests an interdependency between, and reinforcement of, different barriers to adaptation, which is a point also made in other studies on adaptation (Brown and Farrelly 2009; Burch 2010b).

Our research furthermore suggests that both climate and non-climate factors and conditions are considered by the respondents to be important barriers to adaptation. The results show that the ten most important barriers to adaptation are a mixture of barriers from different clusters of barriers and include both climate and non-climate factors and conditions. For example, respondents ranked factors that are inherent to any complex policy issue as important barriers, such as the slow-turning wheels of government bureaucracy; the wait-and-see-attitude of politicians; other competing interests and concerns; and the hidden agendas of politicians. Many of these non-climate barriers have not been addressed by other studies on adaptation, although their influence on policy processes are well known from studies of public administration and political science (March 1994). In order to understand the barriers to adaptation, we propose to include both climate and non-climate barriers in future studies on adaptation.

An important finding of this study is that respondents see the most important barriers to adaptation to be related not only to generating more adaptive capacity but in most instances to mobilizing already present adaptive capacity and turning it into delivering adaptive practice. Our results also show that resources, as one of the key determinants of adaptive capacity, are ranked low as barriers. Several authors have already suggested that high levels of adaptive capacity will not automatically translate into efficient and successful adaptation (Moser 2009). Therefore, in the Dutch case, efforts to create more adaptive capacity by generating more resources is most likely insufficient (H. C. P. Brown et al. 2010; Gupta et al. 2010).

The survey results show a widespread agreement between response groups from different sectors and domains in the Netherlands and the importance of the barriers to adaptation they have experienced. This is consistent with observations in other surveys on barriers to complex environmental issues (Ledoux et al. 2005; Hoffman and Henn 2008; Brown et al. 2009) and adaptation to climate change (Moser et al. 2008). These results are perhaps not surprising; our analysis showed that respondents had a shared understanding of climate change, were well informed, and had a high sense of urgency. Those actively involved in adaptation projects and programmes—the scientists, policymakers, and private actors—have apparently progressed towards a shared perspective on the conditions and factors that constrain adaptation strategies.

However, our results suggest that scales of governance matter in understanding the barriers to adaptation. We found several significant differences in how respondents from different levels of government scored the barriers to adaptation. In general, respondents from local levels ranked the barriers as more important than respondents from the national level. Possibly this is because the local level is closest to adaptive action where most of the integration between climate change adaptation and other issues takes place (Bedsworth and Hanak 2010). One interviewee from the national government commented: “We have published the National Adaptation Strategy ... which is really at the beginning of the policy cycle. Municipalities are faster, more concrete and more energetic”. This suggests that different governance levels are in different stages of the adaptation process and that they progress at different speeds.

Most studies perform their analysis of barriers to adaptation focusing on one, mostly local, governance level (Pitt and Randolph 2009; Keskitalo 2010). However, in order to fully understand the barriers to adaptation and to find the most appropriate interventions in space and time, our findings suggest that a multi-level perspective on barriers to adaptation is necessary. Barriers to local adaptation, for example, can be created by governments at higher levels when new regulations, budget cuts, or conflicting policies are proposed. At the same time, the national government in the Netherlands has informally committed itself to removing barriers to adaptation at national, regional, and local levels. It may be wise to invest in understanding the experienced barriers to adaptation at each level before investing valuable time and resources in overcoming them.

In the Netherlands, the involvement of the national government in adaptation has been relatively low compared to some other countries (Biesbroek et al. 2010). Although this fits within the traditional forms of non-hierarchical governing in the Netherlands, our results show that respondents from local and regional levels foresee a more important role for the national government than hitherto has been the case. When participants of the survey feedback workshop were asked how the national government could contribute to more successful adaptation at the local level to overcome barriers, they argued that it could show more leadership, create incentives for action, stimulate private actors in adaptation, and take strategic decisions to address climate change adaptation. Several other studies from around the world have come to similar conclusions. National governments could support adaptation by including principles of constitutional ordering, providing frameworks for action, encouraging or enforcing adaptive practice, providing resources and capacities, distributing powers and responsibilities, and addressing issues of fairness and equity at all levels of governance (Adger et al. 2005; Duit and Galaz 2008). Some countries (for example the United Kingdom (UK OPSI 2008)) have a more elaborate law on adaptation (see also Craig (2010) concerning the United States) and explicitly mention the role of the national government in the adaptation process when it comes to dealing with barriers to adaptation (Lazarus 2009; McDonald 2011).

The workshop participants suggested developing a formal, but flexible and adaptive framework or set of guidelines to integrate adaptation in vulnerable sectors, regions, and organizations. As one workshop participant explained: “at the municipal level the sense of urgency is generally low ... and to convince the municipal council or local politics to really start adapting I can imagine that [local policymakers on adaptation] want a framework ... also because [convincing others to start adapting] has not been successful in the past”. Recently, a state committee in the Netherlands proposed a Delta law, as an amendment to the existing Water law, to secure funding and the inclusion of adaptation to climate change in new policies and plans, now and in the future (Deltacommittee 2008). Although the Netherlands has not created centralized legislation to remove barriers to adaptation at lower levels of governance, one interviewee from a large municipality said “the bumps [we encounter in the process] are identified and taken to The Hague ... which is often successful ... We all want to be progressive ... and when we encounter a problem ... the ministry is willing to help to find a solution”.

Finally, the results of this study suggest that actors experience and perceive barriers in different degrees of severity; some barriers are considered to be more important than others. The survey has proven to be a valuable instrument in measuring these different degrees of importance of the barriers included in the survey. We acknowledge that the results of this study are the aggregated perceptions of experienced actors working in the field of adaptation. In practice, the presence and severity of barriers needs to be carefully assessed for each situation in order to determine how the process of adaptation is taking place, as well as the relative importance of each barrier in this process.

4.6. Conclusion

We conclude that of the many barriers reported in the literature on adaptation to climate change, barriers related to dealing with conflicting timescales are experienced in the Netherlands as the most important barriers to adaptation. Many other barriers are considered important as well, including non-climate related barriers that occur in any complex policy process.

Research on barriers to adaptation is still in its infancy and much more needs to be learned about their nature and influence on the governance of adaptation to climate change. Based on such improved understandings, intervention strategies need to be developed to overcome the barriers or else the barriers are likely to subsist and continue to impede the development and implementation of adaptation strategies. In this paper we have showed that barriers are experienced in different degrees of severity and at different levels of governance. It is our hope that these observations will provide a useful input into the emerging discussions on barriers to adaptation.

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CHAPTER 5

Does it matter how adaptation is governed? Comparing barriers to adaptation between the United Kingdom and the Netherlands

ABSTRACT Countries have taken different institutional pathways to govern climate change adaptation. In this paper, a mixed method research design is used to analyse if the way adaptation is governed influences how actors from the United Kingdom and the Netherlands perceive barriers to adaptation. Five propositions are formulated based on neo-institutional theory and a qualitative comparative analysis of the governance of adaptation in the United Kingdom and Netherlands. The propositions are tested through a cross national survey among scientists, policy makers and private actors working on adaptation in the United Kingdom (n=148) and Netherlands (n=264). Respondents were asked to score the relative importance of 67 pre-listed barriers to adaptation. The results demonstrate that different institutional settings hardly influence what actors perceive as the most important barriers. Institutional contexts do have an effect on the less important barriers related to responsibility, cohesion, and continuity. Additionally we observed that respondents from the United Kingdom perceived the barriers to be more severe than respondents from the Netherlands. We discuss the implications of our findings for future research and policy practice.

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5.1. Introduction

Governments have different approaches to organize and coordinate their efforts to adapt to the projected impacts of climate change (Biesbroek et al. 2010; Bauer et al. 2012; Lesnikowski et al. 2013b). These differences are most clear at the institutional level: some countries have a central locus of authority and others have a dispersed loci of authority, some have taken a mainstreaming approach while others established a distinct policy field, in some countries adaptation was government-driven and in others public-driven, some countries use legal binding and others soft law. Countries can focus on sectoral or holistic steps, are process orientated or outcome oriented, or have taken approaches that are somewhere in the grey area in between (Ford et al. 2011; Keskitalo et al. 2012). Within these institutional settings, governance actors – such as policy makers, businesses, consultants, scientists, and NGO's – at all levels are actively seeking ways to adapt to climate change. As previous research has empirically demonstrated, adaptation is no simple task but one during which several barriers may emerge. Some of these barriers to adaptation are attributable to the wicked characteristics of the climate change (Termeer et al. 2013), but there is an ensemble of barriers which is linked to the governance of any boundary spanning issues (Jochim and May 2010). Burch (2010a) for example identifies a number of barriers that hamper local level adaptation in Canada, including lack of leadership, cognitive and organizational silos, and competing political priorities. These barriers are created, triggered or become more pronounced because of climate change as context (Moser and Ekstrom 2010).

Institutions are often seen as important sources of barriers to adaptation because they constrain the response options of actors (Dovers and Hezri 2010; Biesbroek et al. 2013). Næss et al. (2005), for example, demonstrate how existing national institutions in Norway provide weak incentives to start adaptation at the local level. It is often overlooked that the institutional setting also influences how barriers are constructed and interpreted by actors operating within an institutional setting. Neo-institutional theory, especially sociological institutionalism, postulates that institutions influence perceptions by creating shared codes of meaning, ways of reasoning, and logics of appropriateness to act in a certain way under certain circumstances (March and Olsen 1989). Institutions – understood here as the regulative, normative, and cultural-cognitive elements that provide stability and meaning to social life (Scott 2008b, p48) – are created by, and can be changed as result of, the (un)conscious (re)production of the institutions through the actions of actors. The purpose of institutions is to provide structure and predictably in an otherwise complex and chaotic world. They are designed to, for example, reduce negotiation and transaction costs, reduce decision making uncertainty, or allow for legitimate decision making even when there is no natural equilibrium among actors. Institutions set the rules for how the governance of adaptation is organized, who is included and who excluded, who is responsible for what, and how interactions between actors take place (Scharpf 1997; Ostrom 2005). Institutions also shape the instruments that are available to deal with constraints. Within this institutional setting, actors display rule and identity-based action; actors have a great deal of agency, but they behave in accordance with their interpretations of the rules, even though these rules are partly codified and open for different

interpretations. Institutional settings, in short, fulfil an important role in governance processes, not only by creating barriers, but also by shaping how actors perceive and respond to barriers.

In this paper we explore if different institutional approaches that countries have chosen to adapt to climate change influence what actors consider as barriers to climate change adaptation. Following from the above, our overall proposition is that different institutional settings would result in differences in how actors from different institutional settings evaluate the barriers to adaptation. Addressing this question allows us not only to theorize about the thus far underexplored, cross-national differences in perceived barriers, but also to reflect on the value of institutional policy designs as a means for addressing barriers to adaptation (Huntjens et al. 2012).

The next section presents a qualitative comparative analysis of the institutional differences in the way adaptation is governed in the Netherlands and the United Kingdom (UK). Being north-western European countries bordering the same sea, these two countries share many similarities. Both the United Kingdom and the Netherlands are vulnerable to sea-level rise, coastal flooding, increase of winter precipitation, fluctuations in river discharge, and northward movement of species (EEA 2013). Both countries are considered to have high levels of adaptive capacity, are among the forerunner countries in adaptation policy and are among the first OECD countries that are moving towards implementing adaptation measures (OECD 2008). As members of the European Union, the United Kingdom and the Netherlands are subject to the same international regulatory environment including the Water Framework Directive, Common Agricultural Policy, and the White paper on Adaptation to Climate Change. Recently, both countries were confronted with decreasing public attention to climate change due to, amongst others, IPCC errors, 'Climate-gate', failed success at the Copenhagen Summit 2009, the recent cold winters, and the economic downturn (Eurobarometer 2009). The two countries were selected because they differ in how they govern adaptation and how they deal with barriers to adaptation. We combine insights from neo-institutional theory with the qualitative research findings to formulate five propositions about the relationship between institutions and the barriers to adaptation. To test the propositions empirically, we asked governance actors from the UK and the Netherlands to complete a questionnaire on barriers to adaptation. The survey included a large sample of possible barriers identified in the academic literature to capture the full spectrum of possibly important barriers to adaptation (Biesbroek et al. 2013). Section 5.2 elaborates on the theoretical perspective and formulates the propositions based on the qualitative comparative analysis. Section 5.3 describes the survey methodology. Section 5.4 presents the survey results and tests the propositions. Section 5.5 discusses the results and the implications of the findings. The paper ends with conclusions.

5.2. Governance traditions, policy regimes and policy instruments

To unravel the 'nested relationship' of the different components of the institutional setting, we build upon the work of Howlett (2009) by analytically distinguishing between governance traditions, policy regimes and policy instruments. For the

purpose of this paper, the focus is on the governance tradition of dealing with constraints, the way the policy regime addresses barriers to adaptation, and which instruments exist to manage barriers to adaptation. We consider the institutionalization of adaptation to be a continuous process of change because structure and agency are co-produced (Mahoney and Thelen 2010). Therefore, we take a snapshot of the institutional setting in the UK and the Netherlands as of 2010, the moment when the survey we used to test the propositions, was implemented. Methodologically, document analysis and interviews with key actors in the UK (n=11) and the Netherlands (n=9) was used to reconstruct the institutional setting. Based on the qualitative comparative analysis in sections 5.2.1 to 5.2.3, a set of propositions is formulated in section 5.2.4.

5.2.1. Governance traditions

Governance tradition is the established way in which decision making in a specific country is generally done. It comprises the accepted paradigms on for example the leadership style, the relation between government and society or the role of the bureaucracy. Governance tradition is the historically grown and relatively stable set of institutions which influence what goals are defined and what the implementation preferences of governance actors are (Howlett 2009). Classical comparative policy studies demonstrate that there are several differences between the UK and the Netherlands when it comes to deep structures such as the and institutions of the state ('stateless' versus 'strong state'), models of democracy ('Westminster' versus 'consociationalism'), and the role of interest groups in decision making ('pluralist' versus 'corporatist') (Dyson 1980; Lijphart 1999). Although these rather crude labels have converged somewhat throughout Europe as a result of the introduction of neo-liberalism in the 1980s and 1990s and collaborative governance in the 2000s, the different traditions are still at the root of contemporary governance in both countries (Pollitt and Bouckaert 2004).

In the liberal, society-led government of the UK, power is exercised through the public that continuously holds the government accountable. Government is oriented towards responsiveness and seeks to obtain public acquiescence on matters that threaten public interests such as climate change. In the dialectic interplay between state and society, the role of central government has shifted towards a differentiated power model of networks with a rather weak government (Bevir and Rhodes 2006) or, as some argue, an asymmetric power model in which government operates in a shadow of hierarchy based on the traditional assumption that 'government knows best' (Marsh et al. 2003). Although debates on post-New Public Management (NPM) in the UK are on-going, the underlying NMP philosophies are very much alive today (Pollitt and Bouckaert 2004). One tradition worth mentioning is result accountability; measurable standards and output controls are developed to accompany new policies in order to organize accountability. The accountability pressure requires a clear division of responsibilities between state and society, and transparency for the public to judge if improvements have been made (Krieger 2013). Devices of accountability include explication of possible constraints for public service delivery as a government strategy to explain potential delay or failure. Internal responsiveness (within governments)

and external responsiveness (public) is increased by providing policy instruments to identify and deal with constraints.

The Netherlands, as a part of the more conservative continental Europe, has a 'strong state' tradition in a unitary nation. This is accompanied with the renowned 'polder model', which is often credited to the origin of the Dutch State where the State deliberated with local water boards about responsibility of flood protection (Van Koningsveld, et al., 2008). The Dutch corporatist model implies that actors with vested interests are invited to the negotiation tables, creating an institutionalised form for negotiation about high stake issues. Interactive decision making is observed to expand by increasing citizens participation in governmental decision making. The decentred, consensus seeking approach is a form of governance in which pragmatic acceptance of differences between actors' preferences and perspectives is the goal of the negotiations. Dialogue at the national level and central agreements continue to be of importance to decision making, due to the fact that most taxes flow through the central government (Kickert 2003). In the Dutch context, the notion of constraints is an implicit component of consensus seeking governance. It is well-known that throughout a negotiation process barriers may emerge; however, there are no explicit guidelines how to deal with barriers or constraints.

5.2.2. Policy regimes of governing climate change adaptation

The second level is the policy regime level of climate change adaptation. The policy regime comprises the broad set of goals, ambitions, expectations and institutions created in each nation to adapt to climate change. Over the past years, adaptation has become an issue of public policy both in the Netherlands and the UK, and new policy regimes were created that draw on ideas and institutions from the traditional forms of policy making (Howlett 2009). It goes beyond the scope of this paper to give a full-fledged account of the adaptation policy regimes in both countries. There are many excellent descriptions of the governance of adaptation. For the UK, see for example Boyd et al. (2011), Tompkins et al. (2010), ASC (2010), or Massey and Huitema (2012). For the Netherlands, see for example Kabat et al. (2005), Court of Audit (2012) or Biesbroek et al. (online first). The key differences in the policy regimes on adaptation are highlighted below, particularly when it comes to the role of government, goal-setting, and barriers to adaptation.

Concerning the role of government for adaptation, the UK builds on the NMP doctrine and the policy regime can best be described as 'managerial'. Government fulfils a coordinating role by governing the governance of adaptation; shape the governance process in such a way that values become commonly shared norms about how adaptation should take place. These ideas are operationalized through governmental framing of adaptation as a local challenge, through new networks involving public-private partnerships, through performance oriented top down evaluation methods that involve government bureaucracy, and through facilitation of local adaptation with new and existing policy instruments (Tompkins et al. 2010; Boyd et al. 2011). In this reflexive relationship between government and society, it is of utmost importance to make clear who is responsible for what (Turnpenny et al. 2012). Despite the

governmental efforts, the UK faces a governance trap where '...government and the governed seek to attribute primary responsibility to the other, and thus neither party acts in a decisive way' (Pidgeon 2012, p89).

Contrastingly, the Dutch policy regime on adaptation can best be described as twin tracked. The role of the state is to lead the process when it comes to long term flood protection, but it is 'deliberative decentred' when it comes to other sectors such as nature, agriculture and spatial planning. The top-down protective state approach for flood safety is strongly embedded in the Dutch water policy culture, currently executed through amendments in the existing Water Law. For other vulnerable sectors, the Dutch state mainly plays an agenda-setting role while leaving the responsibility to act to local actors. Here, use is made of the existing institutional negotiation and coordination structures to address climate change adaptation. While the networks in water management are coordinated by government, the local level adaptation depends on self-organised networks in which the state fulfils a limited role. The main state provision on adaptation is a subsidized knowledge program that delivers scientific input to a number of regional 'hotspots'.

In the UK, the overall goal is to ensure that key public sectors are 'making adequate progress' on adaptation to climate change (ASC 2011). Climate change adaptation is linked to the risk governance discourse in the UK (Keskitalo 2010). This means conducting comprehensive climate change risk assessments to identify the levels of risks, and then entering a debate about acceptable levels of climate change risk (Krieger 2013). As postulated by Massey and Huitema (2012), the UK government has taken an institutionalisation approach to ensure mainstreaming across all vulnerable groups, sectors and regions. Despite the national efforts, local decision making on adaptation remains ad-hoc. In the Netherlands, the overall goal initially formulated was to 'climate proof' spatial planning (Kabat et al. 2005), but around 2009 this was replaced by a more focussed strategy (Court of Audit 2012). Instead of the comprehensive approach followed in the UK, the Dutch focus is now on long term water safety for which intensive risk assessments are conducted in the so-called Delta Program. Climate proofing in other sectors is now mainly seen as a local level task ingrained in existing institutional structures of decision making such as land use and urban management and is therefore hardly coordinated at the national level (Court of Audit, 2012).

The managerial approach in the UK resulted in specific institutions to deal with accountability and public scrutiny. Explicating the possibility of encountering 'barriers to adaptation' has become a central concern in crafting the new institutions. Although the UK government does not provide a definition what a barrier is, they refer to barriers as those factors that hamper the change of lifestyles, prevent selecting the right adaptation strategy or reduce the performance of society in delivering equitable and efficient adaptation outcomes (ASC 2011). Consequently, the UK has created an institutional setting for identifying and dealing with barriers, thereby recognizing that the government itself also creates barriers to public adaptation and is, therefore, responsible for removing those barriers, as long as it is cost-effective. In contrast, the

Dutch pragmatic recognition of pluriformity in opinions and the negotiation between public and private actors about adaptation has the consequence that the notion of barriers to adaptation hardly exists. Instead, barriers are seen as an inevitable part of decision making and existing institutional structures, and addressed accordingly. Rather than emphasising the presence of barriers, the Dutch government mentions 'challenges' to adapt, a more positive framing of the same phenomenon.

5.2.3. Governance instruments

Governance instruments refers to the substantive and procedural mechanisms that are designed to implement adaptation and to address potential policy problems. Which mix of instruments is available and what instruments are considered appropriate to translate abstract goals to implementation is strongly determined by the governance tradition and policy regime. Substantive instruments, in other words those instruments intended to directly affect how adaptation is governed through the distribution of goods and service delivery (Hood and Lodge 2004), have been used only sparsely in climate change adaptation. Instead, procedural instruments such as mechanisms to coordinate the state-society relationship have gained more prominence in the European debates on governance of adaptation (Biesbroek et al. 2010).

In the UK, many new procedural instruments have been developed, for example educational programmes, policy evaluations, procedural guidelines, wizards and toolkits, advisory committees, network management strategies, and public hearings (Turnpenny et al. 2012). Some concrete examples are the compulsory reporting of progress on adaptation for certain actors under the UK Climate Change Act, and the voluntary NI188 progress indicator (Massey and Huitema, 2012). More specifically, several procedural instruments have been developed to deal with accountability pressures and the "governance trap". Local actors are empowered by DEFRA to deal with barriers by increasing attentiveness of barriers in decision making (Rothstein and Downer 2012). To this end, he UK government developed an array of instruments to raise awareness of barriers, such as self-assessment toolkits for organisations and business that want to adapt, illustrative case examples how to deal with barriers, and statutory guidance documents for reporting on barriers. Additionally, the UK government has conducted several public hearings and national self-assessments to identify the key barriers including those that the government creates, and asked the private sector and Statutory Undertakers to identify the barriers they encounter in their efforts to adapt to climate change. In the Netherlands, procedural instruments for adaptation to climate change are limited, although regional examples do exist , for example regulations to subsidize green roofs (Mees et al. 2012). Informal documents and guidelines have been developed (PBL 2009a), but to a much lesser extent than in the UK. Instead, adaptation is fitted within the existing procedural instruments, networks, and decision structures. Because the Netherlands does not have a governance tradition of addressing constraints explicitly, there is no explicit attention for barriers to adaptation at the policy regime level, and there are no procedural instruments to support governance actors in the Netherlands to deal with barriers.

5.2.4. Propositions about barriers to adaptation

Table 5.1 provides an overview of the key findings of the comparative analysis. Our overall proposition is that we expect institutions to have an effect on the perceived barriers to adaptation; therefore we should see a difference in the relative ranking of the barriers to adaptation in the UK and the Netherlands (proposition 1).

Based on the analysis of the governance traditions in 5.2.1 and policy regimes in 5.2.2 two other propositions can be formulated. The analysis showed that the UK government has a smaller role in the delivery of policy results and this small role is constantly made explicit. Therefore, we would expect that UK actors perceive barriers related to the division of responsibility to be less important than respondents from the Netherlands (proposition 2). By establishing a dedicated policy regime on adaptation, we expect that respondents from the UK perceive barriers related to cohesion and coherence among policy goals and objectives to be less important than the respondents from the Netherlands (proposition 3). A fourth and a fifth proposition can be formulated based on the comparison of instruments in 5.2.3. It can be expected that, due to anchoring adaptation in national policies and plans and constructing formal policy instruments, the respondents from the UK feel more supported and therefore consider barriers related to stability and continuity of the adaptation process to be less important compared to the respondents from the Netherlands

Table 5.1. Synthesis of the comparison between the United Kingdom and the Netherlands

		United Kingdom	**Netherlands**
Governance tradition	Focus	Society-led/ liberal, driven by market	Corporatism, driven by vested interests
	Barriers	Making barriers explicit	Barriers remain implicit
Policy regime on adaptation	Institutional setting	Comprehensive and complex institutional setting of new institutions	Using existing institutional setting
	Policy orientation	Meta governance	State governance on flood protection and deliberative governance on adaptation
	Networks	Government driven and self-organised networks; Partnerships between public and private	Self-organised, making use of existing networks and existing institutional structures
	Goals	Creating acceptable levels of risk	Climate proofing
	Actors	Diversity of actors; governments from all levels, public service delivery, NGOs, and businesses	Mostly governments from all levels of government, close involvement of research community
Policy instruments	Procedural	Dense set of new instruments	Existing instruments
	Barriers	Assessment instruments, learning instruments	No instruments

(proposition 4). In the absence of formal, national level coordination instruments in the Netherlands, we expect that respondents from the Netherlands perceive barriers related to coordination to be more severe than respondents from the UK (proposition 5).

5.3. Survey methodology

Survey instruments are increasingly used in studying perceptions of actors on the governance of adaptation in general, and of barriers to adaptation in particular, see for example Moser and Tribbia (2006), Brody et al. (2010), Bedsworth and Hanak (2010), Lemieux et al. (2011), Quinn et al. (2011), Matasci et al. (2013). Cross-national surveys on barriers to adaptation have, however, hardly been done.

5.3.1. Survey design

To assess what governance actors in the UK and Netherlands consider as important barriers to adaptation, we developed and implemented an online survey instrument. The survey was designed to test how actors would prioritize a predefined list of barriers to adaptation. The survey consisted of 67 barriers that were distilled from the literature on climate change adaptation and the literature on governance. For the purpose of testing the propositions 2 to 5 a selection of these 67 barriers in the following categories were categorised: barriers related to the division of responsibility, barriers related to cohesion and coherence among policy goals, barriers related to stability and continuity of the policy process and barriers related to coordination of the responses. Respondents were asked to score each barrier on a scale from 1 (no barrier) to 4 (very large barrier). A pre-test with a small sample of respondents from the Netherlands (n=9) was conducted to improve the survey design, the wording of questions and the likely ranges of the responses. The original survey was translated from the source language Dutch to the target language English, and cross-checked by native speakers to preserve semantic, conceptual and normative equivalence across the survey. The content, structure and answering scales were kept similar to reduce possible response bias. The English version of the survey is included as Supplementary Material B.

5.3.2. Selection of respondents

Respondents were selected through list-based sampling from the existing mailing lists of large national research programmes on adaptation to climate change. The respondents were all well-informed actors involved in adaptation projects and programmes in the Netherlands and the UK. The sample included scientists, policy makers and private actors from different levels and sectors. Supplementary Material B also provides an overview of the respondent characteristics.

5.3.3. Survey implementation

The Dutch and the UK surveys were implemented shortly after each other to limit changes in the context: March 2010 (Netherlands) and April 2010 (UK). Respondents were explicitly asked to score the relative importance of each barrier based on their personal experience. One reminder was sent to the respondents after two weeks. The data of the completed surveys were analysed with quantitative software tools (SPSS

17). On average, the survey took respondents 25-30 minutes to complete. Response rates were average for the UK (n=148, 18%) and high for the Netherlands (n=264, 30%). Policy makers were a main group of respondents in both the United Kingdom (n=81, 55%) and the Netherlands (n=104, 39%). Significantly more respondents labelled themselves as 'scientists' in the Netherlands (n=79, 30%) compared to the UK (n=22, 15%).

5.4. Empirical findings

The research data show a number of important similarities between the Netherlands and the UK. Almost three-quarters of the respondents in the United Kingdom (n=104, 70%) and Netherlands (n=193, 73%) indicated that, in an average week, they spent less than half their time on climate change adaptation projects and programmes. The respondents also have a shared perception of climate change as societal problem; respondents in the UK (99%) and the Netherlands (96%) strongly believe that climate change is a problem influenced by human activities; and 98% of the respondents in the UK and 89% of the respondents in the Netherlands believe that climate change adaptation is a valid and necessary response.

5.4.1. Ranking of barriers to adaptation

Our proposition 1 was that we expected institutions to have an effect on the perceived barriers to adaptation; therefore, we would see a spread in the relative ranking of the barriers to adaptation. To test this proposition, we correlated the calculated mean for each of the 67 barriers between the UK and the Netherlands. The results show that there is a high correlation between responses from both countries ($r=.87$, $p<.001$), suggesting that there is high consensus about the relative scores assigned to the individual barriers. In addition, analysing the relative mean ranking of the barriers between the two countries demonstrates that of the twenty barriers that scored highest by the UK respondents, eighteen were found among the twenty most important barriers in the Netherlands, see table 5.2. This disconfirms our overall proposition 1 that the institutional setting influences what actors perceive as the most important barriers to adaptation. The survey results showed that respondents from both countries considered the barrier 'difference in short term thinking of politicians and long term impacts of climate change' (Question (Q) 25), to be the most important barrier in the United Kingdom (mean=3.42) and the Netherlands (mean=3.26). In both countries significant differences exist between the relative ranking of the first and second most important barrier. In other words, the most important barrier has a relatively big lead over the other barriers on the list.

5.4.2. Testing of the propositions

For each of the propositions 2 to 5, we selected a number of barriers from the survey which served as proxies to test our four detailed propositions. The propositions and the selected barriers are presented below.

Proposition 2: Responsibility

We expected that UK actors would consider barriers related to the division of responsibility to be less important than respondents from the Netherlands. Two

barriers included in the survey are directly related to the proposition on responsibility. Respondents from the Netherlands ranked the barriers 'unclear who is responsible to adaptation' higher than respondents from the United Kingdom (Q1: UK no.27; NL no.15) and the barrier 'unclear division of responsibilities between governments' (Q64: UK no.46, NL no. 23) also scored higher in the Netherlands than in the UK. This supports proposition 2.

Proposition 3: Policy cohesion and coherence

We expected that respondents from the UK would consider barriers related to cohesion and coherence to be less important than the respondents from the Netherlands. We selected five of the 67 barriers for analysing differences in policy cohesion and coherence to compare their relative ranking and to calculate the mean difference. All of these barriers were scored higher by respondents from the Netherlands than by respondents from the United Kingdom: 'unclear who within government is taking the lead on adaptation' (Q23: UK no.49; NL no.30), 'there is no shared understanding of what an adaptation strategy should include' (Q11: UK no.19, NL no. 11), 'conflicting opinions between governmental organisations about the need to adapt' (Q 50: UK no. 36; NL no.18), 'unclear who decides about climate change adaptation' (Q5: UK no.30; NL no. 26) and 'conflicting opinions about what the best adaptation strategy is' (Q26: UK no.29; NL no. 28). Even though the last three barrier only shows a small difference in relative ranking, these results support proposition 3.

Proposition 4: Continuity and stability

We expected that the respondents from the UK would consider barriers related to stability and continuity of the adaptation process to be less important compared to the respondents from the Netherlands. Three barriers could be identified from the survey that can be related directly to this proposition. The data reveal that the barriers 'the temporality of climate change in politics' (Q19: UK no.51; NL no. 21), 'no safeguarding of adaptation for future policy making' (Q13: UK no.16; NL no.7) and 'little political attention to climate change' (Q9: UK no. 54; NL no. 45) all ranked higher in the Netherlands compared to the United Kingdom. The results support proposition 4.

Proposition 5: Coordination

We expected that respondents from the Netherlands would consider barriers related to coordination of responses to be more severe than respondents from the UK. Respondents from the UK scored the barrier 'governments at higher levels do not take climate change adaptation seriously' significantly higher than respondents from the Netherlands (Q6: UK no. 14; NL no. 49). For two other barriers related to this proposition, the difference in ranking was smaller: 'little coordination between government from different levels about adaptation measures' (Q53: UK no.17; NL no.14), and 'lack of central government steering in climate change adaptation' (Q35: UK no.32; NL no. 27). For the barrier 'limited role of private organisations in the policy process' the score was opposite our expectation (Q28: UK no. 38; NL no. 41). These results neither support nor disconfirm proposition 5.

Table 5.2. Summary findings for the 20 highest ranked barriers by respondents from the UK and NL

United Kingdom				Netherlands			Comparison		
Rank	Description of barrier	n=	mean	Rank	n=	mean	Rank diff. UK-NL	Mean diff. UK-NL	Mann-Whitney test
1	Difference in short term thinking of politicians and long term impacts of climate change	146	3.42	1	261	3.26	0	0.15	.04*
2	Little finance reserved or available for implementation of adaptation measures	142	3.21	4	256	2.81	-2	0.40	.00*
3	Other urgent policy issues need short term attention	138	3.04	6	258	2.78	-3	0.26	.00*
4	Existing policy does not include long term impacts of climate change	145	3.01	9	259	2.65	-5	0.37	.00*
5	Unclear social costs and benefits of adaptation measures	144	3.00	3	259	2.87	2	0.13	.14
6	Lack of awareness of the need to adapt	144	3.00	5	262	2.78	1	0.22	.01*
7	Policy makers have other interests than climate adaptation	139	2.96	13	257	2.58	-6	0.38	.00*
8	Conflicting interests between involved actors	145	2.88	2	260	2.88	6	0.00	.91
9	Difficulty to determine the effectiveness of climate adaptation strategies	144	2.86	12	259	2.61	-3	0.25	.00*
10	Few policy makers who want to invest time and money	140	2.81	16	254	2.54	-6	0.27	.00*
11	Difficult international climate negotiations	141	2.79	19	251	2.45	-8	0.34	.00*
12	Passive attitude of many policy makers	142	2.79	10	258	2.63	2	0.16	.09*
13	Low societal support to develop and implement adaptation strategies	140	2.79	32	254	2.34	-19	0.45	.00*
14	Governments at higher levels do not take climate adaptation seriously	146	2.78	49	258	2.13	-35	0.65	.00*
15	Dependence on other actors in decision making	141	2.77	8	255	2.66	7	0.11	.28
16	No safeguarding of adaptation for future policy making	131	2.76	7	247	2.71	9	0.05	.76
17	Little coordination between governments from different levels about adaptation measures	136	2.74	14	252	2.58	3	0.15	.09*
18	Policy makers do not express a sense of urgency	145	2.73	20	248	2.45	-2	0.28	.00*
19	There is no shared understanding what an adaptation strategy should include	146	2.71	11	255	2.62	8	0.09	.27
20	Fear of taking decisions that might have negative consequences in the future	142	2.69	17	241	2.51	3	0.18	.09*

5.4.3. Influence of institutional setting on barriers to adaptation

In addition to scoring the individual barriers, respondents were asked directly how they perceived the link between the governance of adaptation and barriers to adaptation. In general, respondents from the Netherlands were slightly more optimistic about the barriers in the governance of adaptation compared to the UK respondents. In the Netherlands, 13% of all respondents argued that there are more barriers than opportunities, and 79% considered that there were as much barriers as opportunities. Of the UK respondents 25% argued that there are more barriers than opportunities and 66% considered that there were as much barriers as opportunities. In addition, we calculated the difference in mean scores for both countries. The total mean scored by all respondents from the UK (n=148, mean=2.51) was higher than the mean of the Netherlands (n=264, mean=2.27). The mean difference of .24 is substantial given the answering scales used in the survey. The results also show that for 64 of the 67 barriers the calculated mean differences are on or above the line, suggesting that for 64 barriers respondents in the UK ranked the barriers the same or more severe than respondents from the Netherlands. Of the three barriers that scored lower in the UK, the 'temporality of climate change in politics' (Q19: UK no.51; NL no. 21), which also served as proxy for proposition 3, showed the most difference (-.12). These results indicate that respondents from the UK perceive the barriers to adaptation to be generally more severe than respondents from the Netherlands. We tested the mean differences for each of the three response groups: scientists, national level practitioners and local practitioners. In both countries, the respondents from the local level scored the barriers as being more severe than respondents from the national level. This indicates that in both countries scale influences the perceived importance of barriers. Other differences between response groups were not found to be significant.

