

## Coping with the wicked problem of climate adaptation across scales : The Five R Governance Capabilities

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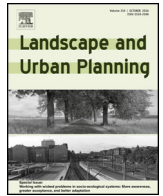
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## Research paper

# Coping with the wicked problem of climate adaptation across scales: The Five R Governance Capabilities



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## HIGHLIGHTS

- Adaptation to climate change across levels is a wicked problem of governance.
- Five governance capabilities are crucial for coping with wicked problems.
- Literature assumes that most conventional governance institutions are poorly equipped to enable innovative strategies.
- In contrast to the literature, we saw many examples of enabling institutional conditions.

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## ABSTRACT

Adapting social-ecological systems to the projected effects of climate change is not only a complex technical