5.5. Discussion of the findings

The United Kingdom and the Netherlands have taken different pathways to adapt to climate change and these pathways show high institutional embeddedness into their governance traditions. The UK government created a new institutional setting, new goals, and new instruments for adaptation at the national level, allowing for ad-hoc adaptation at local levels. The Netherlands used the existing institutional settings, policy instruments and networks and mainstreamed adaptation through the existing negotiation structures, with an emphasis on the historically strong water institutions.

Despite the differences in the scores, the survey results indicate that institutional differences are not of determining influence in what actors consider as the most important barriers to adaptation. Institutional differences matter only for specific types of barriers which are often not among the 20 most important barriers. It seems that we have arrived at a set of important barriers that is shared between these two countries. One explanation could be that practices, ideas and concepts between the two countries has created a shared view about the most important barriers to adaptation (Dunleavy et al. 2006). The two groups of respondents may be part of the same epistemic community in which there is a dominant paradigm on adaptation, leading towards similarities in their ideas on the barriers to adaptation (Haas 1989). However, although cross national learning and knowledge exchange on climate change

adaptation is taking place, the qualitative comparative analysis demonstrates that an explicit discussion on barriers only takes place in the UK. In the Netherlands, barriers to adaptation are not an issue. Moreover, the list of 67 barriers was specifically created for this research and was not known to either of the response groups. A shared set of the most important barriers in both countries can, therefore, not be ascribed to knowledge exchange alone. An important conclusion from this study is that there is a set of barriers to adaptation that is shared across institutional contexts. This finding would require further testing in other countries to increase empirical evidence. Interesting European countries for such an analysis could include France (which has a technocratic tradition of governance, and a governmental approach to adaptation), Germany (which has a semi sovereign, juridical governance approach with a fragmented style of governance of adaptation), and Sweden (which has a decentred state, with bottom up initiatives on adaptation).

A second important finding is that systematic differences exist in the perceived severity of barriers between respondents from the UK and the Netherlands. One might argue that the observed differences are caused by a structural response bias in the two countries, independent of the topic of adaptation. However, no evidence for this argument is found in the comparative survey methodology literature (Van Herk et al. 2004). In addition we carefully selected the terminology to be used in the comparative analysis, since we presumed that the concept of barriers could be culturally loaded (King et al. 2004). Another possible cause is that making the presence of barriers to adaptation explicit in the UK influences the perception of actors about these barriers. Our qualitative comparison demonstrated that the UK government is going to great lengths in making the governance actors aware of the presence of barriers, in contrast to the Dutch government. Alternatively, adaptation in the UK could be more challenging for example because the new institutional setting creates additional pressure and a feeling that there is less time for adaptation to evolve and become internalised. The unclear cause of the observed differences in how severe barriers are experienced warrants further research.

There are some noteworthy similarities and differences when comparing our results to other surveys on barriers to adaptation, see table 5.3. For example, while our results support the observation that financial resources are important barriers to adaptation (Q33: UK no. 2; NL no. 4), we found no evidence to support the lack of staff time or staff resources as important barriers (Q44: UK no 52, NL no.63). Significant differences also exist between those studies: climate projection uncertainty was found to be important in the mining sector study by Ford et al. (2010c) whereas Moser and Tribbia (2006) found that uncertain science was hardly perceived as an important barrier for coastal zone managers. Although this could be explained by different contextual conditions, there is a more fundamental, methodological problem: these studies use different and rather small sets of barriers (including different framings of more or less the same barrier) and different measurement scales. In most studies the goal of the survey is broader than identifying the important barriers. The methodological differences complicate a meaningful comparison of their survey findings on barriers to adaptation.

Table 5.3. Sample of studies that use survey instruments to quantify the perceived barriers to adaptation by practitioners and experts.

Author	Country, Sector scale	Respondent	Scale	Barriers included (ranking and scores of barriers)
Matasci et al. (2013)	Switzerland, Tourism	Practitioners and local citizens (n=566)	1 (not a constraint at all) – 10 (major constraint)	- The low economic means at disposal and the costs of the adaptation measures (6.58) - The lack of political willingness to act at the cantonal or national level (5.64) - The lack of political willingness to act in the region (5.49) - The lack of information about the regional impacts (5.42) - The lack of feasible solutions (5.35) - The lack of coordination and interaction in the tourism sector in the region (5.34) - The lack of willingness to act of people working in the tourism sector in the region (5.10) - The resistance local population to the implementation measures (4.85) - The non-availability of technological solutions (4.76)
Mozumder et al. (2011)	USA, Florida, multiple,	Experts and decision makers (n=225)	Not specified	- Insufficient budget (84.4%) - Lack of direction and leadership (79.5%) - Insufficient staff time and resources (76.5%) - Lack of perceived importance to public officials (76.3%) - Lack of assistance from State or Federal agencies (69.4%) - Lack of public demand to take action (69.1%) - Lack of a legal mandate that takes climate change impacts into account (68.4%) - Lack of perceived solutions (68.1%) - Opposition from stakeholder groups (60.7%)
Ford et al. (2010c)	Canada, Mining sector	Experts and practitioners (n=42)	Select all that apply	- Uncertainty of climate projections(n=20, 65%) - Uncertainty in regulatory regime (n=9, 21%) - Lack of skilled personnel (n= 8, 19%) - Market/economic uncertainty (n=6, 14%) - Short life span of mine (n=4, 10%)
Moser and Tribbia (2006)	USA, California, Coastal zone	Experts and practitioners (n=135)	Big hurdle (listed), small hurdle, not a hurdle	- Monetary constraints (78.2%) - Insufficient staff resources (74.4%) - Lack of funding from state and federal agencies (73.4%) - Pressing issues are all-consuming (61.6%) - Insufficient staff time (59.7%) - Lack of a legal mandate(57.7%) - Lack of perceived importance (51%)[a] - Lack of perceived solution options (48%)[a] - Lack of public awareness/demand (47%)[a] - Lack of technical assistance from state (46%)[a] - Lack of social acceptability (38%)[a] - Science is too uncertain (32%)[a] - Legal pressures to maintain status quo (22%)[a] - Opposition from stakeholder groups (14%)[a]

[a] *The numbers are our interpretation of fig. 4, p40*

We have tried to identify a unified set of barriers to adaptation so as to analyse and compare adaptation practice across spatial and temporal scales. This set of barriers might be further improved and tested. Similar efforts have been successfully made in health and nursing studies: Funk et al. (1991) used expert committees, literature search and several rounds of testing to arrive at 28 potential barriers that hamper the implementation of scientific research into nursing practice. Their set of barriers

evolved into the standardised 'BARRIERS SCALE' approach which has been widely used, thereby providing rich insights in the important barriers for nursing practice actors contexts (Kajermo et al. 2010). In the context of climate change adaptation, such a research endeavour would allow us to better understand the variables that are important in explaining the barriers to adaptation, and would assist policy practitioners in focussing on the repeatedly reported barriers to adaptation. The survey implemented in this study could serve as a starting point from which to develop a more standardised approach.

There is a number of limitations to our study. First, this study compared two countries that share many similarities when it comes to climate change impacts, vulnerabilities, adaptive capacity and adaptation responses. The rationale was to hold the contingent conditions sufficiently constant to make inferences with some level of certainty (Scharpf 2000). Other research on barriers to adaptation suggests that low income, developing countries face quite different types of barriers, particularly those related to creating adaptive capacity. It would be worthwhile to increase the number of countries included in the analysis and to extend it to countries which are not only institutionally different but also different in their social, political and economic aspects. A second limitation was that the unexpected systematic differences between actor scores in both countries have complicated the comparison of the survey results. Additionally, our survey was not designed to include variables that could account for such overall differences in perceived severity. Therefore, we are not able at this point to explain the difference in a conclusive way.

5.6. Conclusion

This paper demonstrates that the different institutional settings of the UK and the Netherlands do not strongly influence what actors consider as the most important barriers to adaptation. We did observe an overall difference in the perceived severity of these barriers. Although this indicated that it matters how adaptation is governed, our study also demonstrated that there is perhaps more convergence in the important barriers than is suggested in the adaptation literature. These insights allows us to focus our future research efforts towards the most important barriers, especially the barrier of temporal discordance.

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CHAPTER 6

Analytical lenses on barriers in the governance of climate change adaptation

ABSTRACT Barriers to adaptation have become an important concept in scientific and political discussions in the governance of climate change adaptation. Over the past years, these discussions have been dominated by one analytical lens in examining barriers and proposing ways to overcome them: the problem solving lens. In this paper, we aim to demonstrate theoretically and empirically that the choice of analytical lens influences how barriers to adaptation are constructed and the intervention strategies proposed. Drawing from recent governance literature, we explore the rationale of three dominant philosophies in the study of governance: the optimist, the realist, and the pessimist philosophy. Next, we demonstrate how these philosophies are operationalized and guide scientific inquiry on barriers to adaptation through four empirically rooted analytical lenses: i) governance as problem solving, ii) governance as competing values and interests, iii) governance as institutional interaction, and iv) governance as dealing with structural constraints. We investigate the Dutch government's Spatial Adaptation to Climate Change programme through each of the four lenses. We discuss how each analytical lens frames barriers in a specific way, identifies different causes of barriers, leads to competing interpretations of key events, and presents other types of interventions to overcome barriers. We conclude that it is necessary to increase analytical variety in order to critically engage in theoretical debates about barriers and to empower policy practitioners in their search for successful intervention strategies to implement adaptation measures.

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6.1. Introduction

In recent years, there has been much scientific debate about social barriers and limits to successful adaptation to climate change (Adger et al. 2009a; Dovers and Hezri 2010; Berrang-Ford et al. 2011; Biesbroek et al. 2011; Ford and Berrang-Ford 2011). Substantive research has already been conducted on barriers to transforming human behaviour towards more sustainable lifestyles and adaptive action (O'Neill and Hulme 2009; Shove 2010; Gifford et al. 2011; Pelling 2011). More recently, scholars have started to investigate barriers that could hinder the governance process of developing and implementing climate change adaptation strategies, policies, and plans (Burch 2010a; Moser and Ekstrom 2010; Measham et al. 2011b). Although these debates are still in their infancy, numerous barriers to the governance of adaptation to climate change have been catalogued and more seem to be added with each new study (Biesbroek et al. 2013). This list of what is thought to be a barrier to adaptation is extensive and ranges from behavioural and cognitive variables to large scale socio-cultural processes.

A review of existing studies on barriers to adaptation shows that one analytical lens is dominant in examining and explaining barriers to adaptation (Biesbroek et al. 2013). This lens is close to what Bovens and 't Hart (1996) in their study on policy fiascos call the problem solving lens. Through this lens, the governance of adaptation is seen as the purposeful efforts of selecting the best options to solve the problem of climate change impacts as effectively and efficiently as possible. Properly designed and implemented governance arrangements are the key instruments to deliver successful adaptation. Barriers are seen as anomalous phenomena that need to be identified and removed in order to adapt successfully. Barriers are explained by failures in the design and execution of the governance process, actors' incompetence, and faulty institutions. The solutions to overcome them are generally found in optimizing the governance process. Although the dominant problem solving lens is an invaluable framework for answering certain questions, the adaptation literature increasingly recognizes that other lenses, underpinned by other ontological and epistemological assumptions about governance, provide alternative – and in some cases more suitable – ways to study complex and erratic governance processes (O'Brien 2009; Burch 2010b; O'Brien and Wolf 2010; Rijke et al. 2012). Research in other fields has demonstrated that choosing one analytical lens, and thereby consciously or unconsciously neglecting others, inevitably leads to bias in research findings (MacCoun 1998; Shepherd and Challenger 2013). One dominant analytical lens also means that an array of alternative interpretations of barriers and possible interventions are overlooked. Despite this recognition, there has been hardly any debate about the ontological and epistemological assumptions or analytical lenses that guide the scientific inquiry on the governance of climate change adaptation (O'Brien et al. 2007; O'Brien and Hochachka 2010).

In this paper, we aim to demonstrate, both theoretically and empirically, that the choice of analytical lens influences how barriers to adaptation are constructed and the intervention strategies proposed. Building upon the work of Bovens and 't Hart (1996), we start by discussing three dominant philosophical understandings of

governance in which the analytical lenses are rooted. These philosophies of governance are operationalized through four analytical lenses on barriers to the governance of adaptation. To examine how different kinds of knowledge on barriers may be derived through different lenses, we investigate the Dutch Spatial Adaptation to Climate Change (ARK) programme through each of the four analytical lenses. The paper ends with a discussion on the advantages and disadvantages of using different lenses and the implications for scientific research and policy practice.

It is important to note that it is not the overall position of this paper to favour one analytical lens over the others, nor do we suggest that there is a superior lens; all lenses can provide valid information when used to answer appropriate research questions. Throughout this article we use the term 'barriers' even though, as will become apparent in the next sections, this term is closely connected to the problem solving lens.

6.2. Philosophies of governance

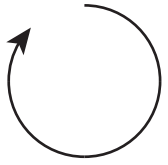
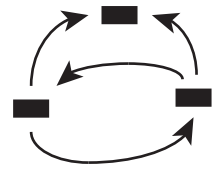
Various concepts, such as research paradigms, research traditions, worldviews, and scientific discourse, have been used to describe the heuristic frameworks in the social sciences for describing and analysing real-world phenomena (Kuhn 1970; Morgan 1980). These have been discussed extensively to demonstrate similarities and differences in the assumptions about the essence of the phenomena under study (ontology), the grounds and scope of knowledge (epistemology), and the ways to obtain knowledge about the real world (methodology), for example positivism, post-positivism, interpretivism, constructivism, or critical theory paradigms (Guba and Lincon 1994; Stone 2001; Lewis and Kelemen 2002). Similar claims are made in the study of public policy and governance; although broad consensus exists that the term 'governance' refers to the alternative ways of steering and managing parts of society (Torfing et al. 2012), a great variety of theories and frameworks have been proposed to analyse governance, each taking specific ontological assumptions on the nature of governance as their point of departure (Rhodes 1997; Stoker 1998; Rhodes 2007). Bovens and 't Hart (1996) categorize the literature on policy fiascos into three 'philosophies' of governance that regulate scientific inquiry by providing guidance on the knowledge that is valued and the knowledge claims that are made: the optimist, the realist, and the pessimist. It is beyond the scope of this paper to elaborate extensively on the notion of philosophies of governance, but we use it here as it is most often understood: the sets of shared beliefs by communities of researchers about the essence of governance, the expectations about good governance, the logic of how governance works, and how to evaluate the process and outcome of governance. These philosophical traditions are not true or false, neither can they be proved nor disapproved (Shepherd and Challenger 2013), yet they play a pivotal role in how we analyse and explain barriers to the governance of adaptation. Table 6.1 provides a short summary of the three philosophies.

6.2.1. Optimist philosophy of governance

Bovens and 't Hart (1996) argue that the optimist philosophy has ideological linkages to the Lasswellian tradition of the policy sciences: to search for an objective, scientific

approach to explain social phenomena and to design better and more successful policies to deal with them. Governance is viewed as the efforts to solve societal problems; climate change is a notoriously complex problem which can only be solved successfully by implementing several technical, social, and organizational adaptation options. Each solution will have its specific advantages and disadvantages, depending on the social context and ultimate goal of adaptation. Some adaptation options require small adjustments, whereas others require major transformations (Kates et al. 2012). The challenge is for governance actors to select, within the context and with the available uncertain knowledge, the best (set of) options to adapt to climate change impacts. Governments play an important role in the governance process as initiators, providing guidance, making resources available, and building institutions. As Bovens and 't Hart formulate it "...they [the optimists] firmly believe in the machinery of governance" (1996, p95) to solve these societal problems. Barriers are seen as unusual errors in this machinery, and the optimist aims to identify the barriers that emerge in order to overcome them. Governance is essentially seen as information processing and making choices to serve the greater good (Hedger et al. 2006). The substantial societal complexity and information uncertainty needs to be reduced to select the right policies and make the most cost-effective decisions. The optimist

Table 6.1. Three philosophies of governance

	Optimist	**Realist**	**Pessimist**
Governance as	Instrumental efforts to solve societal problems	Interactions between dependent actors in the institutional environment	Power play of actors in a locked-in society
Barriers as	Errors in the design and execution of the governance process	Inevitable temporary impasses in the complex interactions between actors about the problems and solutions	Systemic errors in the system or the linkage between subsystems
Interventions as	Removing the barrier by optimizing the actors and governance process	Searching for openings and remaining dynamics in interaction between actors	Impossible as barriers are mostly unmanageable and have a discernible influence on the process
Conceptual approach	Rational policy cycle	Erratic processual	Systems, causal loop diagramming
			

therefore reverts to functional and procedural rationality. Success in solving a problem is determined by how the governance process itself is designed and facilitated: the structures, processes, and means through which decisions are made. Values and objectives of individual actors are not central to the analysis since values cannot be measured objectively. Even if they are included, the actors' goals and values are presumed to be fixed, at least for the purpose of the analysis (March and Olsen 1989). The goal of adaptation to climate change is hardly debated, but is seen as the starting point for the analysis. Processual and programmatic success (McConnell 2010) is considered to be the precondition for successful adaptation. For analytical purposes, the governance process is depicted in rationalized, sequential stages: agenda setting, policy formulation, decision making, implementation, and evaluation. Separating the different stages of the policy process shows how each stage differs in the sort of activities and actors involved, the expertise required, and procedures to govern it (Jann and Wegrich 2007). This separation of stages is important for optimizing the process through, for example, policy learning (Huntjens et al. 2012).

6.2.2. Realist philosophy of governance

The realist philosophy has its roots in the garbage can logic of the policy process: decision making is not about problem solving, but about haphazardly coupling problems and solutions (Cohen et al. 1972). The inconsistent and ill-defined preferences of actors, who come and go throughout the process, create a chaotic and unpredictable image of governance (Duit and Galaz 2008; van Buuren and Gerrits 2008). The erratic nature of decision making is further increased by societal complexity and the wickedness of many societal problems for which there is no shared problem definition and no clear best solution (Weber 2008; Weber and Khademian 2008; Lazarus 2009; Levin et al. 2012). In the realist perspective, governance is considered to be a fragile activity, with labyrinths of struggles, disagreements, and power play between interdependent actors. Governing complex issues thus means accepting setbacks, reversals, and miscommunications (Bovens and 't Hart 1996). The realist does not literally refer to barriers but rather to the conflicts, impasses, or struggles that are inherent in governing complex problems. Societal complexity makes government no longer the dominant actor in the governance of adaptation. Instead, governance includes a pluriform set of interdependent actors from within and outside government who interact to reach negotiated agreements (Koppenjan and Klijn 2004).

The fabrics of governance are the processes of interaction between actors and the institutional structures of formal and informal rules that enable and constrain these interactions. Management, communication, and leadership are key principles in the realist assumptions in an attempt to prevent the governance process from escalating. After all, with the multitude of actors involved, not all ideas and goals can be realized, and worldviews are bound to clash (Kooiman and Jentoft 2009). The realist is therefore particularly interested in understanding the causes of conflict or temporary stagnations in interactions (Torfing et al. 2012). Rather than reducing complexity through rationalization, the realist underlines that complexity should not be reduced but rather embraced. Complexity is important to understand the causes of conflicts and impasses (Klijn 2008), and a precondition to finding openings for revitalizing

governance processes. To take complexity into account, governance is analytically depicted through processual approaches (Pettigrew 1997; Teisman 2000).

6.2.3. Pessimist philosophy of governance

The pessimist philosophy of governance assumes that most of today's societal problems have become more complex and interrelated across spatial and temporal scales. Climate change is one of the monstrous problems society faces and the ultimate price to pay for technological and social progress. Governments play only a marginal role in solving these complex puzzles. Increasing globalization and liberalization of markets blur the boundaries between domestic and international policies, and between the free-market economy and the democratic political system. Nested governance systems emerge that have become less predictable, highly complex, and inherently flawed. It is often unclear who is in the driver's seat and who can be held accountable for what. The governance system is controlled by the wealthy and powerful, leaving other actors to decide whether to serve those interests or the interests of a broader public in a more equitable way. In this philosophy, barriers are considered to be the explanatory variables of why governance continues to fail; tensions and contradictions in the socio-economic, political, and institutional subsystems create structural imperatives, leading to repeated patterns of governance failure (Jessop 2003). Although the barriers, as causes of failure, are often well-known, they can hardly be avoided or removed. Whereas the realist assumes that insightful management of governance processes can still result in successful outcomes, the pessimist argues that, no matter how elaborate the efforts to manage the governance system, the risk of failure is structural (Perrow 1984, cited in Bovens and 't Hart (1996); Pressman and Wildavsky 1984; Jessop 1998). The best we can do is engage in a process of trial and error as forms of social experimentations on adaptation and hope that this will be sufficient to be prepared for future challenges. Analytically, the pessimist is only interested in understanding the sources of barriers that cause recurring failures of the governance of adaptation. Whereas the optimist attempts to decrease social complexity by assuming rationality, the pessimist embraces systems thinking and analysing at higher levels of abstraction in order to simplify social complexity. Although this may result in losing some detail, it allows the pessimist to follow a holistic approach to gain insights into the system as a whole and the interconnectedness between system parts in search of explanations for failure.

6.3. Methodology

The optimist, realist, and pessimist philosophies of governance provide the broader ontological roots from which to start scientific inquiry on barriers to adaptation. These three philosophies are operationalized into one or more analytical lenses, each with a distinct research focus, theoretical orientation, and methodological approach to investigate barriers to adaptation. In section 4, we present four analytical lenses constructed by Bovens and 't Hart (1996) and updated by the results of a systematic review of 81 studies on barriers to adaptation (Biesbroek et al. 2013).

To demonstrate the influence of analytical lenses on how barriers are understood, we investigate the ARK programme through each of the four lenses. The ARK case study

was selected for three reasons. 1) The ARK programme faced considerable delays, thereby providing rich empirical material for exploring barriers through different analytical lenses. 2) The increasing number of governmental programmes on climate change adaptation make the ARK programme a timely and relevant study object (EUROSAI 2012). 3) Real-time access to information created a longitudinal data set from which the analysis could be conducted. The primary data source for the analysis is two rounds of interviews with seven key policy actors conducted during the period 2008–2012. During the semi-structured interviews, which lasted between 1 and 2.5 hours, the interviewees were asked a range of questions about their experiences in the ARK process and to reflect upon four topics: the barriers encountered in the process and how it was attempted to overcome them (problem solving lens), the relation between colleagues within and across departments (competing values and interests lens), the enabling and constraining conditions of the institutional and network setting (institutional interaction lens), and whether parts of the governmental system constrained the ARK programme (structural constraints lens). The choice of topics and their pairing with the four lenses were based on pragmatic considerations as well as on the understanding that each lens requires specific diagnostic questions (Allison and Zelikow 1999). At the end of each interview, interviewees were asked to evaluate the outcomes of the ARK programme as either successful or unsuccessful, and explain why. In addition to the interviews, background information was collected by analysing published and unpublished governmental documents and the results of a recent evaluation study of the ARK programme, see for example Court of Audit (2012). Secondary documents were used to corroborate the findings, see for example Swart et al., (2009, annex 6), Keskitalo (2010, chapter 7), van den Berg and Coenen (2012), Uittenbroek et al. (online first).

An introduction to the case study: the Spatial Adaptation to Climate Change (ARK) programme

In 2005, a motion was adopted by the Dutch Senate to promote long-term thinking in Dutch spatial planning. The motion was named after the first author, and member of the Senate, Lemstra. Soon after this motion, it was decided to install the ARK programme with the objective of climate proofing the Netherlands (Kabat et al. 2005). The acronym ARK was a subtle reminder for the Dutch public of Noah's Ark. The programme included four of the (at that time) 13 Dutch ministries, and the umbrella organizations for the 12 provinces, more than 400 municipalities, and 26 water boards. Although the overall aim was to climate proof the Netherlands, three sequential objectives were defined: (1) increase awareness of climate change, build networks, and formulate a strategy, (2) develop and distribute knowledge on adaptation, (3) develop instruments and guidance, and stimulate bottom-up innovations. The programme, chaired by the Ministry of Housing, Spatial Planning, and the Environment (VROM), started on February 2006 and was expected to be completed by the end of 2014 (ARK 2006). In the autumn of 2007, the ARK programme produced the first National Adaptation Strategy (NAS), which describes the broad vision for climate change adaptation in the Netherlands. More detailed measures and executive actions were expected in the 2008 National Adaptation Agenda (VROM 2007a), but the Agenda was never published. In parallel, the Cabinet

installed in September 2007 a State Commission to investigate the influence of climate change on long-term water safety (Deltacommittee 2008). The Delta Programme, established in 2008 to ensure the implementation of the advice from the Delta Committee and coordinated by the Ministry of Transport, Public Works, and Water management (VenW), was operational at the beginning of 2009. In the Delta Programme, the Dutch government reformulated its policy priorities and restricted them more or less to the water domain. After the parliamentary elections in September 2010, the Ministries VenW and VROM were merged into a new ministry: the Ministry of Infrastructure and the Environment (IenM). In 2011, a Delta Law passed through the Senate, providing a long-term legal basis and budget for the Delta Programme (PBL 2012). At the beginning of 2012, the last sign of the ARK programme – the website – was shut down.

6.4. Four analytical lenses on barriers to the governance of adaptation

The four analytical lenses presented in sections 4.1 to 4.4 are summarized in Table 6.2. As the reader will notice, two analytical lenses start from the same philosophical underpinning: the competing values and institutional interaction lenses are both rooted in the realist philosophy. Their difference pertains to the level of analysis; whereas the former focuses on the actor level, the latter focuses on the institutional environment. We explore each lens theoretically and investigate the ARK case analysis through each of the four lenses.

6.4.1. Lens 1: Governance as problem solving

The problem solving lens is firmly rooted in the optimist philosophy of finding the best solutions to manage climate change impacts. In general, the causes of barriers are found in the execution of the governance process or in the incompetence of actors and institutions involved. If designed well, the self-correcting mechanisms in the governance process will have the capacity to deal with slips and mistakes of individual actors, leading eventually to achieving the predefined goals (Bovens and 't Hart 1996). Causes at actor level include lack of training, knowledge, capacity, or skills, resulting in bad judgements, wrong choices, or carelessness (H. Boer 2010; Moser and Ekstrom 2010; Lemieux and Scott 2011; Flugman et al. 2012). Other causes are found in the execution of the governance process; for example, the social and organizational processes were distorted, resources were not available, or constraints resulted from faulty institutions (Næss et al. 2005; Storbjörk 2007; Moser et al. 2008). Although barriers themselves can be a variety of factors, the sources of barriers are often seen as 'the lack of' something; for example the lack of resources to invest in adaptation, the lack of policy guidance to implement adaptation across scales, or the lack of knowledge and information (Burch 2010b; Biesbroek et al. 2013). The scientific and procedural rationalistic assumptions of problem solving are reflected in how the barriers are analysed; the first and foremost question is 'which' barriers have occurred. The analyst will treat the set of identified barriers as stable and discrete entities that emerge in empirical reality and that can be observed and described as objectively as possible. Barriers are identified with the aim of developing a comprehensive framework to analyse the barriers to the governance of adaptation to support practitioners to adapt successfully. Whether or not barriers have occurred can

Table 6.2. Four analytical lenses for studying barriers in the governance of climate change adaptation.

	Governance as problem solving	**Governance as competing values and interests**	**Governance as institutional interaction**	**Governance as dealing with structural constraints**
Governance philosophy	Optimist	Realist	Realist	Pessimist
Possible sources of barriers	Human, organizational and management error; Governance design flaws	Diverging frames, ideologies, and preferences; Conflicting perspectives on problems and solutions	Institutional misfits across scales and sectors; Failing, lacking, eroding, or unshared institutional rules, checks, and balances	Structural error, blurred by the interactive complexity of the system Decoupling between temporal, spatial, and functional components of the system
Examples from ARK programme	Lack of knowledge for decision making, lack of resources, lack of skills, lack of policy instruments for implementation	Disagreement on the key problems and solutions, conflicting interests and policy agendas, meta-cultural frame conflicts, strategic struggles, reframing of adaptation debate	Institutional voids to support ARK programme, fragmented networks and policy games, low political leadership	Short-termism favoured over long-term climate change, changes in context, technocracy in government, intergovernmental efforts as window-dressing
Possible ways of intervening	Educate people, reorganize, optimization of the governance process	Search for openings in interaction through frame reflection and negotiation	Search for openings through institutional design for process and outcome	Expose the capitalist system as structurally flawed and reduce dependence on the system
Examples from ARK programme	Collect more knowledge through Routeplanner project, start new research programmes, avoid decision making, merge with Delta Programme	None attempted	None attempted	None attempted

be inferred from the difference between the intended and observed outcome: if the outcome was less efficient or effective, took longer to realize, or was more costly than anticipated, this suggests the presence of barriers (Moser and Ekstrom 2010).

When barriers occur, they need to be removed by optimizing the process using the right resources, knowledge, and/or skills. Once a barrier has been identified, it is often approached with an intervention that mirrors the barrier identified (Brown and Farrelly 2009); Faulty institutions need to be replaced with better institutions, uninformed staff need to be educated, granted access to better information, or new knowledgeable staff need to be hired, the lack of resources requires access to, and mobilization of, alternative resources. Ideally, the solutions should result in win-win situations for all the actors involved.

Problem solving lens on the ARK programme

We asked the ARK interviewees whether they encountered barriers, and if so which barriers, in the different stages of the policy process. The respondents informed us about the several managerial, organizational, and resource barriers that had emerged. First of all, the lack of existing knowledge on impacts, vulnerabilities, and adaptation (IVA) posed a barrier to the programme team selecting the most effective adaptation options during the policy formulation stage. Although some work on IVA had already been done (MNP 2006), it was either outdated, highly fragmented, or considered too scientific by the programme team. This had been foreseen by the programme team and therefore a project, entitled Routeplanner (2006), was established to collect all available knowledge from the on-going Dutch research programmes on climate change. However, the reports came too late in the process and quick decisions needed to be made to prevent substantial delays (Interview 5). In addition, during the policy formulation stage it became apparent that only a small budget was available, much of which was in terms of man hours. As a result, those working on the project team had limited time to spend. In addition, several interviewees (Interview 1, 4) noted that some project members were not sufficiently skilled or knowledgeable to participate in these discussions. To prevent further delays, the programme team decided to develop the NAS without making explicit policy choices. After the decision-making stage, it became more apparent that the ARK programme had neither the legislative instruments nor the resources to implement the NAS. As one interviewee (2) from the programme team remarked, “the ministry [VROM] depended on the power of persuasion” rather than the “...financial and legislative powers of [the Ministry of] VenW” (our translation). After the NAS was published, it was unclear how to proceed; the lack of clear choices and the lack of knowledge in earlier stages had clearly delayed implementation of the programme. In the third year of the ARK programme, climate change adaptation started to disappear from the political agenda and became replaced with concerns about long-term water safety. As all interviewees remarked, the newly established Delta Committee and Delta Programme created an inefficient and unnecessary overlap with the objectives of the ARK programme. Integrating the ARK into the Delta Programme was therefore considered a win-win situation; several of the barriers relating to legislative instruments, resources, and knowledge were overcome by integrating with the Delta Programme, and the main objectives of the ARK agenda were still implemented through the Delta-sub-programme New Developments and Infrastructure (Court of Audit 2012).

6.4.2. Lens 2: Governance as competing values and interests

The second perspective can be positioned in the realist philosophy and focuses on competing values and interests. This perspective is based on the understanding that truth is composed of multiple local realities that can only be perceived subjectively (Bevir 2009). Frames or belief systems determine what actors consider to be of value and how actors give meaning to their environment (Schon and Rein 1994; Kaplan 2008). Which choices actors make is strongly influenced by personal preferences, core values, and beliefs: their knowledge and awareness of climate change, their attribution of climate change impacts as an urgent threat, and their personal motivations to act (Schwartz 1994; Scharpf 1997; Weible et al. 2009; Gifford et al. 2011). Different frames lead to fundamentally different descriptions of the same problem and possible solutions (Tversky and Kahneman 1981; Eisenhardt and Zbaracki 1992). Several scholars have called for such value-based approaches to understanding adaptation (Adger et al. 2009b; O'Brien and Wolf 2010). The competing values and interests perspective emphasizes the articulation and negotiation of competing norms, values, and ideas (Bovens and 't Hart 1996). In this lens, governance is about managing competing values and interests and preventing them from escalating. Emphasis is on the cognitive and social causes of impasses and deadlocks: the mutually incompatible ways in which actors interpret their environment, and the disagreement in their normative convictions and arguments. Whereas these values are the moral/normative convictions of actors, interests refer to material interests such as financial resources (Kouzakova et al. 2012). In both cases, conflicts can result from the strategic efforts of actors to protect their ideas, values, and interests, their anticipation of the behaviour of other actors, and the associated power play (Eisenhardt and Zbaracki 1992; March 1994). Kaplan (2008) describes these strategic struggles as 'frame contests' in which winning and losing means getting closer or creating more distance relative to one's own value system. Conflicting values and interests can result in asymmetrical argumentation structures (Koppenjan and Klijn 2004), dialogues of the deaf, and cognitive fixations (Termeer and Kessener 2007).

These impasses and policy deadlocks make reflection on the existing practices impossible; in these cases, more resources or efforts are not sufficient to revitalize the process and may even prove counterproductive. It is necessary to understand the cognitive and social causes of the impasse, and the remaining dynamic in the process can be used as an opening for revitalization (Termeer and Kessener 2007). Several such intervention strategies can be identified, for example working towards mutually satisfactory compromises, alternating between competing values over time, structural separation by assigning the pursuit of each value to a separate organization, and avoiding simplistic decisions by focusing on analogical reasoning and situated judgement (Schon and Rein 1994; Thacher and Rein 2004; Shmueli et al. 2006; Stewart 2006).

Conflicting values and interests lens on the ARK programme

In analysing the case from this lens, we started by identifying conflicting value positions and normative notions underlying the labyrinth of choices, actions, and the chain of events in the ARK case. The interviewees were asked to reflect on the

similarities and differences in value positions and interests among the ARK project members, and whether these differences had escalated at some point during the process. Three interviewees suggested that a key impasse emerged after the publication of the NAS, although the causes thereof were found much earlier in the process. First of all, although there was a shared agreement among project members that climate change posed a serious threat to long-term investments, there was little agreement among individual members on the solutions that were needed. Additional research and assessments through the Routeplanner project provided little help to overcome this problem, but rather strengthened the conflicting positions. The intention of the ARK programme was to have a cooperative process in which many departments were represented, illustrating the cross-boundary impacts of climate change and a broad governmental commitment to act. However, when the programme progressed, project members felt increasingly forced to represent their governmental departments, as several project members feared that the goals of adaptation would conflict with their departmental policy objectives. Rather than choosing cooperative strategies, many actors on the ARK team aimed at defending their values and interests. The actors had hidden agendas that were unclear to the other actors (Interview 4). The defensive strategies undermined the discussions about content and resulted in limited and passive commitments from most actors (Court of Audit 2012). In addition, interviewee 4 remarked that there was an asymmetrical exchange of arguments between the key actors, particularly VROM and VenW, about the direction of national adaptation policy. The project team included actors from different institutional and cultural backgrounds, including technocrats, engineers, and planners, and actors with strongly diverging political rationalities (Vink et al. online first). Their competing worldviews clashed on several occasions, most noticeably when VenW project members questioned the role, intentions, and legitimacy of the VROM actions, and vice versa, creating distrust on both sides. This caused a significant impasse. Two interviewees also suggested that installing the Delta Committee was a strategic move orchestrated by VenW to take over the adaptation agenda and break through the impasse. To do so, the Delta Commissioner strategically reframed the larger part of the political debate towards long-term water safety (Interviews 1, 3). These intentional strategic framing contests eventually led to favouring the values, interests, and ideas of VenW over those of VROM.

6.4.3. Lens 3: Governance as institutional interaction

The institutional interaction lens, also embedded in the realist philosophy of governance, stresses the organizational complexity of governing adaptation and the enabling and constraining conditions of the institutions involved. Institutions are formal and informal practices and procedures that were once new and contested but through socialization have become institutionalized and are now seen as normal, sensible, and logical (March and Olsen 1989; Scott 2008b). For example, institutions are solidifications of cultural discourse through shared beliefs and stories that create collective behaviours about climate change risk (Adger et al. 2012), or the legislative and bureaucratic system of regulatory mechanisms that influence human choice. Institutions have frequently been identified as key barriers to adaptation, particularly because adaptation requires flexibility and change, whereas stability and rigidity are

inherent in institutions (Næss et al. 2005; Dovers and Hezri 2010; Harries and Penning-Rowsell 2011; Lebel et al. 2011; Storbjörk and Hedrén 2011; Termeer et al. 2012). In this perspective, governance is often depicted as strategic 'policy games' that take place in loosely tied networks and policy arenas (Scharpf 1997; Sorensen and Torfing 2009). In these games, actors try to anticipate how the governance process is likely to proceed, how other actors are going to behave, and whether actors should try to prevent or, instead, steer towards conflict (Sabatier et al. 1987; Scharpf 1997; Stevenson and Greenberg 2000). Impasses can therefore result from failing, lacking, eroding, or unshared institutional rules or scripts (March and Olsen 1989), and institutional conflicts can emerge when new ideas, collective values, or beliefs are not aligned with or clash with the prevailing institutional environment (Hargadon and Douglas 2001). In addition, path dependencies, lock-in effects, and the inertia of institutions make them difficult to change (Giddens 1984; March and Olsen 1996; Pierson 2000). Also, institutions may not have the adaptive capacity to respond to climate change adaptation (Næss et al. 2005; Gupta et al. 2010) or there may be no dedicated institutions in place – all of which blurs responsibility, legitimacy, and coordination across scales (Hajer 2003). Finally, lack of institutional leadership and management of the policy games can cause processes to stagnate (Koppenjan and Klijn 2004).

Intervention strategies for barriers through the institutional interactions lens can include clarification and deliberation about the rules of the game (Klijn 2001), designing new institutions or changing existing institutions (Mahoney and Thelen 2010), intensified network management, or changes in the network configuration (Koppenjan and Klijn 2004).

Institutional interactions lens on the ARK programme

The analysis started by mapping the network composition, policy arenas and games, and institutions across governance scales, in an attempt to understand the complex institutional setting of the ARK programme. Interviewees were asked to reflect on how the ARK project was positioned in the network of organizations that worked on adaptation, and whether this influenced how the programme functioned. All interviewees argued that the political aim of the programme was to mainstream adaptation in existing spatially relevant policies (e.g. nature, agriculture, water, infrastructure). This meant crossing a range of institutional boundaries, and this, consequently, created conflicts among actors from different institutional contexts. In addition, the newness of adaptation as a social and political problem and the lack of dedicated institutions posed considerable challenges for the programme. This institutional void was visible, for example, in the limited shared ideas on how to handle the conflicts and disagreements that were bound to emerge during the programme. As interviewee 4 noted, there was limited coordination and management between the different networks and arenas, both horizontally (between government departments) and vertically (between scales of government), resulting in an unclear and fragmented image of the emerging policy arenas in which adaptation was also discussed. These arenas were, at best, loosely coupled. Decisions made by the Delta Committee, the competing policy arena, had a direct impact on the ARK arena by

taking over the most vital part of the adaptation agenda, namely, water safety and freshwater supply, thereby reducing ARK's institutional legitimacy. In fact, there was an institutional misfit between the two main actor groups. The Ministry of VROM had a strong integrative policy tradition and depended upon persuasion, long-term vision, and linking of different sources of knowledge to develop and implement policy. The Ministry of VenW, with a sectoral approach focusing on solving water problems, had strong political and legislative instruments, with substantive resources to implement policies. Probably because of these asymmetric power relations, VenW questioned the legitimacy of VROM as ARK programme coordinator. Finally, two interviewees (3, 4) mentioned the limited leadership in the programme and weak political leadership by the responsible minister, arguing that strong leadership was necessary to manage the complex process of the ARK programme. These institutional conditions caused the process to stagnate and reach an impasse about the way to go forward. Merging the two ministries was not seen as a solution because "...the cultural differences between the [two former] ministries still hamper the implementation of the ARK ambitions in the Delta Programme" (Interviewee 4, our translation).

6.4.4. Lens 4: Governance as dealing with structural constraints

The fourth and final lens is embedded in the pessimist philosophy. This lens can be frequently found in debates about climate change mitigation, but have only recently emerged in discussions on adaptation (Fieldman 2011). Governance in this perspective is seen as dealing with structural constraints in regulating social activities. There are fundamental dilemmas in our society as a result of clashing logics; for example, we are locked into our capitalist system, which created the problem of climate change in the first place, yet we revert to the capitalist system to find solutions (Bailey and Wilson 2009). The choice is either to gain political legitimacy through increased public spending for short-term benefits, or to depart from the profitable economic activities that lead to the uncertain and long-term impacts of climate change. Examples of similar dilemmas are all around, for instance in natural resource depletion (Dietz et al. 2003). This lens questions the functioning of human society as a whole, whereas the other lenses take this overall system for granted. Bovens and 't Hart (1996) argue that discussions on large-scale system failure take place at two levels. Macro level theorists argue that constraints are the result of flaws in the generic properties of the system. For example, Fieldman (2011) describes how neoliberalism and capitalism increase individual and social vulnerability and exposure to climate-induced risk through several nested and interrelated subsystems. Other examples include literature on issues ranging from collective failure of market mechanisms to the provision of adaptation as a public good on the basis of non-rivalry, non-excludability, or externalities. Macro level theorists stress the failure of the democratic system and the limits of democratic mechanisms to govern adaptation in a highly political international arena where vested interests limit consensual decision making. Others have focused on subsystem properties and the interactions between subsystems, arguing that cascading effects of barriers lead to catalytic failure of the system as a whole.

It is nearly impossible to overcome structural constraints. It would require a radical departure from what has been done before, since improving the performance of parts of our system does not improve the performance of the system as a whole. However, only collective efforts of the powerful few will be able to change the overall logic of the system in order to prevent recurring failures. Dealing with structural constrains, therefore, means accepting that the failure of the present system is unavoidable. We can, at most, mitigate the influence of barriers on a smaller scale for temporary relief.

Structural constraints lens on the ARK programme

The analysis from the structural constraints perspective started by asking interviewees whether they believed our societal system was able to adapt to climate change or whether there were system constraints that posed limits on what we could do. From this structural constraints lens, the first and foremost argument is that the firm belief in the capitalist economic system places the market above all else, thus making climate change an 'inconvenient truth.' The slightest signal that climate change may not be certain or may not be seriously detrimental causes political actors to drop the subject altogether and go for short-term economic profits again. This is exactly what happened during the ARK programme. Although the science had not changed, national public opinion became more sceptical about the realness and importance of climate change, further influenced by the errors in the Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report, Climate Gate, and several cold winters in a row (interviewee 1). Second, all interviewees suggested that the social impacts of the economic and financial crisis had become more pressing, pushing adaptation from the political agenda. Third, as stressed by interviewee 4, by 2008 the Dutch political landscape had started to change from a centre coalition to a right-wing coalition, and a large populist political party questioned whether climate change was real and happening. As a result, the political focus was limited to what the Dutch are famous for and could potentially sell abroad: the development of new water safety technologies. This marketing of knowledge is also central in the NAS (VROM 2007b). In addition, designing deliberative governance arrangements, such as the efforts to include the different sectors and levels by organizing meetings and workshops to strengthen the legitimacy of the ARK programme, were merely window-dressing in an attempt to overcome governmental 'pillarization'. Instead, dominant interests in the water sector played a major role in determining the future of the adaptation agenda. The ARK programme did not revolve around content, but around politics. Fourth, the Dutch government was dominated by technocratic reductionists and 'optimists' that were unable to 'solve' the complex problem of climate change adaptation. This combination of factors made the failure of the ARK programme very likely.

6.5. Discussion: what have we gained from using different analytical lenses?

Most of the studies on adaptation to climate change have hardly engaged in fruitful debates about the philosophical roots of the governance of adaptation, perhaps because of the relative newness of the topic (Ford et al. 2011). However, particularly in generative research, articulating and understanding the embedded assumptions about the nature of governance is of central concern for interpreting and engaging with

research findings. In this section, we discuss what our analysis of different philosophies and analytical lenses contributes to our understanding and study of barriers to adaptation.

6.5.1. Comparing analytical lenses

Comparing the four lenses allows us to distil several new insights about barriers to adaptation.

First of all, we find that each governance philosophy has its own linguistics to describe the struggle to develop and implement climate change adaptation measures. Arguably, the concept 'barriers to adaptation' is a 'disciplined imagination' (Cornelissen 2006): an analytical construct created within the optimist tradition to understand complex situations. For the optimist, the concept of barriers is an aggregated artefact composed of multiple factors that is placed in the context of purposeful responses to a societal problem. As discussed, the realist does not use the term 'barrier' but refers to 'conflicts,' 'struggles,' and 'delays' as unavoidable causes of temporary impasses. In fact, in the realist perspective, the concept of 'barriers' is part of the political language of naming, blaming, and shaming (Edelman 1977). The pessimist does not refer to 'barriers' either, because the search is geared towards explaining the recurring sources of systemic failure (Pressman and Wildavsky 1984). Different linguistic descriptions of the same phenomenon do not necessarily mean conceptual weakness, as long as the phenomenon under study is well defined (Pfeffer 1993). However, we argue that if the discussions on barriers to adaptation are to progress theoretically, awareness of the existence of alternative framings of barriers and reflexive engagement with alternative framings become important prerequisites (Weick 1999).

Second, as Allison and Zelikow (1999) demonstrate, analytical lenses start from different questions. For example, the problem solving lens focuses on the question of 'which' barriers have emerged during each stage in the process in order to explain outcomes, whereas questions asked by the two realist lenses are geared towards the dynamics in the process in an attempt to understand the value positions, interests, and institutions that could reveal 'why' impasses have emerged. The fact that different questions underlie each lens is an important observation as this suggests that not all analytical lenses are equally suited to analyse specific phenomena. Also, each question demands specific types of knowledge. For example, collecting the data using the competing values and interests lens proved most difficult and on several occasions became very sensitive and personal. Making inferences through the competing values and interests lens was also more difficult compared to the optimist perspective because of the subjective nature of the collected data.

In addition, different lenses can lead to competing interpretations of the phenomenon studied. For example, the problem solving lens sees the Delta Programme as a natural successor of the ARK programme (win-win), whereas the competing values and interests lens describes the process as a strategic struggle between two ministries in which one side won at the expense of the other. The structural constraints lens creates an even darker view, stressing that the return to water safety in the Delta Programme

is an exemplar of the risk avoidance and short-termism that prevails in capitalist politics. The possibility of arriving at conflicting conclusions does not seem an attractive perspective for a researcher, but it is considered to be an important step in scientific progress (Laudan et al. 1986; Scott 2008a). Conflicting claims lead to healthy scientific discussions, stimulate creativity, and initiate conceptual leaps about barriers to adaptation (Allison and Zelikow 1999). Broadening the scope of analytical lenses leads to alternative interpretations of the studied phenomenon; this is valuable, for example, in evaluating adaptation policy, see Court of Audit (2012).

Fourth, the boundaries of what is being studied differ between lenses. Whereas the problem solving lens focused primarily on the organization and functioning of the governance process, the competing values and interests and institutional interaction lenses tried to open-up this black box by investigating the actor (competing values and interests) or network and institutional (institutional interaction) dimensions of the process. The structural constraints perspective placed the ARK case in a much wider systems perspective in search of the causes of barriers, and this resulted in new variables not identified by the other lenses.

Finally, and perhaps most importantly, the analysis of the ARK case reveals that not only researchers, but also those researched, i.e. practitioners, have presumptions about how the world works, and they will act accordingly. Members of the ARK programme were essentially optimists, aiming to solve the problem of climate change impacts as effectively and efficiently as possible. Because of this mind-set, the interventions that they proposed when confronted with the limited progress of the ARK programme fitted this lens. They considered lack of knowledge as one of the main barriers, and therefore the proposed solution was to acquire more knowledge. This also shows that each lens has its own types of barriers and, because barriers and interventions are directly entwined, specific types of interventions. The ARK project members therefore never considered, for example, alternating between competing values over time (competing values and interests type of interventions) simply because competing values were not considered as the barrier. Whether or not for example the competing values and interests type of analysis would have resulted in other, more successful interventions in the ARK case remains a matter for speculation, but it would certainly have increased the choice options for policy practitioners (O'Brien et al. 2007). This of course presupposes an understanding that there are different worldviews and an acceptance that alternative lenses may yield a better understanding of the sources of barriers and how to overcome them.

6.5.2. Best philosophy? Best analytical lens?

In this paper, we have argued that there are three philosophies and even more analytical lenses. But if there are multiple philosophies, is it possible to choose the most relevant one for analysing barriers? There are, unfortunately, no universal standards for selecting the best perspective. How researchers see the world and how they analyse social phenomena is often hardly a conscious choice but defined by cultural and theoretical traditions, by research institutions, financers of research, and personal ideological preferences. In fact, scholars from each philosophy have vented

criticisms about the others' contributions in explaining governance processes (Shepherd and Challenger 2013). For example, researchers from the realist philosophy argue that optimists have an oversimplified and unrealistic view on governance (Stone 2001), with limited explanatory power and a lack of theories of the governance process as a whole (Sabatier 2007). The realists argue that their perspective is more valuable in complex governance situations with unclear societal problems and policy objectives (Teisman and Klijn 2008). The optimists, on the other hand, argue that the realist perspective has limited prognostic value, making it a challenge to predict when and where barriers might emerge. In addition, the realist perspective is considered to be too abstract and of little value in policy practice. The optimist perspective is still seen as a valuable structuring heuristic and therefore remains popular in policy studies and policy advice to improve decision making on adaptation to climate change (Moser and Ekstrom 2010). The pessimists stress that reductionist thinking in both the optimist and the realist tradition derives barriers from the properties of system parts, whereas holistic and synthetic thinking is needed to derive barriers from properties of the system as a whole. The absence of universal standards also holds true for the choice of analytical lens within each philosophy; all lenses have their assumptions, theoretical blind spots, and methodological difficulties in studying barriers to adaptation. Which analytical lens is best ultimately depends on the objective of the investigation.

6.5.3. Unitary perspective or analytical pluralism?

Because there are no universal standards for selecting the best philosophy, broadly two options remain: choosing one philosophy in a coherent and consistent way, or choosing multiple philosophies, see Shepherd and Challenger (2013) for a more nuanced distinction. Those in favour of unitary approaches assert that incommensurable ontological and epistemological differences between lenses demand a choice of one perspective over others. Opting for a unitary philosophy allows for a consistent research design and protects research integrity (Jackson and Carter 1991). Contrastingly, proponents of the pluralism approach argue that research developed in one philosophy could complement knowledge gained from other philosophies (Gioia and Pitre 1990; Lewis and Kelemen 2002). According to these authors, the traditional task of science to progressively move towards a unitary perspective on elusive concepts such as barriers to adaptation is pointless (Allison and Zelikow 1999; Esbjörn-Hargens 2010; O'Brien and Hochachka 2010). Instead, engaging in a multi-, or pluralist, perspective allows analysts to complement, engage, and utilize insights from different angles (Sil and Katzenstein 2010). Others have pleaded for theoretical pluralism: combining different analytical lenses within one philosophy or among philosophies to increase understanding of social phenomena (Termeer and Dewulf 2012). Such pluralist-type enquiry encourages greater reflexivity on the researcher's own perspective and on the impact of this perspective on research outcomes (Lewis and Kelemen 2002). Reflexive engagement with fundamentally different analytical lenses may shed light on which lens has the most leverage to keep the adaptation process in motion (O'Brien et al. 2007). Although pluralism can increase our understanding of barriers, several concerns about this approach have been mentioned in the literature, including the idiosyncratic combination of variables and concepts

from different epistemologies and the resulting indeterminacy in the interpretation of results (Sil and Katzenstein 2010), or the incommensurability of multiple explanations (Bovens and 't Hart 1995). How to utilize a pluralist approach without violating the underpinnings of each philosophy is not well researched in the literature (Shepherd and Challenger 2013).

6.5.4. Eclecticism in existing studies on barriers to adaptation

We stated in the introduction to this paper that most of the research conducted on adaptation to climate change starts from the problem solving lens in analysing barriers (Biesbroek et al. 2013). Reality is, as always, a bit more nuanced; most studies on climate change adaptation follow a pragmatic eclectic approach and combine different ontological and epistemological ideas in studying barriers to adaptation. Studies tend to start from realist philosophies on the multifaceted nature of governance and the complex social process in which actors from different backgrounds try to reach agreements on adaptation measures (Adger et al. 2005; Keskitalo 2010; Moser and Ekstrom 2010; Tryhorn and Lynch 2010; Juhola and Westerhoff 2011; Hanger et al. 2013). However, when the research approach is operationalized, the realist assumptions are replaced by concepts and methodologies from the problem solving lens (Mozumder et al. 2011; Regmi and Hanaoka 2011; Biesbroek et al. 2013). Although there is no obvious explanation for this observation, we postulate that: i) many researchers are not conscious of their perspectives and the influence these have on studying barriers, making them unaware of this problem; ii) research on adaptation aims to be practice focused and socially relevant. Practitioners are mainly optimists, and this legitimizes the choice of the problem solving lens; iii) most of the research on adaptation is inductive and generative and not very theory driven so therefore strongly influenced by the researcher; iv) there are many problem solving policy frameworks available to analyse adaptation processes, but hardly any analytical frameworks that guide realist and pessimist types of inquiry in analysing barriers to climate change adaptation. In our opinion, these eclectic combinations are rather troublesome; implicitly mixing and matching parts of different philosophies in one study can lead to conflicts between the types of barriers identified and the interventions needed to overcome them.

6.6. Conclusions

Research on barriers to the governance of adaptation is a social science endeavour (Von Storch and Stehr 1997; Rayner and Malone 1998; Adger et al. 2009a; Jasanoff 2010; Moser and Ekstrom 2010). As with any social research, those researching social phenomena should critically engage with the philosophies that underlie their research in order to make valid knowledge claims. As discussed at length in this paper, these assumptions, whether made consciously or not, dictate what is researched and influence the nature of the knowledge claims that are constructed (Mauthner and Doucet 2003). We want to emphasize two observations.

First of all, although explicit reference to theoretical frameworks is becoming more common, most studies on the barriers to the governance of adaptation are still implicit in their ontological and epistemological assumptions (O'Brien et al. 2007; Biesbroek et

al. 2013). We argue that this greatly hampers the transparency and integrity of research as these (implicit) assumptions determine what is analysed and how this is interpreted. The signalled pragmatist eclecticism in these studies also demonstrates the pre-paradigmatic state of the field. We hope that this paper contributes to raising paradigm consciousness about the role of philosophies of governance and the influence of analytical lenses on research results.

Second, we postulate that multiple and complex phenomena, such as barriers, can best be understood through various analytical orientations and perspectives of reality for at least two reasons. First, it allows for intellectual diversity, competing claims, and alternative understandings. Scientific progress benefits from healthy disagreement between researchers. Recognizing the consequences of analytical lenses would already constitute such progress (c.f. Laudan et al. 1986). Second, pluralism increases the reflexivity of researchers and practitioners, and this in turn widens our view towards a more diversified set of interventions to deal with barriers in policy practice. Careful application of these intervention strategies, in turn, will provide additional opportunities to study and understand the adaptation process in practice.

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CHAPTER 7

Rethinking barriers to adaptation: mechanism-based explanation of impasses in the governance of an innovative adaptation measure

ABSTRACT This paper introduces the mechanismic view as a way to explain the causes of impasses in the governance of climate change adaptation. Thus far, scholarly literature on climate change adaptation aims to identify all the possible barriers that actors have encountered in policy practice. In this paper, we argue that barriers to adaptation are simplified constructs of reality which are not necessarily of analytical value when the aim is to explain social phenomena. To this end, we propose the mechanismic view as analytical lens to capture the often non-obvious cause-effect relationships of how a process reaches an impasse. Mechanisms are understood as patterns of interaction between actors that bring about change in the governance process. They are the essential components of middle range theories. Mechanism-based explanations provide a plausible causal account of the configuration of mechanisms that are necessary to explain the observed impasse. We adopt this view in a study of how the idea for an innovative Water Plaza was realized in the city of Rotterdam, the Netherlands. The analysis reveals three explanatory mechanisms: the risk-innovation mechanism, frame polarization, and conflict infection. We postulate that compared to existing conceptualisations of 'barriers to adaptation', mechanism-based explanations produce more precise and well-founded explanations upon which new interventions to address an impasse can be based.

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7.1. Introduction

Examples from policy practice demonstrate that developing and implementing climate change adaptation measures is not a barrier free process, but rather a continuous struggle of encountering and overcoming barriers. Several studies have begun to analyse these barriers to adaptation empirically (Biesbroek et al. 2011; Engle 2012; Archie 2013; Clar et al. 2013; Mukheibir et al. 2013; Pasquini et al. 2013)

In the literature, barriers to adaptation are often conceptualised as unwanted errors in the design and execution of the governance process which prevent policy actors from achieving successful adaptation (Biesbroek et al. online first). Something is considered to be a barrier when there is something missing that from a normative point of view, should be present; lacking resources, skills, instruments, absence of credible information is just a small sample of the many barriers listed in the scholarly literature. Existing scholarly frameworks are designed to capture these many possible barriers to adaptation that policy actors encounter in practice, see for example the frameworks developed by Moser and Ekstrom (2010), Eisenack and Stecker (2011), Kolikow et al. (2012) and Lehmann et al. (2013). These frameworks are designed to catalogue the detailed complexity – the many intervening variables - of the governance process. The question resonating through these frameworks is 'which' barriers have emerged. The collective effort of researchers to capture the full extent of this detailed complexity is based on rationalised assumptions about the governance process and a reified and static representation of the barriers in this process (Biesbroek et al. online first). These studies mark an important first empirical step in understanding what kinds of barriers can emerge. However, their findings provide little insight how the governance process works, why barriers emerge or what effect they have. This requires a more thorough analytical step than identifying lists of barriers empirically.

This paper introduces an alternative perspective on barriers in the governance of adaptation. We assume that decision making on complex issues does not revolve around finding the best solutions, but rather around the articulation of problems and solutions between actors with different frames, values and beliefs. Governance is understood as fragile activity characterised by coupled policy arenas, positive and negative feedbacks, lock-ins, path dependency, reciprocity (Bovens and 't Hart 1996; van Buuren and Gerrits 2008; Kooiman and Jentoft 2009). Reaching impasses in the interactions between actors is an inevitable part of the governance of complex policy issues such as climate change adaptation. In these dynamic processes the causes and effects are often subtle and non-obvious, and often the consequences of taking action in addressing problems are imperceptible over spatial and temporal scales (Termeer et al. 2013). This, what Senge (1990, p71) calls dynamic complexity, requires a different way of thinking about causes and effects. The causes for reaching impasses are not a list of stable entities, as the concept of barriers implicitly suggests, but rather the consequences of and an ingrained part of the dynamic and erratic processes of governance. To understand and explain why policy processes reach impasses requires unravelling the process in detail and putatively link the plausible causes to the observed outcome patterns.

To capture these dynamic processes into analytical building blocks, this paper adopts the so called mechanismic view. Over the past years the mechanismic view gained considerable interest in the philosophies of science (Machamer et al. 2000; Glennan 2002) and social sciences (Tilly 2001; Mayntz 2004; Hedström and Ylikoski 2010) particularly because of the appealing linkages to the generative model of causation. Put simply, mechanism-based explanations aim to provide a plausible account of the generative mechanisms that are necessary to explain how, under certain contextual conditions, an observed impasse has emerged. This perspective is different from existing studies on barriers to adaptation because identifying the generative mechanisms allows us to explain "how" and "why" certain things happened rather than merely observing that something happened (Rohlfing 2013).

We adopt this perspective to provide a mechanism-based explanation of the impasse that emerged in the decision making process on the Water Plazas in the city of Rotterdam, the Netherlands. The Water Plaza case is a prototypical example of concrete climate change adaptation in a highly urbanised area. Especially for cities the challenges to implement climate change adaptation measures are substantial due to competition for space, high investment costs, a large number of stakeholders with diverging values and interests, interdependencies between public and private actors, and multiple issues that compete for attention (Anguelovski and Carmin 2011; Runhaar et al. 2012; Castán Broto and Bulkeley 2013). Since the innovative idea of a Water Plaza was first introduced as solution to the increasing risk of urban floods in 2005, the process reached an impasse in 2009 which needed to be dealt with in order to realise the first Water Plaza in Rotterdam.

The next section extends the above introduction into the mechanismic view and discusses the key conceptual components upon which the mechanismic view rests. Section 7.3 discusses process tracing as the methodology to operationalize the mechanismic view in search for plausible causal mechanisms. In section 7.4 we analyse the Water Plaza case and provide a mechanism based account of the three mechanisms that caused the process to reach an impasse. Section 7.5 reflects on the value of the mechanismic approach in studying impasses in the governance of adaptation. The paper ends with conclusions on the future potential of the mechanismic approach in studying impasses in the governance of adaptation.

7.2. The mechanismic view: explaining impasses in the governance of adaptation

Mechanisms are understood here as being the "...elementary building blocks of middle-range theories'' (Hedström and Swedberg 1998, p6). This type of inquiry assumes that there are often unobservable, generalizable mechanisms that are responsible for producing an observed outcome pattern in a social process. The aim of mechanism-based explanations is to explain why and how an outcome was produced. It should be noted that 'explaining' should not be interpreted in terms of covering laws or explanation through statistical models, but rather the use of mechanisms to open up the black box between cause and effect. Mechanisms obviously have causal tendencies, but rather than proving causality, the aim is to demonstrate plausible or

probable causality. This is because, unlike the causality in mechanistic views in natural sciences, proving causality in the social sciences' mechanismic equivalent is impossible due to the absence of general laws. A well know mechanism is that of the self-fulfilling prophecy formulated by sociologist Merton as: "a false definition of the situation invoking a new behaviour which makes the original false conception come 'true' " (Merton 1948). Over the years, this specific mechanism has been used as the mechanisms that explains the link between belief and behaviour in different fields of social science.

There are many definitions of what constitutes a social or causal mechanism (Steel 2004; Anderson et al. 2006; Weber 2007; Falleti and Lynch 2009; Hedström and Ylikoski 2010). Mechanisms have a structure that, once opened, describes how the mechanism works (Gerring 2008). In our conceptualisation of governance, the mechanisms reside at the level of the (inter)actions between actors, because the actions of actors bring about an impasse. Building upon the work of Machamer et al. (2000), we follow Hedström (2005, p25) in considering mechanisms to consist of "... entities (with their properties) and the activities that these entities engage in either by themselves or in concert with other entities. These activities bring about change, and the type of change brought about depends on the properties of the entities and the way in which they are linked to one another". The term 'entities' refers to the actors or organisations who each have their specific characteristics such as values, belief systems, and experiences. While we see mechanisms as the "cogs and wheels" (Elster 2007) of the governance process, it is not the intention to map out all mechanisms that were present preceding the impasse. The inferential challenge is to abstract the important from the less important processes and to provide a convincing causal account which identified mechanism(s) are responsible for the observed impasse by rendering alternative explanations obsolete, or at least less plausible. One way of doing this is by arguing if it is likely that the outcome would still be produced if the identified mechanism was not present, in other words, counterfactual reasoning.

Mechanisms are always a mechanism for something (Darden 2006 in Hedström and Ylikoski 2010, p50) and therefore can only be identified by the effect they produce. In this study, we are interested in the impasses observed in the governance of adaptation, the explanandum. In contemporary governance literature, impasses are understood as the stagnations in the interaction between two or more actors about what the problem is and how the problem can be addressed (Koppenjan and Klijn 2004). The causes for impasses are multiple and are understood in terms of structure, agency or their interplay (Cairney 2012). In terms of agency, explanations are usually found in the articulation and negotiation of actors with competing norms values and interests and their associated behaviour. In terms of structure, explanations are linked to the organizational complexity of the governance process and the constraining conditions of the institutional environment in which actors operate (Biesbroek et al. online first). It should be re-emphasised that while the causes of impasses are processes, the impasses themselves are outcome patterns rather than stable equilibriums during which nothing happens. Quite the contrary is true – a process has reached an impasse when the interactions may increase they hardly revolve around the content that bring

the process further. Repeated exchange of the same arguments or the inability of actors to reflect on their own actions are strong indications that a process has reached an impasse. Impasses linger on until a breakthrough has been achieved. Possible solutions to deal with an impasse – the so-called interventions - are responses of actors based on a hypothesized idea about the sources of the impasse and their ideas about the intentional changes needed to revitalize the process (Pawson 2006).

There is not a great deal of literature that explicitly addresses the mechanisms that cause governance processes to reach impasses, but there are theories in which these mechanisms are clearly visible. The mechanism of "dialogues of the deaf", for example, refers to a process in which actors from different (cultural) backgrounds talk past each other by advancing arguments that are true in their own view but cause the listeners to arrive at totally different conclusions and actions (van Eeten 1999, p185-186). Another example is the mechanism of the "Hurting Stalemate" in which two or more parties use maximum force but neither side is able to prevail in the conflict and neither side wants to back down or accept their loss either, thereby creating an enduring and costly dilemma (Rubin and Pruitt 1986, p152-155).

Searching for mechanisms requires moving between the observable world and the unobservable ontological level where these mechanisms can be found. There are different levels of abstraction upon which mechanisms can be defined. Mechanisms such as "belief formation" operate at micro individual level (Hedström and Ylikoski 2010), whereas mechanisms such as "hurting stalemate" operate on an interactional level. Within each mechanism lower levels of abstraction can be detailed. For example, the mechanism of "hurting stalemate" includes the micro level mechanism of "escalation" that explains the operation of the hurting stalemate mechanism (Collins 2012). This does not mean infinite regression because the requirement for detailing mechanisms at interaction level is to include the actors and their activities. Such 'stopping rule' is necessary because the analysis does not aim to an endless process of diving deeper into the mechanisms within the mechanisms.

Scholarship on climate change adaptation has frequently argued that barriers to adaptation in water management are not the same as those in nature conservation and that the barriers in South Africa are different from the barriers in the United Kingdom (Biesbroek et al. 2013). As true as such statements may be, this emphasis on contextuality has hampered the generalizability and transferability of research findings across other contexts. Mechanisms address this problem because a mechanism itself is detached from context; the internal functioning of the mechanism itself does not include situational conditions. A mechanism aims to describe a generalizable pattern behaviour of humans in their social context. However, as Falleti and Lynch (2009) argue, any explanation using mechanisms should take into account the situational conditions because this is of determinable influence in explaining how mechanisms are activated and how they produce the observed impasse. Certain types of contexts can be more conducive for activating a certain type of mechanism than others. Changes in context can activate new or diminish existing mechanism(s). Mechanismic scholars have emphasised that any inference using mechanisms should

include periodization by demarcating episodes during which the contextual conditions are relatively stable (Barzelay and Gallego 2006; Falleti and Lynch 2009; Came and Campbell 2010).

In summary, the mechanism-based explanations can be understood as explaining an impasse (I) through configuration of mechanisms (m1,...mx). It requires understanding of the collection of actors (a1,...ax), and their activities (b) under contextual conditions (C), as present during time period (t), so that the configuration of mechanisms (m1...mx) exhibits the plausible causal role (y) of the impasse (I).

7.3. Process tracing methodology for mechanism-based explanations

Process tracing methodology is particularly useful for studying mechanisms in a governance process (George and Bennett 2005). Debates in political sciences are still on-going if process tracing is a distinct research method or if it is merely a variety of historical narratives (Hall 2013). We consider it a distinct method because as Bennett and Checkel (2012, p10) argue, process tracing is "...the analysis of evidence on processes, sequences, and conjunctures of events within a case for the purposes of either developing or testing hypotheses about causal mechanisms that might causally explain the case". The focus on causal mechanisms distinguishes it from historical narratives that may also have other purposes (cf. Blatter and Blume 2008). Merely describing a chronology of events without detailing the necessary explanatory mechanism(s) is not sufficient. The analogy is thus often made to detective work, see (Collier 2011; Beach and Pedersen 2013), in search for pieces of the explanation of why processes evolved as it did, and how to explain the observed impasses.

Because of the limited theories or insights on generative mechanisms in the context of climate change adaptation, the process tracing method deployed in this paper has many resemblances to what Beach and Pedersen (2013) call theory-building process tracing and what George and Bennett (2005) call 'process induction'; generating new insights, described as a generalizable mechanism, on the basis of inductively observed events in case studies. However, because we have theoretical priors about the governance of adaptation and about the causes for impasses and our aim is not to identify new mechanisms per se, a perhaps better description of the adopted approach is what can be called pattern recognition: to connect the observed actions and activities of actors that cause the impasse with known pre-generalized theories and their operative mechanisms. The operationalization of the approach adopted here is thus a creative and intuitive process of cycling between the manifestations of impasses evidenced by empirical data, and the theoretical notions of the causes for impasses at the ontological level, thereby forcing a transparent link between the theory and empirical findings (Beach and Pedersen 2013).

7.3.1. Case selection: the Water Plaza in Rotterdam

The process tracing methodology requires careful case selection as the selected case should be exemplar for a larger class of cases. Hence we used a systematic approach to identify a case study in which impasses were observed in developing and implementing an adaptation measure.

To select the case study, the following criteria were used:

- The case has to be intentionally designed to manage current and projected impacts of climate change by taking concrete adaptation measures.
- Maturity of the case: a prolonged process of interaction to conduct processual analysis before, during, and after the impasses and interventions.
- Presence of impasses: the case should include at least one observable impasse.
- Accessibility: the ease of access to data and information and foreknowledge of the case to allow in-depth process tracing analysis.

Databases of two existing national research programmes on climate change adaptation in the Netherlands were used to select possible cases. Ten possible case studies were listed that met most of the selection criteria. After discussion among the authors of this article, each of the cases was qualitatively scored on a scale of 1-5. The Water Plaza project in Rotterdam scored highest on all five criteria and was therefore considered to be the most suitable case study. The case analysis focussed on the time period 2005-2012, starting from the birth of the concept Water Plaza and ending with the political approval of implementing the first Water Plaza in Rotterdam.

7.3.2. Data collection and analysis

Primary data was gathered through two rounds of semi-structured interviews with key stakeholders involved in the Water Plaza project (n=10), each lasting between 1-2.5 hours. Each interviewee was asked what had been their role and responsibility in the process, how they experienced the process, what (key) barriers they had encountered, how they had tried to deal with the barriers, and what interventions were attempted. All interviews were recorded. Other persons less actively involved were contacted via email or phone (n=6). Other data sources such as meeting minutes, policy statements, background documents, the city's websites and publicly available reports were used to extend and corroborate the findings. Many internal documents were made available by the interviewees. During and after the first round of interviews, a written chronological narrative of the process was drafted to reconstruct the chain of events and formulate hypotheses about the mechanisms that caused the impasses. Interviewee statements about barriers were used as hints where to look for the mechanisms for the impasses. Several follow-up emails and phone calls were made to clarify blank spots that remained after the interviews. In February 2012, a second round of interviews was conducted (n=3) where the preliminary findings of the study were presented and discussed with the actors involved in the process.

7.4. Mechanism-based explanation of implementing the Water Plaza

This section uses the mechanismic approach to explain the Rotterdam Water Plaza case. We will first describe the case context and highlight the different episodes of the case (7.4.1.). Then we present the barriers as they were formulated by the actors (7.4.2.). Based on these descriptions we will show how we identified three mechanisms that explain the impasse (7.4.3.). For each mechanism, we describe the processes triggering, comprising and following the mechanism.

7.4.1. Setting the scene: Rotterdam and the search for innovative adaptation strategies

Water is a principal identity builder for the city of Rotterdam. Historically, the port and canals shaped the city's development and even today its harbour and river provide economic prosperity, leisure, and attractive living environments. Located in Dutch delta region, the city of Rotterdam has a long history of taking flood risk measures (Ward et al. 2013). Faced with the additional threats of climate change, the International Advisory Board of Rotterdam advised the city of Rotterdam in 2007 to invest in developing water knowledge so as to become the most sustainable port in the world and one of the most innovative cities when it comes to water management, climate change and the environment (IAB 2007). Not only because of the need to 'climate proof' the city, but also as an opportunity to capitalize on the investments by exporting knowledge and expertise to other vulnerable cities around the globe.

This ambition is most visibly operationalized into the Rotterdam Climate Proof programme (RCP) which posits that the city should be 100% 'climate proof' by 2025. Rather than perceiving climate change only as a threat, the city reframed the problem of climate change into an opportunity to develop an attractive and economically strong city for its citizens and businesses (de Graaf and der Brugge 2010). The programme divides climate change adaptation in five themes: flood management, accessibility, adaptive building, urban water management, and urban climate (RCP 2010). In terms of urban water management, the city calculated that 600.000m3 additional storage capacity was needed before 2015 and 900.000m3 before 2050 to prevent disruptive flooding (City of Rotterdam 2007). In addition to proven technical measures, the city actively searched for innovations that captured the synergies between urban planning, economic development and water management (de Graaf and der Brugge 2010). Since the start of the programme, a number of adaptation initiatives have been developed and implemented in Rotterdam , including the case of this study, the Water Plazas.

Water Plazas are socio-technical solutions designed to increase the water retention capacity of highly urbanised parts of cities (F. Boer 2010). Water Plazas are essentially redesigns of open public spaces into multi-functional areas that most of the year will remain dry, but in times of heavy rainfall allow for temporary rainwater storage. In addition to increasing retention capacity, Water Plazas are intended to improve the quality of urban space and serve an educative purpose by making the city's water problem more visible among its citizens. The idea of a Water Plaza was coined by a consultant in 2005. It became city-wide policy two years after it was first proposed. To test the Water Plaza idea in practice, the city demanded a pilot project. The two years that followed can only be described as troublesome. Despite its promising start, the first pilot project failed. Having learned from these experiences, the city's second pilot project at a new location was more successful. A first Water Plaza is expected to be operational by the end of 2013. Table 7.1 provides a more detailed, chronological overview of the episodes of decision making in the Water Plaza case study.

Table 7.1. Episodes of interaction in the process towards realization of a Water Plaza.

Episode of interaction	**Summary of episode**
1: Birth of the Water Plaza concept *begin 2005-end 2007*	The City of Rotterdam prepared to host the 2nd international Architectural Biennale, themed 'The Flood". The city's urban design department organised an internal competition to develop an innovative proposal. The winning proposal suggested to change the framing of water as a threat to water as an opportunity, and to connect water management, urban design and economic development. To follow up on this proposal, three external consultants were hired to provide data and creative input. One of their ideas was to develop Water Plazas. The report, "Rotterdam Water city 2035" won the first prize during the Biennale in 2005 and the idea of a Water Plaza received positive media attention. The city asked the consultant responsible for this idea to conduct a typological study on possibilities for realizing the Water Plaza concept. The study provided input for the new Water Plan in which the concept of the Water Plaza was firmly integrated and considered an innovative icon in the transition of Rotterdam's urban water management.
2: Selecting a pilot project *end 2007-end 2008*	The city council decided to conduct a pilot project before starting city wide implementation of Water Plazas. The typological study included several possible pilot locations. Workshops with members of the city departments and water boards were conducted to select five possible pilot locations based on technical and hydrological criteria. Detailed designs were developed for one selected pilot location. To get the Water Plaza implemented, the city government had to contact the sub municipal council for their participation. After presenting the Water Plaza plan, the sub municipality agreed to collaborate, although some concerns about safety and health were raised.
3: Changing collaboration *end 2008-begin 2009*	One of the sub municipal daily board members, responsible for urban planning and a strong advocate of the Water Plaza pilot, suddenly left the board. The newly installed board member, responsible for urban planning, had a more critical stance towards the idea of the Water Plaza on the proposed location. The board member was critical about the proposed design, and was sceptical about the process initiated by the city and programme team to implement it. This was a central issue in the follow-up meetings between the project team and the sub municipality
4: Negotiating social opposition *begin 2009- end 2009*	This resistance resulted in a renegotiation with the city about the conditions under which the Water Plaza could be realised. The agreement was to hire an external consultant that would conduct a study of the neighbourhood support for the proposed Water Plaza by organizing three public meetings to discuss climate change and water, water in the city, and the Water Plaza in their neighbourhood. The outcome of this study was agreed to be decisive for continuation or abortion of the process. After the three meetings, it became apparent that there was not enough support.
5: Fail wisely *end 2009-begin 2010*	After the decision was made to terminate the pilot project, the project members were asked to reflect on the pilot project and identify which barriers they had encountered in the process. This provided valuable lessons about the pilot project and spawned possible follow-up actions. The findings were discussed within the team and the results and recommendations were summarized in an internal memo.

6: Selecting new pilot project *mid 2010- begin 2011*	The city decided that the Water Plaza would be implemented at another location. Based on the evaluation of the project team, new pilot selection criteria were defined. One of the key lessons was to change the pilot selection criteria; and to include not only technical but also social criteria. Also, the strategy of blue print planning and informing the public was changed towards co-creation of a Water Plaza design. From 14 eligible cases, one case was selected, first and fore mostly because there were already initiatives to redesign a public space and the neighbourhood was less complex than that of the previous pilot project.
7: Renewing the WS initiative *begin 2011-end 2011*	After a formal agreement between city and the new sub municipal council about the division of responsibility and the process architecture, three participatory design sessions were conducted to helped design the Water Plaza. By the end of 2011, the sub municipal approved the final design of the Water Plaza.

7.4.2. Barriers identified by the project team

By the beginning of 2010, shortly after the pilot project was terminated, the project team reflected on what were the causes of failure of the first pilot project, what could be learned from these insights, and how to proceed next. During this period of reflection, project participants were explicitly asked to formulate which barriers, in hindsight, they believed to have emerged in the process. The purpose of identifying the barriers – as was explicitly mentioned by the project coordinator – was not to assign blame, but to identify openings and distil lessons learned. The barriers identified by the project participants were collected, openly discussed within the project team, and written down in an internal report. This process of collective sense making was seen as a necessary step to identify the ways to intervene and revitalize the process.

Interpretations of what are the barriers changed over time, especially when new pieces of the puzzle became available. During the interviews in the spring of 2012, respondents were asked what barriers they had encountered in the process. All interviewees agreed that in the first two episodes there were no barriers, which had caused a vibrant and positive mood among the project team. In episodes 3 and 4, however, it became clear that not everything had worked according to plan. Project members began to feel that "...this [the Water Plaza] has become a problematic dossier" (interview #4).

7.4.3. From identified barriers to three underlying mechanisms

Barriers are constructions of actors' past experiences as a way to evaluate the process and identify the causes of the impasse. Using the barriers identified by the actors as a starting point, our analysis reveals three mechanisms that operated during this process which configuratively provide a plausible explanation of why the first pilot project reached an impasse: the conflict infection mechanism, the risk innovation mechanism, and the frame polarization mechanism. As table 7.2 demonstrates, the barriers identified by the actors provided valuable clues about the operative mechanism. Some barriers identified by the project team members we could not attribute to a mechanism. In addition to the three mechanisms, one intervention was proposed that changed the conditions of the operating mechanisms: negotiating a clearance point.

Table 7.2. Examples of the barriers mentioned by the project team that we used to identify the operating mechanisms. Data sources were our own interviews and two evaluation reports. Quotes are translations by the authors.

Barriers identified by actors	Operative mechanism
• "There were several existing political conflicts that lurked throughout the [pilot] process" (interviewee #5) • Collaboration between city and sub municipality started off on the wrong foot (EV)[1] • "We never had a good relationship with the 'Coolsingel' [city]" (interviewee #7) • Chronically unclear division of roles and tasks between city, project team and sub municipality (EV) • Part of the citizens are disappointed about past participatory projects and do not have confidence that it will be better this time (DV, p22)[2]	Conflict infection mechanism
• Location choice was too technical (EV) • "We might have designed the Water Plaza too isolated from its users" (interviewee #10) • Water Plaza is a new experiment and no example exists (EV) • There was no clear, consistent strategy for realising the Water Plaza in the sub municipality (EV) • There are many uncertainties around health and hygiene (DV) • There were different expectations about the Water Plaza between citizens, sub municipality and the city (EV)	Risk innovation mechanism
• "...framing it as a 'drowning plaza' is done for reasons I see as excuses" (Interview #9, city Alderman) • Young children can drown in 20cm of water (DV) • Too little sense of urgency in the neighbourhood (EV) versus the recognized need to take measures to adapt to climate change (DV)	Frame polarization mechanism
• Insufficient understanding of water legislation (EV) • There are few alternative locations to take over the existing function of the public space during construction of the Water Plaza (DV)	Have not resulted in mechanisms

[1] *EV refers to the evaluation by the project team evaluation*
[2] *DV refers to study on public support for the Water Plaza by Van Asseldonk and Treffers (2009)*

The conflict infection mechanism

Respondents reported that prior to the water plaza project several earlier conflicts had happened, and that the relationship between the municipality and sub-municipality was never that good. As one of few cities in the Netherlands, the city of Rotterdam is dependent on its sub municipal councils to get certain measures implemented. This dependency between city and the sub municipalities has always been tenacious in Rotterdam. There is general scepticism among the 14 sub municipal councils and city involvement is quickly experienced as being too hierarchical and top-down (Morlan 1982). Several interviewees referred spitefully to 'the Coolsingel' (street where Rotterdam City Hall is located) which is illustrative for the perceived

distance between the city and sub municipalities (Noordegraaf and Jeroen 2010). The relationship between the city and the sub municipality of the first Water Plaza project has been particularly problematic (interview #3, #4). Between 2002 and 2006, the sub municipality was immersed in political conflicts, management crises, and general distrust, forcing the city several times to take over daily management (BING 2013). This created a sceptical and distrusting attitude of the sub municipality towards any type of city involvement. In turn the city was sceptical about the sub municipality's capacity and commitment in city-led projects. At the start of the Water Plaza project, the city and sub municipality were collaborating in several other projects, most noticeably in a project of revitalizing the city's water ways (interviewee #3), which did not go according to plan. Political conflicts and tensions between the city and sub municipality plagued the processes. These struggles were only visible at the political level where the political actors from city and sub municipality met on a regular basis in different configurations. Not all actors involved in the Water Plaza project were aware of these struggles. In addition to this political history, local citizens had several bad experiences with previous city led projects; although most city initiated projects were participatory in design, citizens felt their voices and wishes were hardly taken into account in city level decision making. Interviewees (#2, #3, #4) made explicit reference to the water ways project and argued that the resulting tensions and distrust had caused the Water Plaza project to start off on the wrong foot.

These processes point at the conflict-infection mechanism. The mechanism refers to the secondary effects that follow from primary processes but which might seem to be unconnected in either space or time, except that some of the same actors happen to be involved. The mechanism captures the process of how the effects of conflicts in one policy arena are transposed to other arenas by the actors that move between these arenas. Actors interpret and give meaning to events that happened in previous projects and take these interpretations as priors to other decision making processes. It is thus not necessarily the primary effect of a conflict or failure that infects the other policy arena, but rather the consequences of the primary effect, such as interpersonal distrust, disbelief, scepticism, and/or weariness, that undermine decision making in other arenas (Klijn et al. 2010). The transmission of these secondary effects affects the decision making in other arenas even when actors do not consciously incur the conflict infection.

The risk-innovation mechanism

The second mechanism is inferred from a number of reported barriers such as the experimental character of the plan and the uncertainties caused by such an innovative project. The innovative idea of Water Plazas had to solve a part of the neighbourhood and city's future water problems; based on rough estimates the project team suggested that around 1000 m3 rainwater could be stored in the Water Plaza. The project team developed a report in which the choice for the pilot location, the technical and design principles and issues such as maintenance, hygiene, and safety were presented and ways to manage them proposed. During the first meetings with the sub municipality, questions were raised about the risks attached to the Water Plaza, for example, who would be responsible for the costs of cleaning, what were the risks of

children drowning, and what would happen if the project would lose its innovative status after a couple of years. The project team responded that there were no guarantees that the project would work, being an innovation, and they firmly stated that the risks identified in the report were kept to minimal. For each of the issues there were design solutions. To support their claims, several experts were invited to address some of these issues. For example, the local Community Health Services prepared a short briefing that there were no reasons to be worried about health issues, since there would be no stagnant water in the Water Plaza and therefore the perceived risks of water borne diseases were unfounded. The sub municipality was not convinced by the answers provided by the project team. In follow-up meetings, a representative from the local citizen organisation raised similar and new questions about the risks of this innovation: would the Water Plaza lead to, for example, lowering of housing prices? What if it increased rather than solved water problems? The project team continued to reassure the concerned citizens by stressing that risks were minimal and referred to expert advice. Insights and examples from previous cases were used to demonstrate the educative value water has for young children rather than dangers. It became clear to the sub municipality and citizens that the project team had no clear answers to the questions they posed. During the participatory workshops it became increasingly clear to the project team that despite their efforts of providing answers and posing solutions to the questions they could not resolve the resistance in the neighbourhood. The citizens had already made up their mind; they did not want to be used as guinea pigs (Van Asseldonk and Treffers 2009).

The processes observed indicate the presence of the risk-innovation mechanism. This mechanism captures the process where a government takes a technocratic stance in communicating about public innovations through risk minimizing strategies, while the citizens, as mutual bearers of the risks, want to negotiate about which levels of risks are acceptable. Governments assume that citizens are risk averse, so in order to get things done, they have to downplay risks as much as possible (Renn 2008; van Eeten et al. 2012). Because of a technocratic stance, governments revert to scientific knowledge and authoritative expertise to communicate about risks. In doing so, the governments avoid the moral debate about the risk of the innovation. Citizens would accept some level of risk if this is counterweighted by the potential benefits, and if there is a fair agreement what will be done if the innovation fails. If their worries are not taken seriously and there is no fair deal available, the citizens revolt against the only thing left to challenge – the technocratic stance of the city putting pressure on the whole project (Corfee-Morlot et al. 2011; van Asselt and Renn 2011; Brown and Osborne 2012).

The frame polarisation mechanism

The third mechanism was identified based on reported barriers concerning the escalation of the discussions about the Water Plaza. Although several possible risks of this innovation were identified, it was the framing of the Water Plaza as a "pond of concrete" and a "drowning plaza" that kept resurfacing during the debates. This framing was triggered by the project team's visualizations of what the Water Plaza would look like; images initially designed to convince the citizens of the uniqueness of

the Water Plaza, its innovative qualities, and its benefits for the neighbourhood. These pictured showed children using small rubber boats to paddle on the Water Plaza once it was filled with rainwater. The project team stressed that the pictures were merely images to illustrate the Water Plaza functioning rather than depicting reality; there was still plenty of room to discuss what the Water Plaza would look like. Nevertheless, the risk of drowning triggered deeply emotional responses from members of the sub municipal council and local citizens. They argued that the plaza was especially dangerous for immigrant children who are not accustomed to water, especially not in a location that is safe at one moment, but unsafe the next. Young children can easily drown in 20cm of water. The project team and city, however, framed the risk of drowning as a relatively small problem that could easily be resolved by implementing signals to warn for the presence of water, or by offering young children free swimming lessons. This perspective proved to be counterproductive and only reinforced the concerns of the citizens. As one interviewee remarked "...framing it [Water Plaza] as 'drowning plaza' is done for reasons I see as excuses" (Interview #9). Over time and through a series of meetings, the different points of view were expressed with an increasing intensity. For example, the citizens used local media to express their concern about having a Water Plaza in their neighbourhood. Efforts to reconcile these differences in participatory workshops hardly were productive as the damage had already been done. Contrastingly, members of the sub municipal council and several local actors became more and more sceptical about the idea of a Water Plaza in their neighbourhood. This resulted in an organised opposition against the implementation of the Water Plaza that even featured in the national news for youth.

Frame polarisation is an interactive process between actors in which the distance between opposing groups increases due to repeated reaffirmation of the same point (Dewulf and Bouwen 2012, p184). The basic principle is that what actors value and believe - their framing - differs between groups. The interaction between actors with opposing view can result in frame polarization when actors from both sides fail to accept the other's point of view. Characteristic of such a polarization is a positive feedback loop: actors do not take each other's point of view seriously, then they feel disrespected, and then both actors try to undermine the standpoint of the other through stereotyping and introducing even stronger arguments why their viewpoint is better. Frame polarization is a process that creates clear winners and losers; actors aim to win bystanders to their side through argumentative reasoning, while removing moderate voices. In the Water Plaza case the mechanism of frame polarization was triggered by the risk innovation mechanism: the risk innovation mechanism provided the content around which the frame polarization mechanism evolved.

Reaching and impasse and searching for an intervention: negotiating clearance point

After one of the meetings in the spring of 2009 it became clear to the project team that there were incommensurable tensions in the pilot project. There were opposing views about the risks of the Water Plaza, already lacking trust eroded even further during the process, and framing of the Water Plaza as a 'drowning square' polarized the discussions. The process escalated during one of the project meetings resulting in an

impasse: it was unclear how to proceed. Shortly thereafter it was decided that in order to revitalize the process, some de-escalation efforts were needed (Putnam et al. 2003). In a reconciliation meeting between representatives of the city and the sub municipality it was decided that neither the city nor the sub municipality should have the final say in whether the first Water Plaza would be implemented in this sub municipality. Being aware that there would be no simple solution, it was agreed that an external consultant would be hired to explore the neighbourhood support for implementing the pilot project. Especially the sub municipality was uneasy about the lack of public involvement in the decision making process so far. The carefully selected consultant proposed to organize three rounds of workshops to assess the public opinion followed by a decisive voting to measure public support for the Water Plaza. Rather than letting the impasse linger on, the intervention created a new clearance point (Pressman and Wildavsky 1984): if there would be sufficient public support, the process would continue. If not, it was agreed that the process would be terminated.

As was more or less expected, the Water Plaza was rejected by the local citizens that participated in these workshops. After the formal termination of this first pilot, the project team evaluated the process, as was described in section 7.4.2. Based on the evaluation the case selection criteria was adapted and a second pilot chosen. For example, the project team selected the second pilot location based on a context where no young immigrant children would make use of the Water Plaza. The new pilot location was also located in a sub municipality with less historical baggage compared to the first pilot project. Moreover, the project team selected a different participatory approach in designing the Water Plaza. The changes made by the municipality of Rotterdam seem to have worked; in 2011 the new pilot project was approved, see figure 7.1 for a schematic representation of the Water Plaze process.

7.5. Discussion: towards explaining impasses in the governance of adaptation

This paper started from the assumption that making intelligible which mechanisms were at work and capturing their underlying relationships helps to understand the causes of impasses. We have argued that rationalization of the process and detailing this complexity into barriers is not useful way, since both the cause and effect are part of the dynamic process and should be understood accordingly.

In this paper, the reflexive process of constructing barriers in practice was revealed. When the actors experienced the impasse they engaged in a process of meaning making; the cognitive and deeply personal process through which an actor constructs mental models to assign meaning about the perceived causes to the impasse (Park 2010). In these retrospective process, the continuous and complex processes actors have experienced are simplified, ordered and clarified by placing boundaries around their interpretations (Schon and Rein 1994; Weick 1995). Constructing barriers is a process of artificial selection which stops when there is a feeling of order and understanding upon which to act rather than arriving at a complete or accurate representation of the process and the causes of the impasse. Constructing barriers is an important part of sense making process because it provides an action perspective

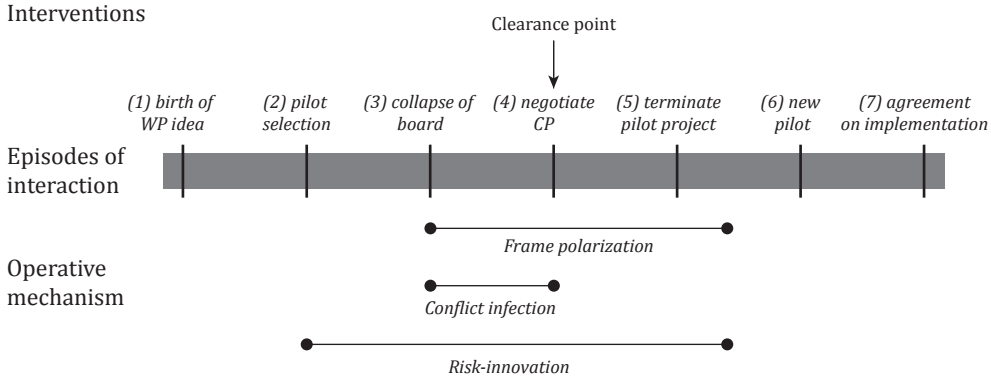

Figure 7.1. Schematic representation of the three mechanisms and the intervention that explain the impasse of the first pilot project.

that motivates rather than creating the imprisonment of complexity (March 1994; Weick 2010). In the process of sense making, actors use primed categories of barriers to designate the causes of the impasse in ways that are easily understood, such as 'unclear division of tasks and responsibility', 'no examples exist', which are self-explanatory constructs. Actors create a shared or collective understanding about the causes of impasses through interaction, and this in turn influences what individual actors act upon.

Interestingly, the barriers identified by the project team in their conscious evaluation are only to some extent connected to the interventions taken thereafter. This may be because actors don't think in terms of 'barriers' as fixed or stable entities, but rather in terms of cascading processes (Schon 1983). We presume that the interventions taken by actors are partially intuitive, based on broader past experiences, and unconsciously directed towards the operative mechanism that we revealed rather than the barriers constructed in their own evaluation. The added value of the mechanismic view is that the processes that actors intuitively already know are captured into theorized mechanisms to explain the impasse and how to intervene. This is supported by the fact that three key informants who were asked to reflect on the three mechanisms identified in this study agreed that all three played an important role in the project.

The mechanismic view was introduced to explain complex social processes by dissecting them into plausible mechanisms that provide a causal account of the dynamic complexity leading to the observed impasse. The mechanismic approach disentangles the important processes from many other ones, and in doing so, provides clarity about the processes that caused the impasse. Here, theory combined with deductive reasoning on the empirical evidence allows the analyst to identify and capture the key processes that are necessary to explain an impasse. In the context of the Water Plaza case, this could mean that if one of these three mechanisms had not been present, the pilot project would not have been terminated. The absence of the conflict infection mechanism, for example, would have meant a stronger trust of local actors in the city's ideas and ambitions, which would in turn have reduced the chance

that the frame polarization mechanism would escalate. By specifying the important from less important processes that explain how the impasse was brought about, mechanism-based explanations produce a precise and intelligible explanation upon which ways to address the impasse can be based. For example, for the risk-innovation mechanism the strategic intervention would be geared towards changing the risk governance strategy from technocratic towards negotiated risk governance (van Asselt and Renn 2011). We cannot know if this would have saved the first pilot but the way of solving problems through the mirroring reflex certainly did not work. In response to the perceived lack of certainty about the risks of the Water Plaza by local citizens it was suggested by the project team that more expert information would be needed. This merely triggered the frame polarization mechanism.

In the case study, including new clearance point could be seen as an intervention. The intervention did not remove or reduce the operating mechanisms but merely clarified the conditions for the process of termination (Bardach 1976). After the moment of reflection by the project team it became clear that substantial changes in the context were needed to prevent these mechanisms from resurfacing in the next episodes. By making the changes, the context became less conducive to trigger the three operative mechanisms. The negative experiences from the first pilot study, however, could still have emerged through the mechanism of conflict infection In this respect, the city context seems to be important. The dominant culture within Rotterdam is to encourage innovation, competition and entrepreneurship. Combined with the ambitions and political commitments on climate change adaptation, failure of the Water Plaza was therefore never considered as a real option. This context supported the start of the second pilot project.

7.6. Conclusions

Barriers, as we discussed them here, are simplified social constructs, created and calibrated by actors' experience. Such simplified constructs are of limited analytical value in the search for the plausible causes of an impasse. If we want to explain impasses, or policy success and failure for that matter, we need to study the process in detail in order to reveal the non-obvious hidden causal levers that have most likely produced an outcome pattern. In this paper, we introduced the mechanismic view as a new analytical perspective to study impasses in the governance of climate change adaptation. Although the argument for mechanismic thinking is not new itself it deserves greater emphasis in the research on governance of adaptation.

The mechanisms-based explanation has its limitations, since it is also a simplification of complex reality. There is a danger that the mechanisms become associated to the positivist logic of 'mechanistic' thinking – as opposed to our 'mechanismic' view – where mechanisms are seen as producing regularities in a predictive way. We want to emphasize that mechanisms are generalized patterns of underlying processes that strengthen our understanding of how and why governance of adaptation often proves difficult. It is not a claim of accuracy but rather a substantiated hypothesis which mechanisms explain an impasse, which should help to choose interventions.

A final observation to be made is that even though select a case that would truly qualify as an typical example of climate change adaptation, we did not need to propose a new kind of mechanism to explain the impasse that occurred. This does not necessarily mean that such specific mechanisms do not exist, but it does indicate that the challenges of climate change adaptation may not be as different as compared to other complex societal issues. The mechanismic view can help to develop further generalizable knowledge about adaptation; for example, by analysing which mechanisms are most likely to occur in the context of adaptation. Adopting the mechanismic view will allow adaptation scholars to theorize about what we believe remains an under-theorized topic and, in doings so, provide more meaningful and informed policy advice about how and where to intervene strategically. This approach requires that we rethink barriers to adaptation.

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CHAPTER 8

Discussion, reflections and conclusions

This dissertation started from the empirical observation that climate change adaptation is not a barrier free process. Actors from all administrative levels are encountering barriers and are actively seeking for ways to overcome them. Today's adaptation scholarship has hardly been able to progress beyond simple descriptions of this empirical reality: barriers are barriers because they prevent something from happening. This raised questions about what the analytical value and explanatory power of barriers as a concept is, what makes something a barrier to adaptation, and how to meaningfully explore and analyse barriers to adaptation. Thus far, barriers to adaptation have remained a conceptual black box that, in order to provide meaningful advice on how to deal with barriers in practice, requires opening up the concept and exploring it further. It is this issue to which this dissertation turned.

Three research questions were formulated in the introduction of this dissertation: (1) How can barriers in the governance of adaptation be defined and conceptualised? (2) What barriers to adaptation do actors encounter in policy practice? (3) How can these insights be used to develop a conceptual framework to analyse barriers in the governance of adaptation? A multi method design was adopted in which both inductive and deductive forms of theorizing were used and in which quantitative and qualitative methods were combined for data collection and analysis. The adopted research approach cycled between the conceptual understanding of barriers (RQ1) and the empirical manifestation of barriers (RQ2) in search for a meaningful way to conceptualise and analyse them (RQ3), see fig. 8.1. Two simultaneous developments took place: (a) widening the view on barriers by measuring and comparing barriers to adaptation across cases, chapters 2, 4 and 5. (b) deepening the existing debates on barriers by moving from empirical descriptive frameworks towards an analytical explanatory framework, chapters 6 and 7.

This final chapter draws together the research findings into a discussion and reflection about barriers in the governance of climate change adaptation. In sections 8.1 to 8.3, I

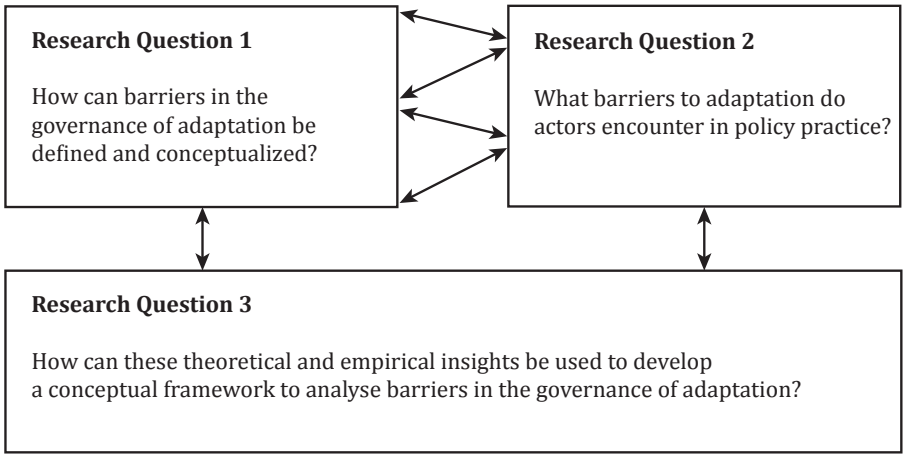

Figure 8.1. Interaction between Research Questions (RQ)

will address the three research questions and discuss the scientific implications of the findings. Section 8.4 reflects on the theoretical and methodological choices and the limitations of this study. Section 8.5 discusses a number of possible directions for further scientific research. In section 8.6, I will discuss the policy implications. This chapter ends with final conclusions about challenging barriers in the governance of climate change adaptation.

8.1. Defining and conceptualising barriers in the governance of adaptation

To address the question of how barriers to adaptation can be conceptualised and defined (RQ1), we first analysed how the existing literature on climate change adaptation has portrayed barriers. By including insights from public administration studies we unravelled and redefined the concept of barriers to adaptation.

The number of empirical case studies on barriers to climate change adaptation has increased significantly after the IPCC AR4 chapter 17 was published (Biesbroek et al. 2013). Despite the many different cases, one discourse gradually emerged that has dominated the scholarly debates about barriers to adaptation ever since. This discourse – which we have called the problem solving lens – is characterised by a set of prevalent assumptions about how to conceptualise barriers to adaptation and how to study them empirically. First, it is assumed that something can be considered a barrier when there is something lacking that, from a normative standpoint, should be there in order to ensure success. Barriers are essentially the reasons of deviation from the optimal condition and are often described as 'the lack of' something, such as financial resources or knowledge (Eisenack and Stecker 2011). Second, barriers are understood as anomalies, or unusual phenomena, that would not emerge in the idealised understanding of the governance of adaptation. There is, for example, a firm belief that most barriers can be prevented by designing proper governance arrangements, thereby suggesting that successful adaptation is largely dependent on creating the most optimal governance arrangements. Third, the effects that barriers produce in the governance of adaptation are hardly specified, but they are presumed

to be multiple; they may reduce efficiency, effectiveness, and legitimacy of adaptation. Fourth, it is assumed that detailing all encountered barriers is necessary to support policy practice in finding solutions how to remove the barriers. The analysis is primarily driven by the question of 'which' barriers to adaptation exist. At the same time, there is an isomorphic conceptualisation of the relationship between barriers and solutions: the solution to the lack of resources is more resources. Finally, it is assumed that if resources, skills, and/or creativity are available and sufficient efforts are made, all barriers are mutable.

> **Insight**: The dominant perspective in understanding and conceptualising barriers to adaptation can be typified as the problem solving lens. Barriers are conceptualised as erroneous entities emerging in an idealised governance process that need to be removed to ensure efficient, effective, and legitimate adaptation.

This dominant set of assumptions has a discernible influence as they steer the research on barriers in the governance of adaptation. As Phoenix et al. (2013) have stated, the analytical implications of these assumptions are often forgotten in current environmental research. In this dissertation, we have made this set of assumptions explicit by introducing three governance philosophies – optimist, realist and pessimist (Bovens and 't Hart 1996). These philosophies shape which theories are selected and how they are operationalized into specific analytical lenses. In addition to the dominant problem solving lens, there are other analytical lenses in the governance literature that can be adopted (Bovens and 't Hart 1995), each of which provides alternative, complementary, and at times conflicting interpretations and explanations about the barriers to adaptation. We demonstrated this principle in the Dutch ARK case study where we adopted four analytical lenses: (a) the problem solving lens emphasised that lack of knowledge for decision making, limited available resources, and lack of policy instruments posed considerable barriers; (b) the competing values and interest lens identified the ingrained differences in views, ideas and values of individuals about climate change and how to adapt as the main challenge; (c) the institutional interaction lens demonstrated that there were fundamentally different institutional contexts and networks that created unbridgeable institutional silos; (d) the structural constraints lens demonstrated that the socio-political system in the Netherlands is more likely to focus on water safety issues rather than invent a new policy field, especially when there are socio-economic uncertainties.

Choosing an analytical lens means selection of theories, methods and data that are important within that frame, which in turn means bias in defining and conceptualising barriers to adaptation. This is not problematic per se, as it can be quite insightful when different lenses are combined. However, because there are different assumptions about the barriers to adaptation and they have an influence on the analysis, it requires detailing the underlying assumptions in a transparent way. Which perspective one adopts in the study of barriers is not completely arbitrary or a matter of taste, but influenced by personal and institutional factors (Shepherd and Challenger 2013).

> **Insight:** How barriers are conceptualised and defined is influenced by the analytical lens adopted by the researcher(s). Different lenses may lead to alternative or competing explanations of the causes and effects and the role of barriers to adaptation therein.

Existing studies on barriers to adaptation often include a number of realist assumptions in their introductions, for example about the complexity of the governance of adaptation. However, in their empirical approach they revert to the optimists problem solving lens to investigate barriers in this process. We have discussed several reasons for this apparent mismatch in chapter 3. In this dissertation, we adopted the realist perspective on the governance of adaptation, a perspective which is dominant in contemporary governance studies outside of the adaptation domain, to redefine and conceptualise our understanding of barriers to adaptation. This realist perspective led to a number of important lessons about the conceptualisation of barriers to adaptation.

First, we understand barriers as simplified constructs created on the basis of negative value judgements of an actor and his or her interpretation of reality. The governance of adaptation is a complex and dynamic process that is characterised by strategic and institutional uncertainties, actor interdependencies, positive and negative feedbacks, political struggles, institutional lock-ins, parallel and loosely coupled decision making arenas, and contiguous change in network composition (Koppenjan and Klijn 2004; Torfing et al. 2012). Within this chaotic process, actors try to make sense of the situation by assimilating the complex set of processes and reconstructing the perceived cause-effect relationships. This process largely relies on intuitive cognitions. Labelling their experiences as barriers is a way to bring order in the complex situation. In the process of what Weick (1995) calls artificial selection, all but a few details are dropped and these become sharpened and more pronounced. What actors construct in hindsight as barriers to adaptation is thus their inherently subjective and deeply personal interpretation. The search for barriers stops when the actor believes that sufficient order is created to decide which action can be taken, see chapter 7.

The second lesson is that constructing barriers to adaptation is not merely an individual cognitive process. When a conscious evaluation process is organized, as we have seen in chapter 7, the involved actors can discuss and negotiate about the barriers they believed were important causes of the observed effect. It is through collective sense making that the meanings are discussed, sharpened and redefined (Weick 1995). To convey their interpretations about the causes and effects, actors seek for simple descriptions that match the frame of reference of others, and which are, at least to a large extent, self-explanatory. For example, to explain the reason for the dismantling of the ARK program, framings such as a lack of resources and unclear political leadership are simple and easy ways to communicate about what went wrong. These barriers are easier to understand than detailing the numerous processes that contributed to the dismantling of the program. Such details may also convey differences in opinion about what happened and strategic moves that are normatively disapproved. The advantage of a list of barriers then also is that it seems to suggest an

objective assessment of the situation. When comparing a large sample of case studies on barriers to adaptation, it becomes clear that there is a repertoire of barriers to adaptation that is often used by actors in discussing the challenges of adaptation, see chapter 3. As we shall see in section 8.2, this repertoire not only comprises barriers specific for climate change adaptation but also many barriers that can be found in any complex governance process.

> **Insight**: Barriers are essentially subjective constructs made to simplify and evaluate a complex chain of past events. Barriers can be negotiated in a group of actors and so become statements in which the value judgements of individual actors are objectified.

A third insight from this dissertation is that the metaphor of barriers itself plays an important role in the process of evaluation. This is because of the inherently negative connotation and the seemingly self-explanatory properties of the concept. When actors are explicitly asked to reflect on the 'barriers' they have experienced in adaptation to climate change, there is a shared understanding about what is asked of them: the metaphor of barriers automatically directs actors to give meaning to and evaluate their experiences by subconsciously placing boundaries around specific aspects of these experiences. By asking actors to identify the barriers to adaptation, the concept of barriers focusses the actors' thinking about the causes and effects, but indirectly also about the solutions to deal with them. This in turn can cause the story to become fixated, including in the framing of the barriers, making it possible to proceed to the solutions that they have constructed without having to understand every detail of the past process (Termeer and Kessener 2007). An example in which the power of the metaphor of barriers is clearly visible is when the project team members in the Water Plaza case are asked to identify the barriers they encountered in the project. It was an opportunity for them to reflect, regroup and develop a follow up strategy. It is the same self-explanatory power that researchers use when they identify the barriers to climate change adaptation in policy practice, see chapter 3.

> **Insight:** The concept of 'barriers' enables actors to place boundaries around certain aspects of their personal experiences of the processes that in their view had something to do with an impasse or failure. Because of the self-explanatory power, the metaphor of barriers is a useful instrument for policy makers and researchers to collect these experiences.

We have thus far produced two answers to research question 1: the conclusion that which barriers are identified in the governance of adaptation is influenced by the researchers assumptions and choices, and that barriers can be conceptualised as simplified constructions of the actors' experiences. What remains is to discuss the value of the concept of 'barriers' when studying barriers to adaptation empirically. In this dissertation, two views turn out to be possible.

The first view is what can be called the descriptive-empiricist view: what actors perceive as barriers is considered to represent the real barriers because, as the

Thomas theorem suggests, what actors construct as barriers has direct consequences for the actors' response. The researcher assumes the inferences made by actors to be true, because the barriers are verified against the actors' own experiences – and there is no reason to question one's experience. Using barriers in such a way, an empirically-based description of the barriers that actors perceive in policy practice can be created. Additionally, the amorphous characteristics and outspokenly negative connotation make the metaphor of barriers to be of particular value in measuring the perceived importance and severity of barriers across a large sample of actors, as we did in chapters 4 and 5. This view remains popular in studying barriers in different types of policy processes, for example health (Checkland et al. 2007; O'Toole et al. 2011; Barnidge et al. 2013), transport (Steenberghen and López 2008), energy (Agterbosch et al. 2007), or business innovations (Chesbrough 2010).

Alternatively, the realist-analytical view considers what actors say to be the barriers to adaptation as having a limited value in providing explanations about cause and effect. The most important reason is that by constructing barriers, actors inadvertently reduce the dynamism and complexity into simplified constructs; but precisely complexity and dynamism are considered to be vital in explaining what happened. After all, especially in complex processes most actors only experience a part of the whole process. They construct the barriers based on personal values and beliefs while over time and with new information the barrier descriptions might change. Constructing barriers by actors is often an intuitive judgement which leads to deficient view of reality. In other words, what actors say are the barriers to adaptation is not sufficient for the analyst to make inferences about causes and effects. However, the barriers actors report may be vital signs for the researcher and provide clues about the underlying processes that are necessary to explain the cause-effect relationships. We adopted and developed this view when analysing the Water Plaza case in chapter 7.

Coming to full circle, this dissertation demonstrated that there are several ways to define and conceptualise barriers to adaptation. The dominant understanding of barriers, rooted in the optimist perspective, assumes that barriers are unusual phenomena that need to be removed to ensure successful adaptation. In this dissertation we propose an alternative conceptualisation that is embedded in the realist perspective; from that perspective, decision making is a complex process in which barriers play an important role. Barriers are defined as the simplified constructs created by actors to make sense of the complex reality with which they are confronted. These constructs capture the value judgement of actors about their past experiences. Which role the concept of barriers fulfils depends on the goal and ambition of the research: an empirical-descriptive view (what actors construct as barriers are the barriers because it influences their actions) or a realist-analytical view (what actors construct as barriers is insufficient to explain phenomena but they can be used to identify the underlying mechanisms).

8.2. Barriers to adaptation in policy practice

To address the question of what actors encounter as barriers to adaptation in policy practice (RQ2) we used the empirical-descriptive conceptualisation of barriers. More specifically, we were interested to understand if actors consider certain barriers to be more important than others, whether the important barriers could be attributed to climate change, and whether there are differences across governance contexts.

An important observation is that a remarkable agreement exists about what the most important barriers to adaptation are. Both Dutch and UK experts on climate change adaptation consider discordance between the long term impacts of climate change and the short-termism in politics and decision making unquestionably as the most important barrier. Scale, age, gender, position, sector, or country – it hardly seems to be of influence. This is an important finding because temporal discordance is, as discussed in the introductory chapter, an important part of what can be called the additionality dimension of climate change (Khan and Roberts 2013; Dupuis and Biesbroek In press). Temporal discordance is the characteristic that makes the governance of adaptation particularly challenging and uncertain; not only because long term impacts of climate change are difficult to comprehend epistemologically, but also because it is hard to choose short term solutions, especially when these solutions require some level of agreement about investments, see for example Frame (2008) and Underdal (2010). This difficulty is enhanced by our existing institutional system that is designed for medium or short term decision making. Institutions in general and policies in particular are created with the purpose of creating stability in a continuous changing societal environment. But they can only do so for a relatively short period. Recently, adaptation research has started to revolve around these questions by searching for ways to manage the temporal discordance in decision making on adaptation, for example by developing multiple decision pathways (Downing 2012; Haasnoot et al. 2013) or sequential policies (Parson and Karwat 2011).

> **Insight:** The temporal discordance between the long term impacts of climate change and the short-termism in politics and decision making is perceived to be the most important barrier to adaptation.

Obviously, many barriers are not directly attributable to the characteristics of climate change adaptation. Survey respondents in the Netherlands and UK considered the lack of financial resources, opposing values and views, and the presence or absence of institutional instruments among the most important barriers to climate change adaptation, see chapters 4 and 5. These barriers are the 'usual suspects' as they are likely to surface in any decision making processes. Adaptation serves as the context in which these barriers emerge and influences the relative importance of the barriers that are not directly connected to climate change adaptation, see Moser and Ekstrom (2010) for similar arguments. The influence of adaptation as decision making context could be observed in the ARK case study presented in chapter 6: the long term changes upon which adaptation decisions needed to be made created the conditions which made securing resources, making commitments or setting priorities by the different competing ministries even more challenging than normally. The fact that it

concerned adaptation accentuated, for example, the limited legislative powers and political leadership of the responsible coordinating ministry (EUROSAI 2012). Contrastingly, the Water Plaza case in chapter 7 demonstrated the opposite effect: framing urban water problems as a future climate change problem created a context that motivated actors to invest in short term decisions needed to adapt to climate change.

> **Insight:** Many important barriers to adaptation can be found in any complex decision making process. Adaptation sets the context for decision making and by doing so, may accentuate certain barriers or downplay others.

Chapter 5 showed that of the many barriers identified in the literature, we have arrived at a set of barriers that actors consider to be the most important barriers, see table 8.1 for the 10 most important barriers to adaptation in the Netherlands and the United Kingdom. This list applies to a larger territory than the Netherlands and the United Kingdom. As chapter 2 demonstrated, a total of nine national governments considered the lack of coordination, the absence of indicators, scientific uncertainties, and the lack of (financial) resources to be the most important challenges implement their National Adaptation Strategy.

Contextual conditions are considered to be an important factor in determining what actors encounter as barriers to adaptation (Shepherd et al. 2006). Especially the institutional context is of importance as it constrains human agency and sets the scope and boundaries within which actors construct and respond to the barriers to adaptation. The institutional context is created both by formal institutions, such as legislation, policy goals, and instruments to respond to barriers and by informal institutions such as the logics of how adaptation should take place, how barriers are understood, and what actions are considered appropriate to deal with barriers. Member States of the EU have taken different approaches to construct their institutional setting for adaptation, see chapter 2. Some countries, like the UK, have built new institutions, developed new policy instruments, and created new networks to enable adaptation to take place. Other countries, such as the Netherlands, have taken a more mainstreaming and focussed approach, using predominantly existing institutions, regimes and instruments in the governance of adaptation, see chapter 5. Although the differences in institutional setting have an effect on specific barriers, survey respondents from both countries consider these context-specific barriers not as the most important barriers to adaptation.

> **Insight:** There is a high agreement on the most important barriers to climate change adaptation across actors from different countries. Differences in the institutional setting between countries hardly seem to influence what actors consider to be the most important barriers to adaptation.

As was reported in chapter 5, respondents from the UK systematically scored the proposed barriers as more severe compared to their Dutch counterparts. Although we cannot conclusively say what caused this effect, an explanation may be the strategy of

Table 8.1. Top 10 of the highest scored barriers to adaptation in the Netherlands and the United Kingdom

United Kingdom		**Netherlands**	
Rank	*Barriers to adaptation*	*Rank*	*Barriers to adaptation*
1	Short term thinking of politicians and long term impacts of climate change	1	Short term thinking of politicians and long term impacts of climate change
2	Little finance reserved/available for implementation	2	Conflicting interests between involved actors
3	More urgent policy issues need short term attention	3	Unclear social costs and benefits of adaptation measures
4	Existing policy does not include long term impacts of climate change	4	Little finance reserved/available for implementation
5	Unclear social costs and benefits of adaptation measures	5	Lack of awareness of the need to adapt
6	Lack of awareness of the need to adapt	6	More urgent policy issues need short term attention
7	Policy makers have other interests than climate adaptation	7	No safeguarding of adaptation for future policy making
8	Conflicting interests between involved actors	8	Dependence on other actors in decision making
9	It is difficult to determine the effectiveness of climate adaptation strategies	9	Existing policy does not include long term impacts of climate change
10	Few policy makers who want to invest time and money	10	Passive attitude of policy makers

making barriers explicit beforehand. This makes actors more aware of the presence of barriers, and allows them to prepare for barriers and to find ways to overcome them. The strategy of making barriers explicit is typical for countries with high accountability pressures and intensive public scrutiny, such as the UK, Canada and Australia, where several institutional mechanisms are installed to identify and raise awareness about the barriers to adaptation. Such institutional mechanisms are not in place in countries like the Netherlands. As one would expect from the existing literature, our findings suggest that that actors at the local level are confronted by the harshness of implementation and that it is here where the barriers become most clearly visible (Storbjörk 2007; Tang et al. 2010; Mazmanian et al. 2013; Pasquini et al. 2013; Persson 2013). Considerable overlap exists in what local level actors considered as barriers between the UK and the Netherlands. The results suggest that scale differences are relevant for the perceived severity of barriers, see also Mukheibir et al. (2013).

To conclude, of all the barriers identified from the adaptation literature, actors consider the temporal discordance as the most important barrier to adaptation. Many

other barriers that actors mention can be encountered in any complex process and are not typical for adaptation. Adaptation as context influences how actors evaluate the importance of the more general barriers. The strong agreement between respondents from both the UK and the Netherlands suggests that we may have arrived at a set of most important barriers to adaptation that actors encounter in policy practice, at least for the western-European context.

8.3. Reconceptualising "barriers": Towards mechanism-based explanations of impasses

The third question in this dissertation pertained to the development of a framework to provide a meaningful way of analysing barriers in the governance of adaptation (RQ3). Since the start of this dissertation, a number of frameworks has been developed with similar ambitions; noteworthy examples include the diagnostic framework of Moser and Ekstrom (2010), the adaptation as actions framework coined by Eisenack and Stecker (2011), the interdisciplinary framework of Kolikow et al. (2012), and the adjusted Theory of Truth framework originally developed by Ken Wilbur and redesigned by Ballard et al. (2013). Despite the fact that these frameworks recognise the complexities of the governance of adaptation, their aim is to systematically collect and catalogue barriers to adaptation. An important limitation of these existing frameworks is that they describe the barriers and do not specify what these are barriers for. Recognizing the limitations of these descriptive frameworks, see chapter 3, we aim to develop a framework that moves towards explaining why the governance of adaptation is challenging. We therefore adopted the realist-analytical view as described in section 8.1.

The framework developed in this dissertation aims to explain the impasses in the governance of adaptation, i.e. the stagnated interaction between actors about the problems and solutions, see chapter 7. To explain why, under certain conditions, the governance process reaches an impasse, requires identifying the plausible but non-obvious causes that reside somewhere in the dynamically complex process of uncertainties, dependencies, lock-ins, feedback loops, and loose couplings. We have argued that the reason the governance of adaptation reaches an impasse is not because, at a given point in time, one or several barriers emerge. Instead an impasse is the consequence of a chain of happenstances, choices and decisions that, when looking back, seem to have led to the undesired outcome. The causes of impasses should thus not be reduced to stable entities, as the concept of barriers implicitly suggests; such reification merely encourages the attribution of independent functionality which in turn reinforces static and isolated explanations. However, although reported barriers might not be sufficient to explain impasses, they provide clues where to search for the mechanisms. To understand and explain the causes of impasses we need not eliminate complexity and fixate dynamism, but we have to accept that the causes are ingrained in and a consequence of these dynamically complex processes.

> **Insight:** To explain the causes for impasses requires embracing the dynamism and complexity that emerges from and is an inevitable part of the erratic processes of decision making.

As noted in the introductory chapter of this dissertation, studies on policy and decision making have trouble in capturing this complexity analytically. This is largely because the conditions, causes, and effects are understood as being in motion constantly, their linkages are non-obvious and their interaction effect is erratic. This dissertation contributes to these scholarly debates by adopting and extending the so-called mechanismic view in studying the governance of adaptation. Mechanismic thinking rests on the assumption that there are generalizable social processes – mechanisms- that can causally explain the impasses. Four conceptual components of the mechanismic framework are important to consider.

The first component, the impasse, is understood as a stagnated interaction between actors about the problems and solutions, as was explained above.

The second component is the mechanism. Mechanisms are theoretical descriptions of specific social processes that can emerge under certain circumstances. Mechanisms, as we have defined them in chapter 7, focus on the processes at interaction level. By conceptually opening up the mechanism we can see its internal workings: actors with their own personal values, beliefs and ideas, interact with other actors, and as result the (inter)action creates directional change. The effect of this directional change is reaching an impasse. As there are usually many processes operating simultaneously it requires identifying the mechanism or mechanisms that produce the impasse and providing a convincing account of the causal role this mechanism had in reaching an impasse. In other words, to arrive at the key operational mechanisms that produced the impasse requires selecting the important from the less important processes. For example, the impasse that emerged in the Water Plaza case could be explained by arguing how three mechanisms operated configuratively – the risk innovation mechanism, frame polarization and conflict infection.

The third component is the contextual setting. Although each case is unique, mechanism-based explanations aims to distil the operative mechanism from the contextual conditions. It is important to consider the contextual conditions in the explanation because they influence which mechanisms are triggered. As was concluded in section 8.2, adaptation itself can be considered as the decision making context. Highly intentional climate change adaptation creates a context with an innovative dimension (Jordan and Huitema in prep.; Dupuis and Biesbroek In press); dealing with the additionality dimension of climate change requires new ideas, policies and measures or at least changes to the existing settings. Although the Water Plaza case is only one study, we expect that these innovative conditions will be present in other case studies on climate change adaptation as well. This is the conducive condition for the risk-innovation mechanism to be triggered.

The fourth component is the intervention. In this dissertation we have mentioned the mirroring reflex as a way to provide solutions for overcoming barriers. This reflex is the result of the isomorphic way scholars tend to portray the relationship between barrier and intervention; if people are afraid that young children may drown, then the solution of providing free swimming lessons seems evident. Intervening based on the

perception and experience of actors is of course possible but when the solution gleans over an important underlying mechanism, it can cause more harm than good, as the Water Plaza case illustrates. Such a short-sighted way of intervening can unconsciously trigger escalating mechanisms, such as the frame polarization mechanism. Our research suggests that interventions should be based on a thorough diagnosis and identification of the plausible causal mechanism(s), allowing to make a strategic and focussed changes to get things moving again.

> **Insight:** Mechanismic thinking is a useful way of capturing the dynamic complexity in order to explain impasses. Mechanism based explanations identify the operative mechanisms and, in doing so, provide an opening for strategic interventions.

To conclude, by recognizing the limits of the existing frameworks and combining insights from the adaptation literature with contemporary decision making theories, we propose a scientifically designed and empirically validated conceptual framework - consisting of mechanisms, conditions, impasses, and interventions - to analyse and explain the impasses in the governance of adaptation. The framework starts from the impasse in the process and searches for the mechanisms that explain the relation between initial conditions and the impasse by identifying the mechanism(s). Identifying a plausible causal role of the mechanisms offers new insights about where to intervene strategically in dynamically complex processes. This mechanismic framework is the main scientific contribution of this dissertation as it allows researchers to move from the empirical descriptive ways of collecting barriers towards more explanatory ambitions.

8.4. Reflecting backward: theoretical pluralism, multimethod research design, research validity, and limitations of the study

The multimethod research approach adopted in this dissertation was designed to better understand, conceptually and empirically, barriers to adaptation. This section reflects on the theoretical and methodological choices, the overall research validity, and limitations of the study.

Theoretical pluralism and multimethod research design

Using multiple theories to study barriers to adaptation has been a deliberate choice that followed from the premise that a single way of knowing is insufficient to comprehend the complexities associated to the real world - real world problems require epistemological pluralism (Miller et al. 2008; Petts et al. 2008; Esbjörn-Hargens 2010). The empirical chapters adopted a wide range of theories from which to study barriers to adaptation, including literature on climate change adaptation, public policy, organization studies, analytical sociology, comparative policy analysis, policy evaluation and implementation theories, neo-institutional theory, decision making theory, and sense making theory. Following the pragmatist dogma of using 'what works', different streams of literature were selected that, despite using conceptualisations different from 'barriers', tried to unravel the same phenomenon.

The research cycled between different theories and new empirical evidence to advance our understanding of the barriers to adaptation. The qualitatively-led multimethod research adopted in this dissertation resulted mixing of qualitative and quantitative methods in which each step forward built upon the insights from the previous step, see fig. 1.1 of the introductory chapter. The multimethod research approach inevitably means sacrificing some depth and specificity; understanding barriers from multiple perspectives and sources was prevailed over truth finding. Purist might consider this approach to be a point of weakness, as there is a risk of combining incompatible ontological and epistemological assumptions while making inferences about barriers to adaptation. In this dissertation, I assumed that barriers are self-explanatory constructs that can be used quantitatively to measure differences in what actors across sampled groups consider as important barriers. At the same time I challenged the concept of barriers as being insufficient to make inferences about cause and effect relationships. My realist perspective is that if we want to understand the barriers in policy practice we need to oscillate between different standpoints, even when this builds on different or conflicting assumptions.

Research and data validity

Research validity was increased by selecting multiple methods to analyse the barriers to adaptation, see the introductory chapter. Two methods deserve explicit mentioning because of their systematic and transparent propensities that increase legitimacy of research findings. Additionally, both methods are hardly used in the context of climate change adaptation and thus form an important part of the methodological contribution of this dissertation.

In chapter 3, we adopted the systematic literature review method to provide a transparent and unbiased approach in synthesising and converging the literature on barriers to adaptation. Data collection protocols, synthesis tables and lists of keywords were designed and were made available to the reader, see Supplementary Material A. This dissertation contributed to the recent introduction of systematic review methodology in global environmental change research by applying mixed methods type of systematic reviews (Ford et al. 2011; Vink et al. Forth.). Systematic reviews have only recently emerged in the social sciences (Gough et al. 2012) but could fulfil an important function in systematically collecting and extending insights in the political sciences and public administration where traditional review methods to assess the state of the field still prevail.

Chapter 7 uses process tracing methodology as a systematic research approach (Beach and Pedersen 2013) that aims to go beyond the idiosyncratic case study approach that has dominated the study of adaptation (Ford et al. 2010b). Process tracing is a systematic method for identifying and analysing cause and effect relationships and guides the researcher in making inferences about the underlying mechanisms. The method aims to rule out potentially intervening variables until the mechanisms remain that are necessary for explaining the observed outcome (George and Bennett 2005).

Several methodological steps were part of the research design to increase validity of data collection and data analysis. The cases in chapters 6 and 7 were selected based on predefined criteria and selected from a larger sample of cases. The systematic review method discussed above, provides a transparent and extensive set of criteria for data collection and analysis. The survey used in chapters 4 and 5 was pretested among the target group for question comprehension and flow of the survey. Small changes were made based on their the feedback. The original survey in Dutch was translated by the authors and cross checked by a native speaker to preserve semantic, conceptual and normative equivalence across both surveys. Data reliability was increased by including open ended questions that allowed survey respondents to add other barriers that were not prelisted. Researcher interpretation bias was reduced by inviting Dutch survey participants to participate in a feedback workshop session were the survey results were presented and discussed with the participants. In chapter 7, we asked three key actors involved the Water Plaza case to reflect on the mechanismic explanations of why the Water Plaza case failed.

Limitations

Despite the methodological considerations, there are some limitations to this study. First, the empirical focus of this study is on barriers to adaptation in high income, developed countries. These countries are selected because they have already started to adapt to climate change and thereby provided the empirical data needed to conduct the analysis. However, it is recognized that low income, less developed countries will be affected harder by the impacts of climate change (IPCC 2007c). Exploring barriers to adaptation for these countries is crucial in reducing vulnerability and increasing adaptive capacity (Adger et al. 2007). At aggregate levels, barriers might be the same between developed and developing countries (Saito 2013; Monirul Islam et al. 2014), but as chapter 3 demonstrates, the relative importance of barriers is likely to be different as barriers to adaptation in developing countries pertain primarily to the creation of adaptive capacity and less to the mobilization of this capacity. The second limitation is caused by the explorative survey design used in chapters 4 and 5. The aim of the survey was to identify the key barriers to adaptation that actors encountered in policy practice and to test if there were differences between actor groups from the Netherlands and the United Kingdom. A more comprehensive survey design might have allowed for a more advanced statistical analysis in search for other possible explanatory variables. Our findings suggest that such an extended analysis is warranted. Third, the mechanismic framework has been tested in only one case. It would require further refinement and testing in order to make stronger claims about the scientific and practical value of the framework compared to the existing approaches for researching the barriers to adaptation.

8.5. Reflecting forward: recommendations and directions for further research

Explorative research on societal issues such as climate change adaptation raises as many question as it seeks to answer, sometimes even more. This research is no different in this respect. Based on the findings, several topics merit further investigation.

The most obvious recommendation is to extend the work on the conceptual framework. Further empirical testing of the mechanismic approach could refine the argumentative and operational logic, could allow a better understanding of the value of the framework in providing scientific insights and could provide new openings for interventions in policy practice. Such an endeavour would require application of the framework in a range of different cases. This could uncover which mechanisms are most likely to be triggered by the conducive conditions of substantive and intentional adaptation, see Dupuis and Biesbroek (in press). A systematic literature review methodology could be a useful first step to provide an overview of the array of social mechanisms that already has been described in the different strands of the social sciences, including the literature on international relations (Tilly 2001), analytical sociology (Hedström 2005), philosophy of sciences (Bunge 2004; Weber 2007), historical and sociological institutionalism (Pierson 2000; Scott 2008a), organizational studies (Anderson et al. 2006), and policy diffusion studies (Shipan and Volden 2008). Further investigation by using methods such as Qualitative Comparative Analysis (QCA) might be helpful in addressing the question which of these mechanisms are necessary and sufficient in explaining the observed impasses in a medium size sample of qualitative case studies (Rihoux et al. 2011; Rihoux et al. 2013).

On several occasions in this dissertation we have touched upon the relation between impasses and interventions. Exploring this link empirically and conceptually would be an important step in extending the mechanismic thinking into the realm of policy practice. Connecting to the organization, management, and decision making literature could provide useful openings (Argyris 1993, 2012). Participatory or action research can be a fruitful way to test interventions in practice, or to collect intervention strategies from the experiences of practitioners (Brydon-Miller et al. 2003). Identifying intervention strategies that do not reduce or abolish complexity but rather embrace it intelligently would provide practitioners with alternative ways to intervene in the governance of adaptation.

In addition to extending the mechanismic framework, there are number of questions about measuring and comparing barriers across contexts that warrant further research. As noted in chapter 5, it would be useful to extend the comparative analysis to non-developing countries to analyse if there are differences in the key barriers to adaptation and how these can be explained. A new survey instrument similar to the BARRIER scale used in the health sciences (Kajermo et al. 2010) could be developed based on our findings in chapters 3-5, with which a comparative analysis could be conducted systematically. In addition, since the publication of chapter 2 on national adaptation policies, the number of descriptive comparative country studies has increased substantially (e.g. Westerhoff et al. 2011; Greiving and Fleischhauer 2012; Termeer et al. 2012; Lorenz et al. 2013). Although these studies are necessary first steps, there is sufficient empirical material available to design research with more explanatory ambitions, see Dupuis and Biesbroek (In press) where we made similar claims. Large-n quantitative research designs would allow to test a large sample of variables to identify the important variables for the adoption and implementation of (national) adaptation policies. Indicators such as GDP, corruption rates, religion,

population size, vulnerability-adaptive capacity indexes, could be starting points for such an analysis, see for example Lesnikowski et al. (2013a) and Massey et al. (submitted) for a preliminary assessment. Our findings in chapter 5 suggest that it will be worthwhile to pay attention to the connection between the state tradition of governance, the policy regimes on adaptation, and the barriers to adaptation.

In addition to quantitative, large-n comparative studies, it could be valuable to investigate the meaning attributed to concept of "barriers" by actors in practice and what effect these meanings have on their actions. More specific questions can include: Do actors that are made aware of the possible barriers beforehand take different actions than actors who are not informed? What is the relation between the perceived severity of barriers and the hardship of adaptation in practice? Interpretative approaches can be useful to analyse how barriers are constructed and used in the process of interactive framing about climate change adaptation, and how barriers are strategically framed in the politics of blaming and shaming (Hood 2010).

At a more general level, we observed that most studies on barriers to adaptation report on case studies that, despite the presence of barriers, result in successful adoption or implementation of adaptation measures and policies. This is somewhat surprising given that policy implementation theories tells us that failure is more likely than success, especially when decision making revolves around complex issues (Pressman and Wildavsky 1984). Compared to success stories, failed cases are harder to find (O'Toole 2000), yet they provide interesting lessons of recurrent causes of failure. Combined with the successful cases, this would create a better understanding of the key operative mechanisms in the governance of adaptation. In this dissertation we have started to address this omission in the literature in chapter 6 by analysing the dismantling of the ARK program, but further studies on failed attempts to implement adaptation are long overdue.

8.6. Reflecting on policy relevance: implications and recommendations

Although it is widely recognized that adaptation is a complex process, we have trouble in embracing complexity when we try to provide practical advice (Gerrits 2008). There is a tendency to give recommendations by suggesting an idealised set of conditions, instruments and policies that prevent barriers from (re)emerging. Such recommendations fall in the tradition of what we have called the problem solving lens in chapter 6. In reviewing over thirty policy guidelines, Clar et al. (2013) observe that existing guidelines are hardly connected to the barriers to adaptation identified in practice, that the recommendations often unclear, and that the suggested interventions are experience rather than analysis based. After reading this dissertation, the observation of Clar et al. (2013) should not come as a surprise; we have discussed in chapter 7 that what actors collectively mention as barriers is not the only source of information upon which their interventions are based. Their actions are also influenced by their former experiences and an intuition of the underlying mechanisms. The policy relevant advice of this dissertation is to consider alternative ways of analysing the causes of impasses in cases that are dynamically complex.

Insight about the mechanisms embraces complexity and in doing so, opens-up alternative ways for interventions. There is, however, no simple recipe book how to intervene.

Impasses (or barriers for that matter) are generally understood as unwanted events. However, they can fulfil an important role in the governance process when reaching an impasse is interpreted as an indicator for the desirability and feasibility of the proposed adaptation measure. Reaching an impasse is a consequence of our governance arrangements and thus provides a kind of selection mechanism that prevents bad ideas from becoming implemented. Reaching an impasse often means that actors need to (re)negotiate what the problem is and how to address it. They have to revise governance strategies, create clearer messages or provide more convincing arguments. By framing barriers as a bad thing one overlooks the positive function they can have in the decision making process.

Despite my hesitations about itemized barriers by researchers, there can be great value in reflecting on the barriers to adaptation in practice. Collective reflection has an important evaluative function after things went wrong. By creating a platform where actors can share and discuss the barriers they can collectively define the barriers to adaptation, formulate possible interventions or distil lessons learned. Even though the constructed barriers may not directly determine which interventions should be used, explicating the barriers allows actors to demarcate the end of a decision making round. It provides actors with motivation and direction to proceed into the next rounds of decision making.

Impasses are an inevitable part of decision making on complex issues. The causes for impasses are not always unique and in many cases can be the result of recurring processes. For example, the troublesome relation between the city of Rotterdam and the sub municipality has not only hampered the Water Plaza case, it has emerged in many, seemingly unrelated projects where the city and sub municipality needed to cooperate. Addressing these operative mechanisms as a general pattern needing a more profound discussion might be more fruitful than finding quick patches for each project. When one observes reoccurring patterns of failure, it might be worthwhile to dive deeper into the mechanismic world. Although this is a more time consuming endeavour than an evaluative workshop, it has the potential benefit of finding ways for dealing with the impasse more strategically.

My final recommendation is that framing something as adaptation to climate change should be a conscious choice. Over the past years, adaptation has become a ‘magic concept’ (Pollitt and Hupe 2011) in responding to climate change risks; adaptation has positive connotations and persuasive powers in collecting, for example, funding for policy measures or raising a sense of urgency. Framing something as adaptation can act as driver for policy development and may even prevent certain barriers from emerging, as the Water plaza case demonstrated. Simultaneously, framing something as adaptation creates the conducive conditions that might trigger barriers that are directly related to the additionality dimension of climate change, as the ARK case

demonstrated. In this case, adaptation may provide an extra source of uncertainty in decision making

8.7. Final conclusions

The overall objective of this dissertation was to gain a better understanding on the barriers to adaptation. The final conclusions of this dissertation can be summarized by referring to the title of this dissertation - 'Challenging barriers in the governance of climate change adaptation' – in three ways.

First, adaptation is not a straightforward process and challenges will emerge throughout the governance of adaptation. There is a potentially endless list of reasons that make the governance of adaptation challenging. How barriers are identified largely depends on how they are conceptualised and which framework is adopted. Adaptation is in many ways similar to other complex societal issues, and so are the barriers that are encountered. It is the additionality dimension of climate change that creates a context which makes decision making particularly challenging. This study showed that temporal discordance between long term climate change and short term decision making can be considered as the most challenging barrier to adaptation.

Second, interventions are needed to challenge the barriers to adaptation. Although this way of challenging barriers has not been the focal point of this dissertation, we demonstrate that the solution to barriers is often seen as an inversion of the problem; if actors consider adaptation to be challenging because of uncertainties, the solution is to provide better information. Our in-depth case study revealed that the actors constructed a list of barriers to make sense and evaluate past events, but this list of barriers did not directly determine the interventions they proposed. We postulated that challenging barriers is a more intuitive process that is likely to be influenced by the tacit knowledge on unobservable mechanisms. This insight would explain why existing policy guidance on barriers to adaptation has so far fulfilled a marginal role in challenging the barriers to adaptation.

Finally, an important contribution of this dissertation is to challenge the concept of barriers to adaptation. Constructing barriers is an invaluable part of decision making in practice. However, the concept is of limited value when the goal is to theoretically explain social phenomena, such as reaching an impasse. We developed an analytical view to study the causes of impasses by diving into the world of mechanismic thinking. This framework offers researchers a way to move from describing towards explaining the reasons why the governance of adaptation is challenging, and by detailing the operative mechanisms, it opens up new ways of making strategic interventions.

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Supplementary material A

Belonging to chapter 3 'On the nature of barriers to climate change adaptation'

Content

Part A: selected key words and search terms

'Barrier*'		'Climate Change'	'Adaptation'
"Obstacle"	"Impede"	"Global Warming"	"Resilience"
"Limit*"	"Lock-in"		"Vulnerability"
"Constrain"	"Restrict"		"Adaptive capacity"
"Hinder"	"Hurdle"		
"Prevent"	"Block"		
"Obstruct"	"Stop"		

Part B: Included variables in the reference database

- **Bibliographic information**: authors, year of publication, and reference information
- **Focus of the study**:
    - Level of analysis: At which level are the barriers identified
        - Individual (Actor, Household)
        - Organisation
        - Local (City, municipality, community, village)
        - Regional (national parks, river basins, counties, provinces)
        - National (country)
        - Population groups
        - Not specified/not present/not relevant
    - Country of analysis: in which country(s) is the barrier identified
    - Sector of analysis: what is the sector in which the barriers are identified?
        - Water/flood risk management
        - Coastal zone
        - Planning (urban, city, landscape)
        - Adaptation
        - Forestry
        - Health
        - Not specified/not present/not relevant
        - Other
- **Methods:** what are the research methods and sources of data
    - Methodology Qualitative, Quantitative, Mixed method
        - Small-n (<5 cases or multiple within one case)
        - Large-n (comparison of multiple cases>5)
        - Model
        - Narrative (theoretical/conceptual)
        - Literature review
    - Data gathering:
        - Interviews
        - Quantitative survey
        - Meetings
        - Document analysis
        - Focus groups
        - Workshops

- **Theoretical orientation:** what are the theoretical frameworks, models or orientations from which the barriers were collected and analyzed

- **Barriers to adaptation:** what are the reported barriers to adaptation? However, barriers are highly context specific. To quantitatively assess the reported barriers, the IPCC-AR4 categories of barriers to adaptation are used (institutional barrier are added):

    - Financial barriers: access to financial resources to adapt
    - Knowledge and informational barriers: access to and reliability of knowledge and information on climate change
    - Cognitive barriers: perceptions of risks/vulnerability and adaptive capacity
    - Social-cultural barriers: how groups experience, interpret and respond to climate change
    - Institutional barriers: formal rules, regulations, policies and plans, informal rules traditions, routines, values

- **Categorisation of barriers:** Are the barriers categorized – if so, what is the categorization that is used or proposed?

- **Interventions and recommendations:** What are the interventions recommendations that the authors identify or propose to deal with the identified barriers? Not stimuli that could improve future adaptation processes

The data extraction table is presented in part C below. Of the papers included in the review some had considerable overlap in terms of authors, methods and focus of study, often being the result of the same project. This could be identified by checking for project numbers and subsidies presented in the acknowledgements. For these papers, the barriers encountered and proposed recommendations and interventions are aggregated in the data extraction table due to their considerable overlap. Note that the data extraction is not intended to evaluate and judge the scientific rigour and/or quality of each individual study on barriers to adaptation, but rather to collect information for synthesis and analysis.

Part C: Data extraction table

	Author(s)	Focus of study			Method	Theoretical orientation	Barriers to climate change adaptation	Interventions and recommendations
		Level	*Country*	*Sectors*				
1	Adger (2000)	Local	Vietnam	Multiple	Method: small-n qualitative case study; Data gathering: interviews	Social vulnerability framework, institutional adaptation	Poverty levels; societal hierarchies; inequalities; unequal distribution of wealth and income within a population; loss of common property management; shift in investment for collective security; presence and access to (financial) resources; Lack of communication in case of threat; vulnerable lines of communication;	Poverty reduction; Risk spreading through income diversification; compensatory measures for loss of property; promote forms of community security
2	Kelly and Adger (2000)	Not relevant	Vietnam	Coastal zone management	Method: narrative (theoretical), small-n qualitative case study; Data gathering: documents, interviews; survey	Social vulnerability framework		
3	Adger et al., (2009)	Not relevant	Not relevant	Not relevant	Method: narrative (theoretical); Data gathering: documents	Not specified	*Ethics* (ultimate goal of adaptation, diverse values); *Knowledge* (values placed on scientific and local knowledge); *Attitudes to risk* (different concepts of risks and need to respond); *Under appreciation of cultural values*; lack of preparedness/ability to change	Governance mechanisms that can acknowledge and negotiate the complexity arising from the manifestation of diverse values, for example deliberative platforms
4	Ahammad (2011)	Local	Bangladesh	Multiple	Method: small-n; Data gathering: document analysis, focus group	Not specified	Lack of connection between the formal institutional structure for disaster preparedness and the groups most at risk; no clear definition of roles between government agencies; financial weakness of (local) government; lack of national government support (urban not part of national climate policy); limited assessment of impacts; no consideration for climate change adaptation; lack of coordination between agencies; lack of training and skills of professionals; lack of legal frameworks to integrate adaptation; unclear division of responsibility	NGOs and private sector provide financial support to government; mainstreaming of risk reduction in policy and planning; built partnerships;
5	Allman et al., (2004)	Local	England and Wales	Multiple	Method: survey; Data gathering: survey; document study	Not specified	Lack of awareness or interest (from councillors, other public sector organizations, voluntary community sector organizations); limited funding; difficult to coordinate between departments and between county and district councils; lack of appropriate government guidance; insufficient staff (time); other issues take higher priority in the council; lack of ICT support; insufficient local authority powers; difficulties in exploiting EU assistance; local resistance to specific schemes; risk of litigation	Not specified
6	Amundsen, Berglund and Westskog (2010)	Local	Norway	Multiple	Method: small-n mixed method case study; Data gathering: survey,	Not specified	Unfamiliarity with climate change; unawareness; lack of data; unclear role of local governments; lack of national attention on climate adaptation (lack of rules and regulations); lack of funding; lack of local expertise for dealing with the effects	Multilevel governance framework to ensure processes for proactive adaptation are developed

7	Biesbroek et al., (2010)	National	Denmark, Finland, France, Germany, Hungary, Netherlands, Romania, Spain, United Kingdom	Multiple	Method: large n qualitative case studies; Data gathering: documents, interviews	Not specified	Lack of coordination between administrative levels; Lack of stakeholder involvement in developing NAS; Unclear division of responsibility; Lack of specialised knowledge within government; Scientific uncertainties; Lack of resources; Cross level/sectoral conflicts; lack of public support/awareness; global impacts	Not specified
8	Bedsworth and Hanak (2010)	Region	USA	Planning	Method: literature review; Data gathering: survey, interviews, documents	Not specified	Uncertain information about climate related impacts; conflicting goals and trade-offs; backward looking regulatory regimes; coordination failures; limits on institutional authority.	No-regret actions; make a policy decision and impose new standards irrespective of opposition; provide financial compensation; State leadership with mandates and incentives for local actors; search for alternative sources of funding; identify barriers
9	Boer (2010)	Region	Australia	Water management	Method: small-n qualitative case study; Data gathering: interviews, documents	Not specified	Barriers encountered in existing policy instruments will be exacerbated if climate change is mainstreamed; intensely developed urban areas along coast; relative newness of climate change; claims for compensation; existing policies and schemes; landowners are unwilling to support if measure results in loss of productivity or increase flood exposure; governments are unlikely finance all necessary options; conflicting adaptation strategies/perspectives; lack of science and technology to guide adaptation	Not specified
10	Brown et al., (2010)	Individual	Cameroon	Forestry	Method: small-n qualitative case study; Data gathering: interviews, documents	Not specified	Lack of (infrastructure on) human , technical and financial resources; linguistics; lack of awareness among the general population; lack of capacity to respond; lack of clear definition of land tenure; short term goals over long term impacts; no links between scales; missing link between climate and non-climate objectives and policies; no vertical coordination with local communities; other more pressing development issues; lack of key determinants for adaptive capacity; lack of resources limits local action (only national government);	Facilitate institutional linkages and coordinating multilevel responses across all boundaries of government private sector and civil society; collaborative capacity building; enhance human and technical capacity;
11	de Bruin and Dellink (2011)	Not specified	Not specified	Multiple	Method: model; Data gathering:	Integrated Assessment Model AD-DICE08	*Restrictions on level of adaptation costs* (lack of funds, competition for funds, irreversibility of decisions to invest, unknown adaptation costs); *Restrictions on the level of adaptation* (uncertain how much adaptation is needed, lack of information, unknown to the public, risk perception, presence of other threats, technological limits, myopia); *Restrictions on residual damage* (loss aversion, low acceptance of residual damage, overinvestment of adaptation); *Restrictions on the timing of adaptation* (considerable time to implement adaptation, accept cultural changes, inertia of political system, wait for improved information); *Restrictions in the flexibility of adaptation* (rate of collecting adaptation knowledge/ experience)	Not specified

12	Bryan et al., (2009)	Individual	Ethiopia and South Africa	Agriculture	Method: quantitative survey; data gathering: survey, documents	Not specified	Shortage of land; policy and institutional environment; lack of (and/or access to) financial resources; lack of information about climate change and adaptive responses; insecure property rights; shortage of (skilled) labour	Raising awareness; make adaptation options available; social assistance; improve access and usefulness of information
13	Bunch et al., (2010a)	Local	Tanzania and Mozambique	Coastal Zone management	Method: small-n qualitative case study; data gathering: interviews; focus groups	policy misfit theory	Policy interventions at higher scales (local communities already exposed to climate and non-climate stressors may be made more vulnerable by large scale interventions for societal benefits at higher scales); misfit between large scale intervention and local vulnerabilities; different worldviews and interests between scales; lack of knowledge/foresight to act at multiple scales and for long term objectives; policies address specific issues and do not take cross-scale dynamics into account; not include interaction between multiple stressors	Move towards novel forms of governance and policy making that are more reflexive, integrated, inclusive and work across multiple scales; actively building adaptive capacity
14	Burch (2010a)	Local	Canada	Planning	Method: small-n qualitative case study; Data gathering: interviews, documents	Barrier framework	*Cultural/Behavioural barriers* (combative behaviour; formalised approach exacerbates educational and cultural differences, policy silos, operational staff are sceptical, consensus orientated council, strong organisational culture of risk aversion, organisational ethos, personal routines and habits, personalities and values in organisations, lack of leadership, conflicting priorities); *Structural or operational barriers* (extensive transparency, time limits affect long term decision making, rare mechanisms for institutional learning; lack of long term plan; no incentives; long history of community consultations; budgetary cycles; macro planning is favoured; redundancies and inefficiencies in jobs; hierarchical system inhibits flexibility and innovation; dependency on individuals to see linkages; routinization; too big institutions; inefficiency, rivalry between parties, no learning of past experiences, isolation of climate change in department); *Regulatory/legislative barriers* (intra-jurisdictional conflicts, lack of local control; absence of long term strategy; lack of common language; lack of detailed implementation plan; weak mayor; ad-hoc committees; need to work within existing programmes; lack of policy tools, quality of policy, routine decision making); *Contextual barriers* (competing priorities, need for demonstrable impacts to act, resistance to change); *combinations of barriers* (lack of public awareness, disempowerment, organisational silos)	Stimulate enthusiasm; stimulate competition; buy-in new way of doing things; casual workshop approach; exploit opportunity for change; stimulate skills and personality of champion; focus on long term; stimulate local leadership; stimulate political leadership; weight educated and uneducated voices; hiring practices to stimulate spirit of collaboration; include new people; not overly emphasise importance of formal rules; respect skills from others; impose higher standards; in camera meetings; commission new research; explore options in zone-planning; stimulate easy wins to improve confidence and enthusiasm; comprehensive sustainability framework to prevent silos; healthy competition among politicians; 'work under the radar' harness hierarchy to stimulate action; map roles and responsibilities;
15	Burch (2010b)	Local	Canada	Planning	Method: small-n qualitative case study; Data gathering: interviews, documents	Barrier framework		

16	Carter (2011)	Local	Europe	Planning	Method: literature review; Data gathering: documents	Not specified	Limited overarching policy framework to support adaptation at city level; patchy high level political leadership; lack of political will, existing policy frameworks encourage development in vulnerable locations; policies that are inflexible or short-termist; social and cultural inertia in individual and collective actions; uncertainty in climate science, uncertainty in nature, scale and timing of climate change impacts; unclear costs and benefits of adaptations; prioritizing of adaptation options; complexity of institutional arrangements; hierarchical frameworks	Awareness raising and stakeholder network building for taking a more holistic approach to adaptation
17	Conway and Schipper (2011)	National	Ethiopia	Drought	Method: small-n mixed method case study; data gathering; model, interviews, documents	Not specified	Climate change as environmental issue rather than development issue; short term perspective; culture of food aid; ownership of climate change policy and research; under investments; growing population;	Not specified
18	Crabbé and Robin (2006)	Local	Canada	Water management	Method: small-n qualitative case study; documents	Institutional perspective; framework not specified	Municipal Institutional barriers – *external barriers* (little autonomy of municipalities over financial resource, no management responsibilities from higher authorities, limited access to long term borrowing of financial resources, lack of specific information, overtly dependence on engineering/ technical fixed, election cycles of municipal councils (3 years)), *internal barriers* (management culture conflicts, absence of management cycle planning, lack of enforcement of by-laws and regulations, lack of databases about existing infrastructure, insufficient expertise at all levels, conflicts bout municipal, political, administrative priorities between levels, municipal culture is dominated by crisis management, mistrust on information about climate change)	Federal intervention in municipal infrastructure financing; new sources of financing; revision of planning to include climate change; facilitate access to funding; separate speculative from certain information; select appropriate means of communication; use windows of opportunity; develop stronger relations between staff; citizens participation; social learning/policy learning; communication across levels
19	Deressa et al., (2009)	Individual	Ethiopia	Agriculture	Method: empirical model; Data gathering: survey	Not specified	Lack of money; lack of information; shortage of labour; shortage of land; poor potential for irrigation	Investments in educational system; increase farm income; provide information about climate change; encourage informal social networks;
20	Djoudi et al., (2011)	Region	Mali	Forestry	Method: small-n mixed method case studies; data gathering: interviews workshops	IVA	Short term measures increase vulnerability; short term measures impact (natural) resources; unclear property right for resources; interdependency between resource access, political disputes and moralities; institutional vacuum due to decentralization; unclear legal status of forests; psychological barriers (traumatism) as result of ecological transformation (solastalgia); no long term planning to bring lack back; lack of capacities and knowledge for adequate management; uncertainty of climate change and other socio-political factors for long term planning; political instability; lack of financial means	Include multi-level, participatory, integrative and gender sensitive in IVA; stronger information flows, stronger investments from government in local empowerment; national government improve coordination

21	Dupuis and Knoepfel (2011)	national	Switzerland	Politics	Method: quantitative survey; Data gathering: survey	Hypothesis testing from theories on policy process development	Perceptions of decision making actors on climate change; unequal attention of adaptation in national politics; policy makers do not perceive link between adaptation and economy; adaptation considered as trivial matter; local climate change impacts not considered by national policies; historical focus on mitigation; national climate policies influenced by international institutions and not as domestic issue	Not specified
22	Eisenack and Stecker (2011)	Region	Rhine catchment: Italy, Austria, France, Germany, Luxemburg, Belgium, the Netherlands	Water management	Method: narrative (theoretical) and large-n qualitative case study; data gathering: documents	Climate Change Adaptation Action Framework	*Missing operator* (Limited problem recognition of potential operators, missing frames of reference, rigid social habits and normative standards); *Missing means* (limited institutional capacity, budget constraints, existing legislative framework limits adaptation); *unemployed means* (misaligned economic incentives, under/over adapt as result of positive/negative effects of adaptation, moral hazard); *complex actor relations* (complex network of exposure units, operators and receptors, not tailored institutional arrangements, increased transaction costs); lack of coordinated efforts; upstream-downstream conflicts	No simple solution that resolves all barriers at the same time
23	Eriksen and Lind (2009)	Region	Kenya	Drought	Method: small-n mixed method case study; Data gathering: survey, interview, focus group	Not specified	*Conflict and violence* reduces human and social capital and reduces adaptation options	Not specified
24	Falaleeva et al., (in press)	National	Ireland	Coastal zone management	Method: small-n qualitative case study; Data gathering: documents	Earth system governance principles	*Credibility* (Lack of credibility due to absence of regulatory requirements, lack of continuity challenges credibility); *Stability* (lack of long term financial commitment, no long term monitoring and reportage, learned experiences under pressure, political and economic instability in Ireland); *Adaptiveness* (no consistent system of data gathering, lack of institutional co-ordination, low level of local actors' awareness); *Inclusiveness* (institutional fragmentation, lack of options for knowledge exchange; loss of sense of ownership)	Gradually building knowledge and experience how to deal with climate change
25	Farley et al., (2011)	Region	USA	Water management	Method: small-n qualitative case studies; Data gathering: interviews	conceptual model of vulnerability	Historical data used for future planning; limited impact/ vulnerability data available; decisions are made on past conditions; conflicting objectives between climate and non-climate policies; difficult to change institutions and practices; USACE operates with congressional authorization; unintended consequences of measures; existing policies as disincentives for conservation of water; multi-year process to change plans; climate change not included in water quality requirements	Not specified

26	Few et al., (2007)	Local	United Kingdom	Coastal zone management	Method: small-n qualitative case study; Data gathering: interviews, workshop	Not specified	No formal requirement to make long term assessment or plans for action for sector; mismatch between national policies and local intervention decisions; political controversy about retreatment strategy; discounting future costs and benefits; cyclical funding schemes with short time horizon; lack of concrete evidence; lack of technical ability to interpret information; prioritization of immediate urgent measures; competing other priorities; climate change is considered complex and controversial; short-term political cycles; problem of fit between problem and capacity; issues of motivation and local politics	Invest in local adaptive capacity; strengthen local long term planning mechanisms; establish cross scale institutions on coastal management
27	Ford et al., (2010a)	Population group	Canada	Health	Method: literature review; Data gathering: document analysis	Vulnerability framework	*Poverty* (human and financial resources, ranks behind other challenges); *limited technological capacity* (accessibility of health services, availability of technologies to health systems, not culturally sensitive services, underdeveloped early warning system, inadequate health data, limits in analytical capacity, lack of institutional memory, high staff turnover, culturally specific communication); *political inequality* (lack of political powers, attention to other issues); *constrained institutional capacity* (jurisdictional conflict over health care provision between scales, unclear responsibility, fragmented decision making, short term policy development, bureaucratic maze, limited accountability, inexperienced personnel, lack of skills and training of staff); *information deficit* (health system vulnerability is limited, uncertainty about climate impacts on health, unknown risks)	Interdisciplinary scientific research; health sector leadership; effective communication; government action; institutional reform; international cooperation; co-ordination and collaboration ; partnerships with indigenous peoples and organisations
28	Ford et al., (2010b)	Population group	Canada	Not relevant	Method: small-n mixed method case study; Data gathering; interviews, focus groups, workshops, documents	Vulnerability framework	Climatic and non-climatic barriers to adaptation; costs of equipment; territorial budget constraints; financial capacity to afford adaptations; constrained access to adaptation options; lack of knowledge in existing programs; programs not developed in context of climate change; regulations constrain flexibility; (scientific) controversies over how to manage climate change impacts on wildlife; differential power relations; conflict over science versus traditional knowledge; erosion of traditional adaptive skills; assessing effectiveness; lack of support to adaptation; fragmented support and planning for adaptation	Support teaching and transmission of environmental knowledge and land skills; enhance and review emergency management capability; ensure flexibility of resources management regimes; provide economic support to facilitate adaptation; increase research efforts to identify response options; promote awareness of IVA among policy makers; innovative co management of natural resources; enhance existing strategies, develop new strategies
29	Ford and Pearce (2010)	Population group	Canada	Not relevant	Method: literature review; Data gathering: documents	Vulnerability framework		
30	Ford et al., (2010c)	Individual	Canada	Mining	Method: quantitative survey; Data gathering: survey	Not specified	Uncertainty (climate projections, regulations, market); Costs of adaptation measures; Lack of skilled personnel; Short lifespan of mining operations (time to implement adaptation measures)	Not specified

31	Fünfgeld (2010)	Local	Not relevant	Risk management	Method: literature review; Data gathering: document	Not specified	Low understanding of emerging scientific information on hazards and impacts on cities (change of the information, access to information, counter productivity, believe of relevance, integration in decision making); Low understanding of how socio economic processes influence urban vulnerabilities; integration of information on exposure and vulnerability into local planning (connecting policy and practice, mitigation and adaptation treated as separate issues); lack of suitable governance networks for climate risk management	Mainstream climate change in local planning; building multi-level governance frameworks; converge top down science and policy guidance; clarify roles and responsibilities
32	Gifford et al., (2011)	Individual	Not relevant	Not relevant	Method: literature review; data gathering: documents	Not specified	*Limited cognition* (ancient brain, ignorance, environmental numbness, uncertainty, judgement discounting, optimism bias, lack of perceived behavioural control); *Ideologies* (world views, system justification, supra-human powers, techno-salvation); *Other people* (Social comparison and norms, perceived inequity); *Investments* (sunk costs, behavioural momentum, conflicting values goals and aspirations, the lack of place attachment); *Discredence* (mistrust, perceived program inadequacy, reactance, denial); *Perceived risk* (functional risk, physical risk, financial risk, social risk, psychological risk, temporal risk); *Limited behaviour* (tokenism, the rebound effect)	Behaviour focused interventions (promotion of pro environmental behaviour, persuasive communications; antecedent vs consequence strategies; informational vs structural strategies)
33	Glaas et al., (2010)	Local	Sweden	Multiple	Method: literature review; data gathering: document analysis	Not specified	Few policies, rules or guidelines that provide guidance; unclear division of responsibilities; sectoral perspective on climate risks; vulnerability as technical problem rather than social issue; limited coordinating capacity in municipal arena; not taking ownership of issue; lack of inter-sectoral communication and co-learning; lack of supra-organisational coordinative body for climate change; no established system for learning	Not specified
34	Goulden, Conway and Persechino (2009)	Region	Africa	Water management	Method: literature review; Data gathering: documents	Not specified	*Physical barriers*; *Socio-political barriers* (adaptations subjected to conflict and power struggles, undesirability of adaptation options); *Economic barriers* (costs of adaptation); weak legal frameworks; inflexible mechanisms and treaties; asymmetric power relationships between states; state perspectives on climate change; transboundary impacts; crisis situations enhance conflict	Not specified
35	Grothmann and Patt (2005)	Individual	Germany, Zimbabwe	Water management; Agriculture	Method: narrative (conceptual) and small-n qualitative case study; data gathering: interviews, workshop	Socio-cognitive model of private proactive adaptation to climate change	Perceived adaptive capacity; underestimation of direct consequences; illusion of control; lack of objective adaptive capacity (resources, time, knowledge); cognitive bias; heuristics; reliance on public adaptation; social amplification of risk; lack of motivation; routines and habits; lack of adaptation intention; unwilling to believe that actions will help; information provision; effectiveness and costs of adaptations	Not specified

36	Hamlet (2010)	Region	USA	Water management	Method: not specified; data gathering; not specified	Not specified	Traditional timescales of water planning (20~30 year) and long term climate change; practical timescales for policy making; short-termism in policy cycles; institutional fragmentation; lack of centralised authority; conflicting management objectives; rigid water law; inflexible institutional arrangements; large complex systems; bureaucracy; evaluating adaptation strategies (costs and benefits); loss of technical capacity; lack of expertise; complex interactions between competing agencies; poor coordination; lack of centralised decision maker with authority to act; unwilling to create meaningful change; limited exposure to hydrological modelling; model simulations rather than optimalisations; extraordinarily expensive adaptations; not clear when or how often planning studies and decisions should change; stationary as assumption for policy design; limited access to scenarios and information; disconnected policy and practice; federal agenda to block climate change policy	Focus adaptation at sub basin level, integrated levels of governance; flexible and self tending techniques; use optimizing techniques
37	Harries and Penning-Rowsell (2011)	Region	England	Water management	Method: small-n qualitative case study; data gathering: interviews	Not specified	Engineering focussed social identity among decision makers; decision makers accountability to public (opinion) rather than central government; institutional inertia; sticky policy; narrow defined policies; bias towards structural measures; benefit cost ratio; skills and knowledge to evaluate non-structural measures; ambiguity in government communication; previous policies; no procedures, data, values and benefits of non-structural measures; cultural legacies; European directives	Greater attention to and improving social justice; combine experts with professional groups of other risk perceptions
38	Huang et al., (2011)	Not specified	Not specified	Health	method: literature review; data gathering: documents	Not specified	Uncertainty of future health impacts of climate change; uneven distribution of adaptive capacity; governmental prioritization; financial resources; accessibility of technologies to those most affected; lack of skills; specialized policy domains; current institutional arrangements; difficult to catalogue all adaptations; lack of understanding of the effectiveness of adaptation options and costs; low level of social capital; motivation to respond; lack of monitoring and evaluation of adaptation measures	Identify lead agency to that can coordinate effectively
39	Jantarasami, Lawler and Thomas (2010)	Regional	USA	Forestry	Method: small-n qualitative case study; Data gathering: interviews;	Not specified	*Input barriers* (lack of information, lack of resources, budget and staff time, potential public opposition*); Informal institutional barriers* (internal inertia to change traditional ways of thinking) *Formal institutional barriers* (internal operation procedures); *Environmental la*w (existing legal constraints); *Ownership mosaic* (multiple jurisdictions, different rules)	Update existing policies; public education and dialogue; change laws; working across jurisdictions; monitoring and adapting management; funding and time; judicious approach; update partner policies; establishing a clear agency policy mandate for climate change adaptation; educate government employees; formal division of labour to focus on climate change; funding and staff support for adaptation

40	Jones and Boyd (2011)	Local	Nepal	Adaptation	Method: small-n qualitative case study; Data gathering: interviews, document study, focus group	Conceptual framework to study social barriers to adaptation	Differences in perception of risk as result of caste and gender; victims of discrimination; Low self-efficacy and perception of inability to effectuate change in lowest caste; reluctance to accept assistance and aid; traditional and historic norms restrict opportunities; hegemonic dominance of political authority; caste related political neglect; non-decision making strategies; cultural subjugation; lack of opportunity to access political spheres	Stimulate bottom-up approaches; wider development interventions (reduce poverty, social protection)
41	Kithiia (2011)	Local	East Africa	Planning	Method: literature review; Data gathering: document analysis	Not specified	Limited budget to invest in climate change adaptation initiatives; premature obsolescence; weak institutional frameworks; absence of explicit policies linking climate change with urban development; lack of integrative planning framework/process across scales; lack of knowledge and skills of professionals; lack of analytical capacity; operational weaknesses (no initiatives); challenges appear sooner than anticipated in the past; failure to institutionalise sustainable patterns of behaviour	Mainstreaming climate change in urban planning
42	Koch et al., (2007)	Organisation	South Africa	Multiple	Method: small-n qualitative case study; Data gathering: interviews, workshop	Institutional perspective; multilevel governance framework	Unclear roles and responsibilities; lack of authority and power in departments; conflicting frames and perceptions; lack of communication between departments; unclear internal institutional arrangements; poor coordination between departments lack of capacity; high mobility of staff; exclusion of certain parties; hierarchical government response; information filtering; cross scale coordination; lack of exposure to business sector; low priorities; dominance of mitigation; poor information transfer; lack of understanding and awareness	Building and strengthening of institutional networks; more integrated and collaborative approach; mainstreaming
43	Krysanova et al., (2010)	Region	Amudarya, Elbe, Guadiana, Nile, Orange, Rhine	Water management	Method: large-n mixed method case study; survey, interviews, documents,	Not specified	Spatial and temporal uncertainties in climate change scenarios; lack of adequate financial resources; lack of horizontal cooperation; different risk perception; lack of human capital; lack of transboundary cooperation; lack of vertical cooperation; lack of regulatory framework; problems in organisational setup; low level of awareness; lack of needed technologies	Not specified
44	Lata and Nunn (2011)	Region	Fiji	Multiple	Method: small-n qualitative case study; Data gathering: interviews	Not specified	Lack of awareness of climate change; gap between risk and perceived risk; short term planning perspectives; spiritual beliefs; traditional governance structures are unsuited; attribution of climate change to the will of a divinity; risk is unrelated to daily life; information is not presented in their first language; cross-sectoral issue that does not fit in one portfolio; high expectations; confusion between weather variability and climate change; short term goals and reap benefits of these	Empowering community decision maker to appropriate action

45	Lebel et al., (2010)	Local	Thailand	Water management	Method: small-n case narrative (conceptual); Data gathering: interviews, documents	Vulnerability framework; Institutional perspective	*Fragmentation* (institutional incapacities, institutional gaps; lack of coordination, bureaucratic separatism, responsibilities and objectives); *Rigidity* (technical bureaucracies; structural measures to control, existing regulations and practices); *Scale* (concentrate response on one level, centralized approach, scale competences of actors, lack of community based incentives); *Elite capture* (dominance of experts and technical tools, interests other than adaptation); *Crisis management* (political attention only high after event, reactive decision making, short-termism)	Expand public participation; build adaptive capacities at multiple levels; integrate with development; prioritize the vulnerable; link knowledge and practice
46	Lemieux et al., (2011)	Regional	Canada	Protected areas	Method: quantitative survey; Data gathering: survey	Not specified	Lack of applied research on impacts and adaptations; lack of monitoring; limited budget on climate change adaptation; no individual within agency responsible for climate change adaptation; climate change considered as future issue; limited inclusion in public communication/education; lack of staff; no adaptation policy/strategy; lack of strategic response; lack of understanding by policy/decision makers on climate change	More integrated and collaborative approach; strengthening networks across scales; more resources to build capacity; recognize complementary strengths and weaknesses
47	Lorenzoni et al., (2007)	Individual	United Kingdom	Not relevant	Method: small-n mixed method case study; Data gathering: survey, interviews, focus group,	Public perceptions theory	Individually perceived barriers – *Lack of knowledge on causes of impacts, consequences and solutions* (confusion, experience, understanding, awareness); *Uncertainty and scepticism* (seriousness, scientific controversy); *Distrust in information resources* (media, bias, contradictory frames); *externalising responsibility and blame*; *perceive climate change as distant threat*; *other issues are more important*; *reluctance to change; fatalism, drop in the ocean feeling*. Social barriers – lack of political action (distrust in actions and responsibility); lack of action by business and industry ('fat cat syndrome'); free rider effect (no one else is interested); social norms and expectations; lack of enabling initiatives; locked-in to current patterns; information overload; lack of desire to seek information; perceived lack of local information; information conflicts; credibility and trustworthiness of information;	Increase tailored information through credible channels; educate; supportive institutions and networks to enable individual behaviour; community engagement and initiatives; regulatory frameworks; integrate societal perspectives in planning;
48	Marino (in press)	Local	Alaska	Multiple	Method: small-n mixed method case study; Data gathering: document analysis, interviews, survey	not specified	Disaster response protocol does not accommodate climate change scenarios; feelings of mis- and under-representation local actors political arenas; historically constructed vulnerability limits adaptation planning; traditional adaptation measures are no longer practical (migrate); prefer rebuilding after disaster instead of relocation; high costs of relocation; lack of organizational capacity and political mandates to migrate; existing laws require rebuilding after disaster; no responsible agency; low confidence in bureaucratic processes; fundamental distrust in government-driven adaptation; community feels misunderstood by government workers; inadequate finances	Not specified

49	Martins and Ferreira (2011)	Local	Not relevant	Planning	Method: literature review; Data gathering: document analysis	Not specified	Lack of financial, human and technological resources; commitment from political leaders; lack of attention to environmental issues; short-term view; business as usual approach; lack of impact and vulnerability assessments; mismatch between policy makers and scientific community; lack of authority and international support; poor vertical and horizontal coordination across levels and policies; poor governance structures, difficulties in getting key sectors involved	Not specified
50	McEvoy et al., (2010)	Regional	Not specified	Insurance, flood risk management	Method: narrative (theoretical), existing case studies; Data gathering: documents, workshops	Not specified	Promoting good risk management practice; behavioural constraints (adverse selection, moral hazard); land acquisition; fragmentation of responsibilities and funding; general lack of political awareness; absence of strong management body; divergence in objectives and mandates of public bodies; weakness of local capacity; increasing competition amongst actors; variation of flood protection standards ; weak institutional capacity; economic difficulties; tensions between government and NGO; institutional inertia; over-reliance on engineering solutions; policy 'silo's'	Learning approach combined with participation to ensure inclusion of local knowledge
51	McNeeley (2011)	region	Alaska	Wildlife management	Method: small-n qualitative case study; data gathering: documents, interviews	Vulnerability and adaptive capacity approach	Institutional hierarchies determine how adaptation is manifested; large scale policies can exacerbate vulnerability or reduce adaptive capacity; shortened harvest window due to changes and fixed regulations; disconnected scales; complexity and fragmentation of institutions; lack of comprehensive knowledge of climate change by decision maker; institutions limit compliance of locals; knowledge gaps about weather and climate, uncertainty about moose breeding date and climate change; lack of research capacity; differing priorities; mistrust, delegitimization of the system by local stakeholders	Incorporate knowledge of climate variability and change; regulatory reform and in-season management;
52	Measham et al., (2011)	Local	Australia	Planning	Method: small-n qualitative case study; Data gathering: interviews	Not specified	Lack of information; institutional limitations; resource constrains; lack of leadership; competing priorities; reluctance to embrace adaptation; different perspectives of staff and officials about climate change; focus on mitigation rather than adaptation; little inclusion of adaptation in strategic planning; gaps in knowledge; climate change as stable process; uncertainty of information; institutional silos; key players do not consider climate change; climate change assigned to environment department; lack of climate change in national planning frameworks; competition between adaptation and other issues	Role of leadership to support adaptation; aim for mainstreaming; push for reform at higer levels to include adaptation in planning framework; embed climate change in council functions
53	Moench (2010)	Region	India	Water management	Method: small-n qualitative case study; Data gathering: documents	Adaptive policy framework	Loss of indigenous techniques to adapt, conflicting interests of state-led activities and local initiatives; engineering bureaucracy; corruption; lack of experiences from impacts; institutional differences between countries; low levels of flexibility of options; little incentive to diversify investments; social rigidity; path dependency; incapable local institutions	Enabling policy frameworks (flexibility) that includes local actors

55	Moser and Leurs (2008)	Region	USA	Coast	Method: narrative (conceptual); Data gathering: documents; interviews	Awareness-analytic capacity-action framework		
56	Moser and Tribia (2006)	Region	USA	Coast	Method: quantitative survey; Data gathering: survey	Not specified		
57	Tribia and Moser (2008)	Region	USA	Coast	Method: quantitative survey; Data gathering: survey	Science-policy interface		
58	Moser and Ekstrom (2010)	Not relevant	Not relevant	Not relevant	Method; narrative (conceptual); Data gathering: documents	Barrier framework	*Barriers in understanding phase* (existence of a problem, framing of response, availability of information, credibility and trust, willingness and ability to use information, level of agreement); *Barriers in planning phase* (Leadership in leading process, perceived credibility/salience and legitimacy, agreement on selecting options, sphere of responsibility/ influence/control over option, threshold of concern); *barriers in the managing phase* (accountability, legality and procedural feasibility, sufficient momentum, existence of monitoring plan, availability of resources, willingness to learn, availability of needed expertise, data and evaluation methodology); unclear communication	Structuring heuristic provided (actors ability to overcome barriers and source of origin of barriers (spatial jurisdictional and temporal origins). Interventions are actor, governance and system specific
59	Mozumder et al., (2011)	Region	USA	Multiple	Method: quantitative survey; Data gathering: survey	Risk perception framework	Insufficient budget; lack of direction and leadership; insufficient staff time and resources; lack of perceived importance to public officials; lack of assistance from State; lack of public demand to take action; lack of legal mandate that takes climate change impacts into account; lack of perceived solutions; opposition from stakeholder groups	Additional state funding assistance; public workshops and training; local models to predict local short term impacts; creating national disaster fund; taskforce; data base of best management practices; strengthening adaptive capacity
60	Flugman et al., (2011)	Region	USA	Multiple	Method: quantitative survey; Data gathering: survey	Not specified		
61	Murthy et al., (2011)	National	India	Forestry	Method: narrative; Data gathering: documents	Adaptation framework	Diverse interests and values of stakeholders; lack of reliable assessment of climate impacts and damage (uncertainty, lack of supportive climate projections for adaptation, forecasts of changes); lack of information on impacts and benefits of adaptation; lack of funding to support long term research; lack of cost benefit analysis of adaptation options; paucity of institutional, financial and policy environments to support adaptation; lack of pilot projects on adaptation.	Not specified

62	Næss et al., (2005)	Local	Norway	Water management	Method: small-n qualitative case study; Data gathering: interviews, documents	Institutional analysis	Unclear roles and division of responsibility; prioritisation of measures; political costs; emphasis on insurance and regulation; short-termism; lack of standards; institutional rigidity; short public memory; consolidate existing power structures; integration of new perspectives, tools and guidelines; role of powerful individuals; interplay between administrative levels; institutions slow process of social learning; personalized learning rather than institutional learning; cultural differences between local and national levels of governance	Not specified
63	Nielsen and Reenenberg (2010)	Local	Burkina Faso	Adaptation	Method: small-n qualitative case study; Data gathering: interviews, focus groups, survey	Not specified	Cultural barriers; livelihood diversification; gender issues; cultural pluralism and traditions; lack of engagement; personal integrity; personal preference	Not specified
64	O'Brien et al., (2006)	National	Norway	Adaptation	Method: literature review; Data gathering: documents	Not specified	High levels of national adaptive capacity mask local vulnerabilities; emphasis on sectoral and biophysical impact assessments; pressures from powerful interest groups; loss of traditional building techniques; lack of local knowledge in decision making; conflicting objectives among interest groups at local level; not primary objective in society; isolation from other societal developments and goals; budgetary constraints; high adaptive capacity does not lead to adaptation	Not specified
65	Patt and Schröter (2008)	Region	Mozambique	Flood risk management	Method: small-n mixed method case study; interviews, survey, workshop	Behavioural theory on contextual factors	Disagreement between farmers and policy makers about perceived risk, omission bias; status quo bias; different perspectives on probabilities of (flood) risk; farmers more concerned with less significant but constant threats; quick design of policy plan after floods; not include farmers in process	Participatory risk appraisal in climate policies
66	Quinn et al., (2011)	Local	South Africa	Multiple	Method: small-n mixed method case study; method: interviews, survey, documents	Vulnerability framework	Lingering consequences of past management actions; Poor communication between levels of government, and between government and local citizens; lack of authority; lack of information; villages lacked awareness about who to approach with their problems or requests for support; mismatch in priorities between local government and local communities; limited livelihood opportunities; lack of providing long term financial and management support lack of institutional capacity;	Adaptation strategies must be embedded to reduce the potential conflicts; multi-scale and integrated approach to link levels, supports collaboration, involves extensive engagement and deliberative decision making between stakeholders;

67	Reid et al., (2007)	Region	Canada	Agriculture	Method: small-n qualitative case studies; Data collection: interviews, focus groups	Agricultural adaptation framework	*Awareness* (unawareness, more important issues, confident about own adaptive abilities, confident about local conditions); *Technology* (high costs of new machinery/technology, research needed, technology not available); *Resources* (declining farm income, small farms have little resources); *Institutions* (government does not see risk for sector, lack of communication from government on climate change adaptation, regulations indirectly restrict adaptation, less subsidies compared to other markets); *Human capital* (farmers are late innovators, inexperience with new risks, choose to stay small farms); *Social capital* (young people do not become farmers); *Risk spreading* (specialization and diversification of practices); *Information management* (limited services to communicate about climate change, new weather related surprises)	Not specified
68	Shepherd et al., (2006)	Region	Canada	Water management	Method: small-n qualitative case study; Data gathering: interviews	Adaptation framework	Consumer attitudes; Internal municipal communication; public mistrust of new faces (consultant) in process; political resistance; attitudes and suspicion among stakeholders; mistrust; redistribution and proposed measures was considered unfair by some groups, disagreement between the Board and field staff; lack of financing structures	One-on-one meetings, workshops to resolve internal conflicts; timing of adaptations; step-wise approach ;
69	Sietz et al., (2011)	National	Mozambique	Development assistance	Method: small-n qualitative case study; Data gathering: interviews	Social vulnerability framework	Barriers to mainstream: *Individual* (lack of human resources within institutions); *Organisational* (insufficient data and information available; weakly managed data and information; inadequate dissemination of data; erosion of institutional memory); *Enabling environment* (lack of inter-institutional coordination and communication, gaps and overlaps in mandates, short-term goals are given priority, scarce sources of funding, lack of communication to and participation of community)	Strengthen governmental capacity; hire experienced staff; training and education; improved coordination and communication; create local committees; integrate expert actors in all domains; partnerships; strengthen environmental support; benefit from international frameworks; mainstreaming
70	Smith et al., (2011)	Not relevant	Not relevant	Not relevant	Method: narrative (theoretical); Data gathering: documents	Not specified	*Psychological and social barriers* (disempowerment); *cognitive responses to uncertainty* (decision making on past experiences; abstract visions of the future, disjunction between risk and action, tools information and frameworks do not cause institutions to change); *governance structures and institutions* (structural aspects of institutions, climate change governance trap; not acceptable to consider adaptation to more than 2degrees);	Systematic approach to reduce complexity of the adaptation decision making environment when complexity is growing; show that decisions are not equal; turn to manageable and actionable steps; decision pathways

71	Storbjörk (2007)	Local	Sweden	Planning	Method: small-n qualitative case study; Data gathering interviews, documents	Not specified	*Prioritising climate adaptation*; (residents' understanding of the need of the measures; no core theme in politics; lack of preparedness; it-won't-happen-in-my-backyard-mentality); *unclear adaptation* (unclear local consequences, no local impact assessments, lack of capacity and competence, more pressing other problems, lack of clarity and communication about climate change impacts) *Knowledge and responsibility* (unwillingness, unclear who is responsible, strong expert dependency)	Not specified
72	Storbjörk (2010)	Organization	Sweden	Flood risk management; Coastal zone management	Method: small-n qualitative case study; Data gathering: interviews, document analysis	Learning theory	Uncertain future knowledge; lack of capacity; lack of competence; continuation of business as usual; unclear responsibilities; re-organisation; lack of central guidelines; wait-and-see-approach; lack of overall problem ownership; lack of acceptance; lack of common frames of reference; interdepartmental rivalry; personal integrity; traditional sectoral administration; convenience to prevent change; different political interests, priorities, cultures and goals; lack of continuity in learning; knowledge only in minds of individuals; lack of organizational mainstreaming; no long term perspective; from awareness to concrete decision making; lack of reflexive learning from experiences; communication between administrative units; cemented roles; learning from experience; ability to mediate tensions; event driven management; tension between interest, values, and priorities;	Reflection based on learning from experience; systematic (organizational) learning (instrumental compliance, proactive internal learning, proactive external learning, systematic and cross sectoral learning, institutional modification); lobbying and influencing; proactive change of routines; participate in international projects to increase knowledge;
73	Storbjörk and Hedrén (2011)	Local	Sweden	Coastal zone	Method: small-n qualitative case study; data gathering: interviews, document	Institutional capacity building	Weak internal coordination capacity; lack of mutual ownership of coastal zone; weak vertical interplay; lack of formal coherent policies; tensions and trade-offs between policy agenda values and political priorities; lack of integrated cross sectoral approaches; lack of continuity;	Harmonise, mediate and discuss policy different policy agenda's, values, priorities and goal conflicts openly;
74	Sutton and Tobin (2011)	Individual	Australia	Ocean	Method: small-n quantitative case study; data gathering: survey	Constraints on personal engagement model	*Objective constraints* (lack of relevant actions individuals can take in climate change adaptation;; lack of time; lack of approval by family and friends; financial costs associated by doing more) *subjective constraints* (having more important priorities; belief that things they could do would have no impact, and lack of certainty that human activities cause climate change; perception that it is too late to do anything about climate change; belief that they already do more than their share)	Expanding current engagement strategies, provide tools and alternative activities to allow for more active contribution

75	Tryhorn and Lynch (2010)	Local	Australia	Flood risk management	Method: small-n qualitative case study; Data gathering: interviews, documents	Not specified	No clear common goal; dominant and conflicting interests within community; no comprehensive information, lack of community engagement in framing the problem; conflicting demands; no integration of community input in decision making; lack of authoritative signature of documents; no plan for funding stage; lack of institutional memory (high turnover in council and staff, missing records and documents); overburdened staff; lacking resources and skills; staff not experienced in solving complex issues; no passionate individuals; global knowledge versus local needs	Not specified
76	Urwin and Jordan (2008)	Region	United Kingdom	agriculture; water management; nature;	Method: narrative (theoretical), illustrated by small-n qualitative case study; Data gathering: documents, interviews	Policy interplay framework	Higher scale (adaptation) policy limits local adaptive responses; Scientific uncertainty; current state of technology; insufficient financial resources; short term horizons of policies and policy makers; emphasis on mitigation; conservationism; inflexible legislation; existing EU legislation; little encouragement from policies to adapt	Climate proofing new and existing policies of centralised and decentralised systems
77	Werners et al., (2009)	Regional	Hungary	Flood risk management	Method: small-n qualitative case study; Data gathering: documents, interviews	Earth system governance framework	*Problem structure* (uncertainty, functional, spatial and temporal interconnectedness); *Governance principles* (lack of stability, Loss of credibility); implementation at different speeds; sectors lagging behind; lack of inclusiveness; insufficient funding; high costs of measures; complex organizational responsibilities; divergence in objectives and mandates; discontinuity of financial resources; sectoral approach; rigid financial instruments; unclear property rights; dependence on global markets and regional infrastructures; central decision making; not recognized by higher governments; conflicting interests	Additional attention for subsidiary, creating networks, cooperation across scales, open access to information, risk mitigation, benefit sharing and compliance; restoring reciprocity; PPP;
78	West and Hovelsrud (2010)	Local	Norway	Fishery	Method: small-n case study; Data gathering: interviews, meetings	IVA	Actors do not consider themselves vulnerable; scepticism that fluctuations in fish stocks were due to climate change; not perceived as problem: high variable weather is part of daily life; collective knowledge/experience might hinder pro-active adaptation; outmigration; highly politicized and institutionalized fishing industry leaves little flexibility in mobility, investments, and livelihoods of fishermen; eroded confidence and trust in fishery science and policy making; legal barriers; economic crisis; lack of knowledge on climate change impacts	Not specified

79	West et al., (2009)	National	USA	Natural resources	Method: narrative (conceptual); literature review; data gathering: documents	Not specified	*Legislation and regulations* (static legislation and policies); *management policies and procedures* (climate change not perceived as problem or stressor, political boundaries do not align with ecological processes, resources cross boundaries); *human and financial capital* (level of funding, staff capacity, area of land required to implement adaptations, adequate training and expertise, lack of understanding of the problem, lack of incentive to take risk, funding encourage routines); *information and science* (no baseline information, history no guide for future, lack of decision support tools, uncertainty in science, extreme events outside historical experience, insufficient information to evaluate adaptations, stakeholders prevent adaptations)	Interventions framed as opportunities: expand interagency collaboration, integration and lesson sharing; re-evaluate priorities and consider triage; manage for change;
80	Wolf et al., (2010)	Individual	United Kingdom	Health	Method: small-n qualitative case study; Data gathering: interviews	Risk perception and social support networks perspective	Perceptions of vulnerability, individuals do not associate risk/ threat with themselves; culturally constructed perceptions; cognitive dissonance; biased assimilation or pre-existing beliefs; unawareness of options; little understanding of the effects; not adjust daily routines; low priority of the effects; little motivation to act; perceived independence; lack of social contacts/networks; reactive strategies; perceived likelihood of reoccurrences; role for government in taking responsibility	Adopt multipronged communication approach; bonding social networks, for example financing local social development; synergies between responses from different governmental actors; provide advice to behavioural change by communities
81	Yates (2011)	Local	Nepal	Water management	Method: small-n qualitative case study; Data gathering: interviews, focus group, meeting	IVA: Participatory Vulnerability Assessment	The governance system reduces incentives to invest; short term coping strategies; initiatives are not equal across space and social groups; no stable institutional support in relation to ecosystem management; ineffective institutions; in active committees lead to failure of projects; bureaucracy limits responsiveness; perceived lack of representation within decision-making scenarios; lack of active and engaged community-based water governance mechanisms; division of water rights; conflict between different stakeholders; continuous dispute between the downstream and upstream communities	Technical support; build institutional adaptive capacity; focus on process rather than (technical) outcome

Supplementary material B

Chapter 5. 'Does it matter how adaptation is governed? Comparing barriers to adaptation between the United Kingdom and the Netherlands'

Content

Part A Ranking of the barriers to adaptation in the United Kingdom and the Netherlands

	Description of barrier	United Kingdom			Netherlands			Comparison UK-NL		
		Rank	n=	Mean	Rank	n=	Mean	Rank difference	Mean difference	Sig. Mann-Whitney test
Q25	Difference in short term thinking of politicians and long term impacts of climate change	1	146	3.42	1	261	3.26	0	0.15	.04*
Q33	Little finance reserved/available for implementation	2	142	3.21	4	256	2.81	-2	0.4	.00*
Q32	More urgent policy issues need short term attention	3	138	3.04	6	258	2.78	-3	0.26	.00*
Q15	Existing policy does not include long term impacts of climate change	4	145	3.01	9	259	2.65	-5	0.37	.00*
Q54	Unclear social costs and benefits of adaptation measures	5	144	3	3	259	2.87	2	0.13	0.14
Q21	Awareness of the need to adapt	6	144	3	5	262	2.78	1	0.22	.01*
Q66	Policy makers have different interests than climate adaptation	7	139	2.96	13	257	2.58	-6	0.38	.00*
Q2	Conflicting interests between involved actors	8	145	2.88	2	260	2.88	6	0	0.91
Q16	It is difficult to determine the effectiveness of climate adaptation strategies	9	144	2.86	12	259	2.61	-3	0.25	.00*
Q42	Few policy makers who want to invest time and money	10	140	2.81	16	254	2.54	-6	0.27	.00*
Q45	Difficult international climate negotiations	11	141	2.79	19	251	2.45	-8	0.34	.00*
Q30	Passive attitude of many policy makers	12	142	2.79	10	258	2.63	2	0.16	0.09
Q60	Little societal support to develop and implement adaptation strategies	13	140	2.79	32	254	2.34	-19	0.45	.00*
Q6	Governments at higher levels do not take climate adaptation seriously enough	14	146	2.78	49	258	2.13	-35	0.65	.00*
Q20	Dependence on other actors in decision making	15	141	2.77	8	255	2.66	7	0.11	0.28
Q13	No safeguarding of adaptation for future policy making	16	131	2.76	7	247	2.71	9	0.05	0.76
Q53	Little coordination between governments from different levels about adaptation measures	17	136	2.74	14	252	2.58	3	0.15	.09*
Q57	Policy makers do not express a sense of urgency	18	145	2.73	20	248	2.45	-2	0.28	.00*
Q11	There is no shared understanding what an adaptation strategy should include	19	146	2.71	11	255	2.62	8	0.09	0.27

Q59	Fear of taking decisions that might have negative consequences in the future	20	142	2.69	17	241	2.51	3	0.18	0.09
Q12	Too few people take the initiative to start adapting	21	143	2.69	31	256	2.34	-10	0.35	.00*
Q3	International climate adaptation policy is not decisive enough	22	140	2.67	37	252	2.27	-15	0.4	.00*
Q55	There is too little applied research on climate adaptation	23	140	2.64	35	246	2.28	-12	0.36	.00*
Q39	Little expertise within governments to develop adaptation strategies	24	138	2.64	44	252	2.21	-20	0.43	.00*
Q40	There are no laws or regulations that enforces the development of adaptation strategies	25	137	2.62	36	252	2.27	-11	0.35	.00*
Q34	There are no societal norms and values that lead to climate adaptation	26	136	2.61	46	238	2.17	-20	0.44	.00*
Q1	Unclear who is responsible for climate adaptation	27	147	2.61	15	259	2.58	12	0.03	0.68
Q49	There are no clear criteria for what effective adaptation is	28	144	2.59	25	260	2.4	3	0.19	.04*
Q26	Conflicting opinions about what the best adaptation strategy is	29	143	2.59	28	254	2.37	1	0.22	.00*
Q5	Unclear who decides about climate adaptation	30	145	2.58	26	253	2.39	4	0.19	.03*
Q37	Lack of communication between involved actors	31	140	2.57	33	245	2.31	-2	0.26	.00*
Q35	Lack of central government steering in climate adaptation	32	144	2.57	27	256	2.38	5	0.19	0.1
Q67	Nobody has a complete overview of what is happening	33	138	2.57	34	251	2.3	-1	0.27	.01*
Q56	Conflicting perspectives on future climate change	34	140	2.56	29	260	2.37	5	0.19	.05*
Q14	Difficult to integrate adaptation into other policy domains	35	143	2.55	50	255	2.11	-15	0.44	.00*
Q50	Conflicting opinions between governmental organisations about the need to adapt	36	139	2.53	18	252	2.48	18	0.05	0.66
Q36	Media only reports negatively on climate change	37	143	2.52	53	252	2.01	-16	0.51	.00*
Q28	Limited role of private organisations in the policy process	38	138	2.51	41	250	2.23	-3	0.28	.00*
Q17	Long term impacts of climate change provide little guidance for action	39	144	2.51	48	248	2.13	-9	0.38	.00*
Q52	Hidden agendas of politicians	40	118	2.51	22	232	2.41	18	0.1	0.46
Q47	Uncertainties about climate change are not communicated clearly enough	41	142	2.5	38	257	2.26	3	0.24	.00*
Q65	Too little knowledge about the impacts of climate change	42	143	2.48	43	259	2.23	-1	0.25	.01*
Q38	Required knowledge is too dispersed and insufficiently available	43	139	2.45	47	255	2.16	-4	0.29	.00*

Q41	Conflicting opinions of involved actors about what adaptation comprises	44	139	2.44	42	253	2.23	2	0.21	.01*
Q7	Little confidence that climate adaptation will prove successful	45	142	2.39	60	241	1.82	-15	0.57	.00*
Q64	Unclear division of responsibilities between governments	46	133	2.39	23	253	2.4	23	-0.01	0.93
Q27	It is unclear who should be involved in climate adaptation	47	142	2.39	55	256	1.93	-8	0.46	.00*
Q29	Recent climate scandals in the media – 'climate gate'	48	146	2.37	24	257	2.4	24	-0.03	0.86
Q23	Unclear who within government is taking the lead on adaptation	49	144	2.35	30	254	2.35	19	0	0.83
Q61	Traditional solutions limit the development of new climate adaptation strategies	50	124	2.34	40	245	2.23	10	0.11	.26*
Q19	Temporary presence of climate change in politics	51	140	2.33	21	255	2.45	30	-0.12	0.16
Q44	Insufficient time to get involved in climate adaptation	52	135	2.33	63	252	1.73	-11	0.6	.00*
Q58	Climate-fatigue in policy making	53	141	2.31	39	244	2.25	14	0.06	0.52
Q9	Little political attention to climate change	54	145	2.3	45	260	2.19	9	0.11	0.35
Q63	Existing National laws and legislation on climate sensitive policy domains	55	122	2.21	54	230	1.94	1	0.27	.05*
Q24	Different policy domains work simultaneously on adaptation	56	140	2.19	52	255	2.02	4	0.17	.02*
Q51	Existing European laws and legislation on climate sensitive policy domains	57	110	2.19	56	216	1.91	1	0.28	.02*
Q31	Climate discussion includes too much jargon	58	144	2.17	57	255	1.9	1	0.27	.00*
Q10	Insufficient scientific research on climate adaptation	59	147	2.17	61	257	1.75	-2	0.42	.00*
Q4	Climate adaptation offers little recognition to those involved	60	133	2.1	51	243	2.07	9	0.03	0.68
Q8	Few technological measures available to adapt	61	143	1.99	67	255	1.41	-6	0.58	.00*
Q62	Climate change adaptation is dominated by water management and land use planning	62	126	1.95	59	248	1.88	3	0.07	0.36
Q46	Many people think they are climate experts	63	140	1.94	62	256	1.73	1	0.21	.00*
Q22	Labelling traditional measures as climate adaptation strategies	64	129	1.9	58	237	1.89	6	0.01	0.88
Q18	Few adaptation options available	65	142	1.79	65	256	1.57	0	0.22	.00*
Q48	Too many people are involved in developing adaptation strategies	66	136	1.68	64	251	1.67	2	0.01	0.82
Q43	People with different backgrounds participate in adaptation discussions	67	131	1.48	66	255	1.48	1	0	0.96

Part B Respondent characteristics

	United Kingdom (UK)		The Netherlands (NL)	
General information				
Survey invitations (N=)	827		890	
Returns (N=)	268		432	
Completed returns (N=)	149		264	
Response rate (%)	18%		30%	
Sample information	*Cases (N=)*	*Valid percentage*	*Cases (N=)*	*Valid percentage*
Gender				
Male	99	66%	200	76%
Female	50	34%	64	24%
Age (average)				
<30 years	25	16,8%	15	5,7%
31-40 years	46	30,9%	64	24,2%
41-50 years	42	28,2%	77	29,2%
51-60 years	28	18,8%	85	32,2%
>61 years	8	5,4%	23	8,7%
Time spent on adaptation				
None	12	8,1%	10	3,8%
<25% (1 day or less)	64	43,0%	127	48,1%
25-50% (2 days per week)	28	18,8%	56	21,2%
50-75% (3 days per week)	16	10,7%	33	12,5%
>75% (more than 3 days per week)	29	19,5%	38	14,4%
Response groups				
Policy	81	55,5%	103	39,0%
Science	22	15,1%	79	29,9%
Private	39	26,7%	62	23,5%
Other	4	2,7	20	7,6%
Scales				
International	16	10,7%	42	15,9%
National	56	37,6%	95	36,0%
Regional (county, province)	35	23,5%	51	19,3%
Water board	5	3,4%	29	11,0%
Local (municipal)	25	16,8%	27	10,2%
Individual	5	3,4%	1	0,4%
Other	6	4,0%	3	1,1%
None	1	0,7%	16	6,1%
Sectors				
Biodiversity and ecosystems	16	11,0%	4	1,5%
Climate and energy	44	30,1%	42	16%
Land use planning	14	9.60%	32	12%
Water management	15	10.30%	108	41%

Part C: Invitation letter to participate in survey research

Dear *name respondent,*

In an effort to understand the barriers in the policy process of climate change adaptation, Wageningen University (the Netherlands) in close cooperation with the UK Climate Impacts Programme is conducting a research study with a selected target group of participants.

You were selected because of your experiences in climate change adaptation and therefore we would like to invite you to participate in the survey 'Barriers in the policy process of climate adaptation'

We estimate that it will take you approximately 15 minutes to complete the survey.

Your input is very important to us. All replies are anonymous and will be treated confidentially.

To start the survey please click here *Survey link*

We would appreciate your response by *Deadline*

If you do not wish to participate please click here. If you have any questions about this study or would prefer to complete a paper survey please contact Robbert Biesbroek at *XXXX* (the Netherlands) or by email robbert.biesbroek (at) wur.nl

Thank you in advance – your feedback is very valuable to us.

Yours faithfully,

Dr. C.C. (Chris) West,
Director of the UK Climate Impacts Programme

Prof. Dr. P. (Pavel) Kabat
Chair and full professor at the Earth System Science and Climate Change Group, Wageningen University, the Netherlands
Scientific director of the Climate Changes spatial Planning research programme

Prof. Dr. C.J.A.M. (Katrien) Termeer
Chair and full professor at the Public Administration and Policy Group, Wageningen UR, the Netherlands

G.R. (Robbert) Biesbroek, MSc.
PhD candidate at the Earth System Science and Climate Change Group and the Public Administration and Policy Group, Wageningen University, the Netherlands

Part D: Online survey instrument (English version)

Barriers in the policy process of climate adaptation

Introduction

An increasing number of adaptation strategies are being developed and implemented to reduce the impacts of climate change. However, in the policy process of adapting to climate change several barriers can occur. These barriers can hamper the development or implementation and even prevent the adaptation from taking place. We describe adaptation strategies as all initiatives, projects and measures to reduce the impacts of climate change. In this survey we will ask several questions about your personal experiences of these barriers in the policy process of climate adaptation.

The survey will take approximately 15 minutes.

For further questions please contact Robbert Biesbroek, robbert.biesbroek (at) wur.nl

Thank you in advance for your participation.

Perspectives on climate change

1 Which of the following statements best describes your opinion about current climate change?
- □ Climate change is constructed by scientists and is not true
- □ Climate change is a natural phenomenon that human activities have little influence on
- □ Climate change is a natural phenomenon that is strengthened by human activities
- □ Climate change is only caused by human activities

2 Which of the following statements best describes your opinion about climate adaptation?
- □ Climate change adaptation is not necessary because people will adapt autonomously
- □ Climate change adaptation is perhaps necessary but let us wait to see how climate change will progress
- □ Climate change adaptation is necessary in short-term to prepare society for the impacts of climate change

3 Which phrase will best complete the following sentence: "In the policy process on climate adaptation there are…"
- □ only barriers
- □ many barriers and only few opportunities
- □ just as much barriers as opportunities
- □ many opportunities and only few barriers
- □ only opportunities

Involvement

4 Could you briefly indicate in which projects/processes on climate adaptation you are involved?

Open question:

Three Barriers

5 What do you consider to be the three most important barriers in the policy process of climate adaptation?

Open question:

Barriers in the policy process of climate adaptation (1 of 3)

The purpose of the following questions is to find out what you consider to be the most important barriers in the policy process of climate adaptation. We consider barriers as all factors that negatively influence the policy process. We make a distinction between very large barriers, large barriers, small barriers and no barriers. You will be asked to fill in three lists with possible factors that could influence the policy process of climate change adaptation.

6 Please indicate as to what extend you consider the following factors to be a barrier

	Very large barrier	Large barrier	Small barrier	No barrier	No opinion
Unclear who is responsible for climate adaptation					
Conflicting interests between involved actors					
International climate adaptation policy is not decisive enough					
Climate adaptation offers little recognition to those involved					
Unclear who decides about climate adaptation					
Governments at higher levels do not take climate adaptation seriously enough					
Little confidence that climate adaptation will prove successful					
Few technological measures available to adapt					
Little political attention to climate change					

Insufficient scientific research on climate adaptation					
There is no shared understanding what an adaptation strategy should include					
Too few people take the initiative to start adapting					
No safeguarding of adaptation for future policy making					
Difficult to integrate adaptation into other policy domains					
Existing policy does not include long term impacts of climate change					
It is difficult to determine the effectiveness of climate adaptation strategies					
Long term impacts of climate change provide little guidance for action					
Few adaptation options available					
Temporary presence of climate change in politics					
Dependence on other actors in decision making					
Awareness of the need to adapt					
Labeling traditional measures as climate adaptation strategies					

Barriers in the policy process of climate adaptation (2 of 3)

The purpose of this section is to find out what you consider to be the most important barriers in the policy process of climate adaptation. We consider barriers as all factors that negatively influence the policy process.

7 Please indicate as to what extend you consider the following factors to be a barrier

	Very large barrier	Large barrier	Small barrier	No barrier	No opinion
Unclear who within government is taking the lead on adaptation					
Different policy domains work simultaneously on adaptation					
Difference in short term thinking of politicians and long term impacts of climate change					
Conflicting opinions about what the best adaptation strategy is					
It is unclear who should be involved in climate adaptation					
Limited role of private organisations in the policy process					
Recent climate scandals in the media – 'climate gate'					
Passive attitude of many policy makers					
Climate discussion includes too much jargon					
More urgent policy issues need short term attention					
Little finance reserved/available for implementation					
There are no societal norms and values that lead to climate adaptation					
Lack of central government steering in climate adaptation					

Media only reports negatively on climate change					
Lack of communication between involved actors					
Required knowledge is too dispersed and insufficiently available					
Little expertise within governments to develop adaptation strategies					
There are no laws or regulations that enforces the development of adaptation strategies					
Conflicting opinions of involved actors about what adaptation comprises					
Few policy makers who want to invest time and money					
People with different backgrounds participate in adaptation discussions					
Insufficient time to get involved in climate adaptation					

Barriers in the policy process of climate adaptation (3 of 3)

The purpose of this section is to find out what you consider to be the most important barriers in the policy process of climate adaptation. We consider barriers as all factors that negatively influence the policy process.

8 Please indicate as to what extend you consider the following factors to be a barrier

	Very large barrier	Large barrier	Small barrier	No barrier	No opinion
Difficult international climate negotiations					
Many people think they are climate experts					
Uncertainties about climate change are not communicated clearly enough					
Too many people are involved in developing adaptation strategies					
There are no clear criteria for what effective adaptation is					
Conflicting opinions between governmental organisations about the need to adapt					
Existing European laws and legislation on climate sensitive policy domains					
Hidden agendas of politicians					
Little coordination between governments from different levels about adaptation measures					
Unclear social costs and benefits of adaptation measures					
There is too little applied research on climate adaptation					
Conflicting perspectives on future climate change					
Policy makers do not express a sense of urgency					
Climate-fatigue in policy making					
Fear of taking decisions that might have negative consequences in the future					

Little societal support to develop and implement adaptation strategies					
Traditional solutions limit the development of new climate adaptation strategies					
Climate change adaptation is dominated by water management and land use planning					
Existing National laws and legislation on climate sensitive policy domains					
Unclear division of responsibilities between governments					
Too little knowledge about the impacts of climate change					
Policy makers have different interests than climate adaptation					
Nobody has a complete overview of what is happening					

Propositions

9 Please indicate how much you agree with the following propositions

	Agree strongly	Agree	Neutral	Disagree	Disagree Strongly
Uncertainty on climate change is often used to prevent taking decisions in the short term					
Uncertainty about knowledge is not the biggest barrier, but uncertainties in the policy process					
Everybody likes to participate until things have to be implemented					
Policy makers purposefully create barriers to realise their own agenda					
Extreme events (droughts, floods) are necessary to start developing adaptation strategies					

Other barriers

10 Are there any barriers which we have not mentioned but are, according to your experiences, barriers for the development and implementation of climate adaptation strategies?

Open question:

Closing

To finalise this survey, we would like to ask you to answers some questions regarding your personal data and working activities. The answers are for analytical purposes only and will not be distributed

11 In an average week, how much of your time are you involved in climate adaptation projects?
Please select one of the following answers:

- □ None
- □ <25% (1 day per week)
- □ 20-50% (2 days per week)
- □ 50-75% (3 days per week)
- □ >75% (more than 3 days per week)

12 In which of the following sectors are you most active? Please select one of the options below:

- □ Aquaculture and fisheries
- □ Biodiversity and ecosystems
- □ Forestry
- □ Health
- □ Infrastructure/construction
- □ Climate and energy
- □ Coastal zone
- □ Agriculture
- □ Land use
- □ Nature
- □ Tourism
- □ Transport
- □ Insurances
- □ Water management
- □ Other:

13 At which of the following levels are you most active? Please select one of the options below:

- □ International
- □ National
- □ County
- □ River basin
- □ Municipal
- □ Individual
- □ None
- □ Other:

14 Within which of the following organisations are you most active? Please select one of the options below:

- □ Non-governmental organisation
- □ Political party
- □ County
- □ Water board
- □ Municipality
- □ Research institute
- □ Consultancy
- □ Other:

15 Which of the following function descriptions best fits with most of your activity?
- □ Assistant policy maker
- □ Junior policy maker
- □ Senior policy maker
- □ Department manager/team leader
- □ Director
- □ Project coordinator
- □ Project manager
- □ Junior researcher
- □ Senior researcher
- □ Other:

16 What is your age category? Please select one of the options below:
- □ 30 years or younger
- □ 31-40 years
- □ 41-50 years
- □ 51-60 years
- □ 61 years or older

17 What is your gender?
- □ Male
- □ Female

Results

Thank you for filling in the questionnaire. Would you like to be informed about the results of the study? Please select one of the following options:
- □ No
- □ Yes, please keep me informed about the research results

Remarks

Do you have any remarks following this questionnaire? Please fill in your answer below:

Open question:

Summary

This dissertation explores the reasons why the governance of climate change adaptation often proves difficult in practice. For centuries mankind has adapted to the natural variability of the climate system, for example by building dikes. As a consequence of human influence on the climate system by emitting of greenhouse gasses, additional adaptation efforts are likely to be needed in the future. Taking proactive decisions and implementing measures based on projected impacts of future climate change, or what can be called 'intentional adaptation', proves to be problematic in practice. In the academic literature the difficulties in realizing climate change adaptation are addressed under the heading 'barriers to adaptation'. However, why adaptation proves to be problematic, has hardly been explored. The aim of this dissertation therefore is to gain a better understanding of the barriers to climate change adaptation in order to support policy practice in overcoming them. The three research questions central to this dissertation are:

- How can barriers in the governance of adaptation be defined and conceptualised?
- What barriers to adaptation do actors encounter in policy practice?
- How can these theoretical and empirical insights be used to develop a conceptual framework to analyse barriers in the governance of adaptation?

The adopted research perspective is that of the realist where different theories are combined eclectically and multiple quantitative and qualitative methods for data collection and analysis are used to gain understanding in the research objective. This cumulative dissertation consists of six scientific publications that conjointly contribute in addressing the three research questions.

Chapter 2 analyses how European countries have adapted to the impacts of climate change and which barriers they encountered in the process. Central in this chapter are the so-called National Adaptation Strategies (NAS). A NAS is a cross sectoral vision developed and formally adopted by the national government with the aim of reducing the impacts of climate change. The NASs of seven European countries that have adopted a NAS in 2008 were analysed: Denmark, Finland, France, Germany, the

Netherlands, Spain, and the United Kingdom. Using document analysis and interviews, the strategies are compared based on six dimensions: (1) the factors that drive the development and implementation of the NAS. (2) the scientific and technical measures needed to make the development and implementation of the adaptation policy possible. (3) informing and communicating about climate change adaptation. (4) the existing and new forms of multi-level governance to coordinate and implement adaptation policy. (5) how the integration of adaptation in existing sectors is organized. (6) how the strategy is implemented and how the progress of adaptation policy is monitored and evaluated. The results show that the role of NASs differs between countries, but they play a vital role in placing adaptation high on the political agenda. Considerable overlap exists between the different countries, not only in the way the strategies came about and the measures they propose, but also in terms of the challenges countries are facing when designing and implementing climate change adaptation strategies. Particularly a lack of stakeholder involvement, a lack of coordination instruments, unclear responsibilities and a lack of specialised knowledge were identified as key barriers to adaptation.

Chapter 3 investigates the current state of the scientific knowledge on barriers to climate change adaptation. Systematic review methods are used to identify and assess 81 scientific publications. The analysis shows that the scientific debate on barriers to adaptation has intensified under the influence of the Intergovernmental Panel on Climate Change (IPCC) since 2009. By using qualitative research methods such as interviews and case studies these 81 studies aim to identify which barriers have emerged in the practice of climate change adaptation. The results show that a large diversity exists in the reported barriers to adaptation. The most important barriers are institutional and social barriers. Governments play an important role both in creating and (helping to) overcome barriers to adaptation. The results show that the listed barriers are not clearly linked to the characteristics of climate change adaptation, but may constitute recurring barriers that can emerge in addressing complex environmental issues. The scientific literature emphasises the role of contextual conditions in determining which barriers emerge when and how, making a comparison between the findings more complicated. Despite the increase in the number of articles on barriers to adaptation only a few studies have focussed on removing barriers to adaptation. The focus in most studies is on the 'which' question, instead of the more analytical 'how' and 'why' questions. Despite the numerous barriers to adaptation, a dominant scientific discourse can be identified when it comes to how barriers are understood. As demonstrated in chapter 7, this scientific discourse strongly influences how barriers are defined, which methods and theories are used to investigate barriers, and how the findings are interpreted.

The central question in chapter 4 is what Dutch actors involved in climate change adaptation experience as the most important barriers to adaptation. Special attention is given to the differences between actors from administrative scales, sectors and actor groups. In this chapter a list of frequently mentioned barriers found identified in chapter 3 was used to construct an online survey. In the summer of 2010, 264 actors – policy makers, scientists, consultants and other private actors –completed the online

survey and scored the relative importance of 67 prelisted barriers to adaptation. A feedback workshop with a number of survey participants allowed us to interpret and discuss the findings of the survey. The analysis shows that barriers representing conflicting time scales are considered to be the most important cluster of barriers to adaptation, with the conflict between short term thinking of politicians and the long term issue of climate change as the statistically significant most important barrier to adaptation. Other important barriers include the fragmentation between levels of government, unclear tasks and responsibilities, conflicting values and interest, and lack of financial resources. The findings also show that the barriers are most visible at the local level where concrete adaptation measures have to be implemented.

Chapter 5 reports on a comparative analysis of the survey findings from the Netherlands and the results of the same survey implemented in the United Kingdom. The central research question in this chapter is broader than the one in chapter 4: do the differences in how the governance of adaptation is designed in both countries influence what actors consider to be the key barriers to climate change adaptation? In the marked oriented United Kingdom emphasis is on creating a formal policy regime that focusses on the full bandwidth of climate change adaptation. An extensive set of policy instruments is designed to enable local and regional level adaptation to climate change. In the Netherlands the existing institutional structures are used to integrate adaptation into existing policy domains. The focus is on long term flood protection and freshwater supply. An important difference between the two countries is also that in the United Kingdom barriers to adaptation are an explicit part of climate change adaptation policy, while barriers to adaptation are hardly mentioned in the Netherlands and there the focus is more on the opportunities. The results show a remarkable consensus about the key barriers to climate change adaptation in both countries. Of the 20 most important barriers identified in the United Kingdom, 18 are considered the most important in the Netherlands as well. Like in the Netherlands, respondents from the UK considered the temporal discordance as the significantly most important barrier to adaptation and in both countries the respondents from local levels score the barriers as more severe than respondents from higher administrative levels. A difference between the Netherlands and the UK is that respondents from the UK scored all barriers to adaptation as more severe than respondents from the Netherlands. The study provides no conclusive answers why this systematic difference has occurred. The results suggest that institutional context is important, but does not determine what actors experience as the most important barriers to climate change adaptation.

Chapter 6 starts from one of the findings from chapter 3, namely that there is a dominant discourse in the scientific discussion on barriers to climate change adaptation. The chapter uses the idea of analytical multiplicity: a societal issue is studied with different analytical lenses which leads to different insights about the issue and different ways how to address this issue are proposed. In chapter 6, three perspectives are presented on the governance of climate change adaptation: the optimist, the realist and the pessimist perspective. The large majority of the scientific discussions starts from the optimist perspective; in this discourse there is the belief

that climate change is solvable by making the right choices in terms of arrangements, instruments, resources and actors. Encountering barriers is seen as something unique and undesirable that needs to be prevented or solved by making correct interventions. The two other perspectives are hardly used in the discussion on barriers to climate change adaptation. The three perspectives can be operationalized in four analytical lenses: the problem solving lens, the conflicting values and interest lens, the institutional interaction lens and the structural constraints lens. The inter-ministerial program "Spatial adaptation to climate change (ARK, 2006-2010)" is analysed through each of the four analytical lenses to gain insights in the barriers to designing and implementing the program. The analysis shows that each lens leads to different and sometimes conflicting insights about cause and effect. Making the choice for one analytical lens is often not self-evident, but it influences the interpretation of the research findings and the concrete recommendations that are made. This chapter demonstrates that increasing variety in analytical lenses leads to better understanding of the ways to address the barriers.

Chapter 7 aims to develop an alternative for the existing analytical frameworks that are designed from an optimist perspective. In this chapter, the realist perspective is adopted where it is assumed that barriers are an integral part of complex governance processes. It is assumed that what actors define as barriers to adaptation are constructions of a simplified reality which is insufficient to explain the consequences of the barrier for the governance process or its outcomes. The proposed analytical perspective searches for the underlying social mechanisms that explain how impasses emerge in climate change adaptation projects. Social mechanisms are, in contrast to the static and negative connotation associated with the concept of barriers, process oriented. A mechanism consists of two or more actors that interact about an issue at hand. When the process is pushed in a certain direction as a consequence of the interaction, leading to an impasse, it can be considered an blocking mechanism. Understanding social mechanisms not only requires a different way of thinking but also other research methods to identify them. This chapter therefore introduces the so-called process tracing methodology. The mechanismic framework is used to analyse the attempts of the city of Rotterdam to develop the first water plaza. Water plazas are the highly urbanised equivalent of a wadi where rainwater can be temporarily stored during times of intensive rainfall which is then slowly discharged to surface water or infiltrates into the soil. By dividing the governance process of realising the first Water Plaza in seven decision making rounds, three mechanisms were identified that conjointly explain why the first attempt to realise a water plaza failed: conflict infection, frame polarization, and the risk innovation mechanism. The proposed framework not only offers a different scientific perspective but also allows for more strategic interventions than the simplifying frameworks used so far.

Chapter 8 brings the most important findings together in a synthesis. This dissertation has shown that despite some uniqueness attributed to barriers to adaptation, only temporal discordance is seen as a key barrier to adaptation, both empirically and theoretically. Many of the other barriers are also found in other complex societal issues. However, the relative importance of these commonly found barriers is

influenced by the conducive conditions of climate change adaptation. The concept of barriers fulfils an important role in the governance of climate change adaptation. In practice, barriers are an important part in the process of constructing meaning and communicating about cause and effect. and the construction of barriers offers an evaluative framework with perspectives for future action. The shared ideas about the most important barriers to adaptation suggest that actors delve from an existing repertoire of barriers that are not necessarily related to climate change adaptation. From a scientific perspective, the concept of barriers is helpful to measure what actors experience as barriers to adaptation. This perspective has been central in the first part of this dissertation. In the second part, it is assumed that we might have an idea what the most important barriers are, but that listing barriers is not sufficient for finding ways to deal with the barriers because the solutions to the most important barriers are often too simplistic ("lack of financial resources" requires "more financial resources"). Making meaningful recommendations requires a better understanding of the cause-effect relationships in the adaptation process. The mechanismic framework proposed in chapter 7 suggests that what actors identify as the barriers to adaptation should not be considered as the endpoint of the analysis since these are merely simplifications of reality, but rather as starting point for in-depth analysis of the underlying mechanisms. The most important recommendation of this dissertation therefore is to test and develop the mechanismic view and search for recurring mechanisms that emerge under the conducive conditions of long term climate change impacts. This will not only advance our scientific understanding and create a new perspective in the scientific study of the governance of climate change adaptation, but also offers opportunities for more strategic interventions in policy practice.

Samenvatting

Waarom is het ontwikkelen en uitvoeren van klimaatadaptatie in de praktijk vaak lastig? Op deze vraag richt dit promotieonderzoek zich. Sinds mensheugenis nemen we maatregelen om ons aan te passen aan de variatie van het natuurlijke klimaatsysteem, bijvoorbeeld door het bouwen van dijken. Als gevolg van menselijke broeikasgasemissies verandert het natuurlijke klimaatsysteem nu sneller en onvoorspelbaarder en lijken extra inspanningen in de toekomst noodzakelijk. Het voortijdig nemen van beslissingen en het implementeren van maatregelen op basis van geprojecteerde toekomstige klimaatverandering, ofwel intentionele klimaatadaptatie, blijkt in de praktijk echter problematisch te zijn. Over de oorzaken hiervan, die in de wetenschappelijke literatuur worden beschreven onder de noemer 'barrières voor klimaatadaptatie', is echter weinig bekend. Het doel van deze dissertatie is dan ook om beter inzicht te krijgen in de barrières voor klimaatadaptatie om daarmee de beleidspraktijk te helpen met deze barrières om te gaan.

De drie onderzoeksvragen die centraal staan in dit onderzoek zijn:

- Hoe kunnen barrières voor klimaatadaptatie worden gedefinieerd en geconceptualiseerd?
- Welke barrières komen actoren tegen in de governance van klimaatadaptatie?
- Op welke wijze kunnen deze theoretische en empirische inzichten worden gebruikt om een conceptueel raamwerk te ontwikkelen om de barrières in de governance van adaptatie te analyseren?

Het gehanteerde onderzoeksperspectief is dat van de realist, waarbij verschillende theorieën eclectisch worden gecombineerd, en kwantitatieve en kwalitatieve methoden van dataverzameling en analyse worden ingezet om tot betere inzichten te komen in de gestelde onderzoeksdoelstelling. Deze dissertatie is opgebouwd uit zes wetenschappelijke publicaties die gezamenlijk bijdragen aan het beantwoorden van de gestelde onderzoeksvragen.

In hoofdstuk 2 wordt ingegaan op de vraag hoe Europese landen zich aanpassen aan de gevolgen van klimaatverandering en welke uitdagingen ze daarbij tegen komen. Centraal in het hoofdstuk staan de zogenoemde Nationale Adaptatie Strategieën (NAS). Een NAS is een sector overstijgende visie die door de nationale overheid is opgesteld en formeel is geadopteerd om de kwetsbaarheden ten aanzien van de gevolgen van klimaatverandering te verminderen. In hoofdstuk 2 zijn de NAS van zeven Europese landen die in 2008 een NAS hadden geadopteerd geanalyseerd: Denemarken, Finland, Frankrijk, Duitsland, Nederland, Spanje en het Verenigd Koninkrijk. Door middel van document analyse en interviews zijn de strategieën vergeleken op zes verschillende dimensies: (1) de factoren die de ontwikkeling van de NAS stimuleren; (2) de wetenschappelijke en technische maatregelen om de ontwikkeling en uitvoering van het adaptatiebeleid mogelijk te maken; (3) het informeren en communiceren over het klimaatadaptatievraagstuk; (4) de bestaande en nieuwe vormen van sturing om nationaal klimaatadaptatiebeleid te coördineren en implementeren; (5) de afstemming en integratie van klimaatadaptatie met andere beleidsvelden; (6) hoe de strategie wordt geïmplementeerd en hoe de voortgang wordt gemonitord en geëvalueerd. De bevindingen laten zien dat de rol van de NAS sterk verschilt tussen de verschillende landen, maar dat de NAS in alle gevallen een belangrijke rol speelt in het politiek agenderen van klimaatadaptatie. Er zijn ook overeenkomsten tussen de zeven landen, niet alleen in hoe de strategieën tot stand zijn gekomen en hun inhoudelijke basis, maar ook in de uitdagingen die landen tegenkomen wanneer dergelijke strategieën worden ontwikkeld en geïmplementeerd. Belangrijke barrières die werden gevonden zijn gebrek aan betrokkenheid van gebruikers, gebrek aan instrumenten voor coördinatie, onduidelijke verantwoordelijkheden en gebrek aan specialistische kennis.

In hoofdstuk 3 wordt dieper ingegaan op de vraag wat de huidige stand van de wetenschappelijke kennis over barrières voor klimaatadaptatie is. Om dit inzichtelijk te maken is een systematische methode gebruikt om 81 wetenschappelijke publicaties te identificeren en te beschouwen. De analyse laat zien dat de wetenschappelijke discussie rondom barrières voor klimaatadaptatie na 2009, onder invloed van het vierde Intergovernmental Panel on Climate Change (IPCC) uit 2007, sterk is toegenomen. De nadruk in deze studies ligt op het achterhalen van welke barrières in het proces zijn opgetreden. Hierbij wordt vooral gebruik gemaakt van kwalitatieve methoden zoals interviews en casuïstiek. De resultaten laten zien dat er een grote diversiteit bestaat in welke barrières worden geïdentificeerd en hoe deze worden bestudeerd. De belangrijkste gerapporteerde barrières zijn institutioneel en sociaal van aard. Overheden spelen een belangrijke rol zowel in het creëren als in het doorbreken van barrières. De resultaten laten zien dat de barrières niet direct gekoppeld lijken te zijn aan de klimaatproblematiek, maar veel voorkomende problemen zijn in het adresseren van complexe maatschappelijke vraagstukken. In de wetenschappelijke discussies wordt een belangrijke rol toegedicht aan contextuele factoren: die bepalen wat, wanneer, en hoe een barrière optreedt. Dit bemoeilijkt een vergelijking tussen de kwalitatieve bevindingen en belemmert verdieping van de inzichten. Ondanks de sterk toegenomen aandacht voor barrières voor klimaatadaptatie zijn er maar weinig studies die zich richten op het doorbreken van

barrières. De nadruk ligt op identificerende 'wat' vraag, in plaats van de meer analytische 'hoe' en 'waarom' vragen. In de studies naar barrières voor klimaatadaptatie is er een dominant wetenschappelijke perspectief waar te nemen als het gaat om hoe barrières als concept worden beschouwd. Zoals wordt aangetoond in hoofdstuk 7 bepaalt het wetenschappelijke perspectief mede hoe barrières worden gedefinieerd, welke theorieën en methoden worden toegepast, en hoe de bevindingen worden geïnterpreteerd.

In hoofdstuk 4 staat de vraag centraal wat actoren die in Nederland betrokken zijn bij klimaatadaptatie daadwerkelijk ervaren als belangrijke barrières voor klimaatadaptatie. Daarbij wordt specifiek gekeken naar mogelijke verschillen in opvattingen tussen de actor groepen. Belangrijk vertrekpunt is daarbij de bevindingen van de systematische review uit hoofdstuk 3. Door middel van een online enquête hebben 264 actoren, dat wil zeggen betrokken beleidsmakers, wetenschappers, adviesbureaus, en andere private partijen, in de zomer van 2010 hun mening gegeven over de relatieve belangrijkheid van 67 barrières die veel werden genoemd in wetenschappelijke publicaties. Na een terugkoppelingsworkshop met een aantal participanten van de enquête zijn de verkregen inzichten uit de enquête verder verdiept. Uit de analyse blijkt dat conflicterende tijdschalen de belangrijkste groep aan barrières wordt gevonden, waarbij conflict tussen korte termijn denken van de politiek en lange termijn vraagstuk van klimaatverandering als de statistisch significant belangrijkste barrière werd gevonden. Daarnaast werden fragmentatie tussen overheidslagen, onduidelijkheid in taken en verantwoordelijkheden, conflicterende belangen en interesse, en gebrek aan financiële middelen als zeer belangrijke barrières genoemd. De bevindingen laten zien dat de barrières zwaarder wegen op de lokale schaalniveaus waar concrete adaptatiemaatregelen worden geïmplementeerd.

In hoofdstuk 5 wordt een vergelijkende analyse gemaakt tussen de resultaten van de Nederlandse enquête en de resultaten van eenzelfde enquête die is geïmplementeerd in het Verenigd Koninkrijk. De centrale onderzoeksvraag is echter breder: zijn de verschillen in hoe het bestuurlijke proces van klimaatadaptatie wordt georganiseerd van invloed op wat de actoren als belangrijkste barrières ervaren? In het markt-gedreven Verenigd Koninkrijk ligt veel nadruk op het creëren van een formeel institutioneel beleidsregime dat zich richt op de volledige breedte van de klimaatproblematiek. Er is een uitgebreide set aan (beleids)instrumenten ontworpen om maatschappelijke aanpassing op lokale en regionale niveaus mogelijk te maken. In Nederland worden vooral de bestaande institutionele configuraties gebruikt om klimaatadaptatie te integreren in de reeds bestaande beleidsdomeinen. De beleidsfocus is sterk gericht op de lange termijn waterveiligheidsvraagstukken. Een belangrijk verschil tussen beide landen is dat in het Verenigd Koninkrijk barrières een integraal onderdeel zijn in het beleid voor klimaatadaptatie, terwijl in de Nederlandse context mogelijke barrières nauwelijks een rol spelen en de nadruk vooral ligt op het benutten van kansen. De resultaten van de enquêtes laten een verassend beeld zien: er is een grote mate van consensus over wat de belangrijkste barrières voor klimaatadaptatie zijn tussen beide landen. Van de 20 hoogst scorende barrières in het

Verenigd Koninkrijk zijn er 18 overeenkomstig met Nederland. Ook in het Verenigd Koninkrijk wordt het lange termijn vraagstuk van klimaatadaptatie als belangrijkste barrière beschouwd en zijn het vooral de lagere schaalniveaus waar de barrières merkbaar zijn. Opmerkelijk is dat in het Verenigd Koninkrijk de barrières substantieel zwaarder worden ervaren dan in Nederland. Een eenduidige verklaring is daarvoor moeilijk te geven. De resultaten laten zien dat institutionele context een zekere invloed heeft, maar niet bepalend is voor wat actoren als belangrijke barrières ervaren.

Hoofdstuk 6 start met een bevinding uit hoofdstuk 3, namelijk dat er een dominant discours is in de wetenschappelijke discussies over barrières voor klimaatadaptatie. Het hoofdstuk start vanuit het idee dat eenzelfde maatschappelijk probleem beschouwd door verschillende analytische lenzen leidt tot verschillende inzichten over oorzaak en gevolg. In dit hoofdstuk worden drie perspectieven geschetst waarmee naar de governance van klimaatadaptatie kan worden gekeken: de optimist, de realist en de pessimist. De drie perspectieven worden geoperationaliseerd in vier analytische lenzen: de probleem oplossende lens, de conflicterende waarden en belangen lens, de institutionele interactie lens en de structurele belemmering lens. Het overgrote deel van de wetenschappelijke discussie vertrekt vanuit een 'optimist' perspectief; er wordt vooral van uit gegaan dat het klimaatvraagstuk oplosbaar is door de juiste keuzes te maken in de arrangementen, beleidsinstrumenten, middelen en betrokken actoren. Het tegenkomen van barrières wordt daarin als iets unieks en onwenselijks gezien dat ten allen tijde moeten worden voorkomen. De juiste ingrepen maken de barrières oplosbaar. De twee andere worden tot nu toe in de discussies rondom barrières voor klimaatadaptatie niet of nauwelijks gebruikt. Om inzichten te krijgen in de invloed van de verschillende lenzen is het opzetten en uitvoeren van het interministeriële programma 'Adaptatie Ruimte en Klimaat (ARK, 2006-2010)' geanalyseerd door alle vier de analytische lenzen. Uit de analyse blijkt dat iedere lens tot andere inzichten leidt die soms conflicteren. Het expliciet maken van de keuze voor een analytische lens is nog niet vanzelfsprekend, maar blijkt wel bepalend in het interpreteren van de onderzoeksbevindingen en het doen van concrete aanbevelingen. Het hoofdstuk laat zien dat het vergroten van de variëteit in analytische lenzen de mogelijkheid biedt tot betere inzichten te komen in het omgaan met de barrières.

In hoofdstuk 7 wordt gezocht naar een alternatief voor de bestaande analysekaders voor barrières die tot op heden vooral vanuit een optimist perspectief zijn opgesteld. In dit hoofdstuk wordt het in hoofdstuk 6 beschreven realist perspectief gehanteerd. Daarbij wordt ervan uitgegaan dat 'barrières' een integraal onderdeel vormen van bestuurlijke processen. Daarnaast wordt gesteld dat wat actoren als barrières construeren simplificaties van de werkelijkheid zijn en daarom in veel gevallen niet voldoende om inzicht te krijgen in de oorzaken van het vastlopen van een beleidsproces. In het voorgestelde analytische perspectief ligt de nadruk op het benoemen van de onderliggende sociale mechanismen die verklaren waarom in een klimaatadaptatie project beleidsimpasses ontstaan. Sociale mechanismen zijn proces georiënteerd in tegenstelling tot de statische en vaak negatieve connotatie die is verbonden aan het concept barrières. Een mechanisme ontstaat uit twee of meerdere

actoren die, ieder met bepaalde belangen en waarden, met elkaar in interactie gaan over de gestelde problematiek en de betreffende normen en waarden. Als gevolg van de interactie treden er veranderingen op die het proces in een bepaalde richting duwen. Wanneer dit leidt tot het vastlopen van het proces kan worden gesproken over een blokkerend mechanisme. Het duiden van de mechanismen vergt niet alleen een andere manier van denken, maar ook andere methoden om ze te identificeren. Daarom is in dit hoofdstuk de zogenaamde 'process tracing' methode geïntroduceerd. Dit mechanismische raamwerk is toegepast op de Rotterdamse pogingen om een allereerste waterplein te realiseren. Een waterplein is de hoogstedelijke equivalent van een wadi waar piekneerslag tijdelijk wordt geborgen en deels geïnfiltreerd in de bodem, deels vertraagd wordt afgevoerd naar het oppervlakte water. Door het opdelen van het bestuurlijke proces voor het realiseren van de waterpleinen in een zevental beslisronden zijn drie onderliggende sociale mechanismen gevonden die gezamenlijk verklaren waarom de eerste poging tot het realiseren van een waterplein mislukte: conflictbesmetting, framepolarisatie, en het risico-innovatie mechanisme. Het voorgestelde raamwerk biedt niet alleen een ander wetenschappelijk perspectief, maar ook mogelijkheden om strategischer te interveniëren in het adaptatieproces.

In hoofdstuk 8 zijn de belangrijkste bevindingen samengebracht. De dissertatie heeft laten zien dat, ondanks dat aan barrières voor klimaatadaptatie een bepaalde uniciteit wordt toegekend, enkel de lange termijn problematiek empirisch en theoretisch is verbonden aan het klimaatadaptatievraagstuk. Veel andere barrières worden ook gevonden in andere complexe beleidsvraagstukken. De relatieve belangrijkheid van deze barrières wordt mede bepaald door klimaatadaptatie als contextuele conditie. In de praktijk lijkt het construeren van barrières een belangrijk onderdeel te zijn in het bestuurlijke proces van klimaatadaptatie. Met het begrip barrières geven actoren betekenis aan oorzaken en gevolgen van een moeizaam beleidsproces. In de praktijk biedt het benoemen van barrières een evaluatief raamwerk met een duidelijk handelingsperspectief. De gedeelde opvatting wat de belangrijkste barrières voor klimaatadaptatie zijn in zowel Nederland als het Verenigd Koninkrijk geeft aan dat actoren een repertoire aan bestaande barrières gebruiken die niet specifiek zijn gebonden aan de context. Daarnaast is vanuit een wetenschappelijk perspectief het concept barrières behulpzaam om te 'meten' wat actoren als barrières ervaren. In de eerste hoofdstukken van deze dissertatie heeft vooral dit perspectief op barrières vooral centraal gestaan. In het tweede deel van de dissertatie wordt er van uit gegaan dat we nu beter weten wat actoren als belangrijkste barrières construeren, maar dat het benoemen van barrières niet direct resulteert in oplossingsrichtingen. De oplossing van veel genoemde barrières is vaak het tegenovergestelde van de barrière (bijvoorbeeld: 'gebrek aan geld' vergt 'meer geld'). Om tot betere aanbevelingen te komen is een beter inzicht in oorzaak en gevolg noodzakelijk. Het voorgestelde mechanismische raamwerk in hoofdstuk 7 stelt dat wat actoren als barrières noemen niet als eindpunt van de analyse moet worden beschouwd omdat dit simplificaties van een deelwerkelijkheid zijn. Het is eerder een vertrekpunt in de zoektocht naar de onderliggende mechanismen. De belangrijkste aanbeveling uit dit onderzoek is dan ook om het mechanismische perspectief verder te ontwikkelen en op zoek te gaan naar terugkerende mechanismen die optreden onder de condities van

klimaatadaptatie als lange termijn vraagstuk. Dit is niet alleen behulpzaam voor een betekenisvoller onderzoek naar de governance van klimaatadaptatie, maar biedt ook aanknopingspunten voor strategische interventies die actoren in de beleidspraktijk kunnen helpen.

Curriculum vitea

Robbert Biesbroek was born on 23rd of October 1983 in Bant, the Netherlands. After finishing Secondary school at the Hondsrug College, Emmen in 2001, he completed his Bachelor of Science in Landscape Architecture and Civil Engineering at van Hall Larenstein, Velp (2001-2005). He continued his studies with a Master of Science in Land Use Planning at Wageningen University (2005-2007). His Master thesis addressed the intertwinement of spatial planning and water management in the context of climate change adaptation. After graduation he continued to work at the Land Use Planning group for one year as researcher to explore the relationship between spatial planning and climate change adaptation.

In august 2008, he started his Ph.D. study at the Earth System Science and Climate Change group and the Public Administration and Policy group, both at Wageningen University. In the following five years he was involved in several projects on the governance of climate change adaptation, including for the Partnership for European Environmental Research, the Knowledge for Climate program, the Deltaprogram. In November 2013 he started as Associate Professor at the Public Administration and Policy group at Wageningen University where he continues to develop the mechanismic view in environmental governance, focussing specifically on the mechanisms for intentional change in boundary spanning issues, such as climate change, food security, and sustainable agriculture.

Selected refereed journal publications

Dupuis, J. and **G.R. Biesbroek** (in press) Comparing apples and oranges? The dependent variable problem in comparing and evaluating climate change adaptation policies, *Global Environmental Change* (DOI: 10.1016/j.gloenvcha.2013.07.022), 1-12

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C E R T I F I C A T E

The Netherlands Research School for the
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(SENSE), declares that

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born on 23 October 1983 in Bant, The Netherlands

has successfully fulfilled all requirements of the
Educational Programme of SENSE.

Wageningen, 27 January 2014

the Chairman of the SENSE board	the SENSE Director of Education
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The SENSE Research School declares that **Mr. Gijsbert Robbert Biesbroek** has successfully fulfilled all requirements of the Educational PhD Programme of SENSE with a work load of 47 ECTS, including the following activities:

SENSE PhD Courses

- Environmental Research in Context
- Research Context Activity: Organizing the European workshop "Europe adapts to climate change – science-policy interactions in national adaptation policy"
- Basic Statistics

Other PhD Courses

- Masterclass Public Administration
- Process Tracing Methodology
- Working with comparative survey data
- Scientific Writing
- Writing Grant Proposals
- Mobilising your Scientific Network
- Organizing and Supervising theses

Management and Didactic Skills Training

- Co-organizing *Working towards a sustainable 2061*, Young Scientist Session, Sixth International Symposium on Non-CO_2 Greenhouse Gases (NCGG-6): Science, Policy and Integration, 2-4 November 2011, Amsterdam, the Netherlands
- MSc Thesis supervision
- Internship supervision

Oral Presentations

- *'Barriers' as concept in the governance of climate change adaptation.* European Climate Change Adaptation conference, 18-21 March 2013, Hamburg, Germany
- *Barriers revisited: a processual framework to study barriers in the governance of adaptation.* Chameleon Research Workshop on Barriers to Adaptation to Climate Change, 18-21 September 2012, Berlin, Germany
- *Institutional governance barriers for the development and implementation of climate adaptation strategies.* International Human developments Program conference "Earth System Governance: People, Places, and the Planet", 2-4 December 2009, Amsterdam, the Netherlands
- *Europe adapts to climate change - Comparing National Adaptation Strategies.* Climate Impacts Research Coordination for a Larger Europe (CIRCLE) workshop , 17-18 June 2009, Budapest, Hungary

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ack of awareness or interest | limited funding | difficult to coordinate between departments and between county | lack of appropriate government guidance | insufficient staff (time) | other issues take higher priority | lack of ICT s
raining and skills of professionals | lack of legal frameworks to integrate adaptation | unclear division of responsibility | under appreciation of cultural values | loss of common property management | unfamiliarity with climate char
lack of public support/awareness | conflicting goals and trade-offs | backward looking regulatory regimes | coordination failures | limits on institutional authority | existing policies and schemes | short term goals over long term i
ulnerabilities | different worldviews and interests between scales | policy silos | operational staff are sceptical | dependency on individuals to see linkages | hierarchical system inhibits flexibility and innovation | routinization | rivaln
uality of policy, routine decision making | lack of local control | competing priorities | need for demonstrable impacts to act | no incentives | patchy high level political leadership | lack of political will | social and cultural inertia | com
lack of options for knowledge exchange | unintended consequences of measures | lack of technical ability to interpret information | costs of equipment | territorial budget constraints | scientific controversies over how to manag
raditional adaptive skills | lack of perceived behavioural control | the lack of place attachment | perceived program inadequacy | tokenism | the rebound effect | inflexible mechanisms and treaties | asymmetric power relationships b
hange | extraordinarily expensive adaptations | stationary as assumption for policy design | disconnection of policy and practice | engineering focussed social identity among decision makers | sticky policy | narrow defined policie
naking strategies | cultural subjugation | lack of opportunity to access political spheres | premature obsolescence | high mobility of staff | information filtering | exclusion of certain parties | lack of exposure to business sector | spiri
poor governance structures | increasing competition amongst actors | delegitimization | corruption | path dependency | ignorance | equitable access to information | institutional misfit | state level leadership | lack of risk spreadin
ublic memory | consolidate existing power structures | personalized learning rather than institutional learning | cultural pluralism and traditions | personal integrity | high levels of national adaptive capacity mask local vulnerabiliti
nclear who is responsible | unwillingness | wait-and-see-approach | lack of awareness or interest | limited funding | difficult to coordinate between departments and between county | lack of appropriate government guidance | in
overnment agencies | lack of national government support | lack of training and skills of professionals | lack of legal frameworks to integrate adaptation | unclear division of responsibility | Under appreciation of cultural values |
ocal expertise for dealing with the effects | cross level/sectoral conflicts | lack of public support/awareness | conflicting goals and trade-offs | backward looking regulatory regimes | coordination failures | limits on institutional autho
f political system | misfit between large scale intervention and local vulnerabilities | different worldviews and interests between scales | policy silos | operational staff are sceptical | dependency on individuals to see linkages | h
ommittees | need to work within existing programmes | lack of policy tools, quality of policy, routine decision making | lack of local control | competing priorities | need for demonstrable impacts to act | no incentives | patchy high
ecognition | lack of continuity challenges credibility | institutional fragmentation | lack of options for knowledge exchange | unintended consequences of measures | lack of technical ability to interpret information | costs of equipme
exibility | conflict over science versus traditional knowledge | erosion of traditional adaptive skills | lack of perceived behavioural control | the lack of place attachment | perceived program inadequacy | tokenism | the rebound effe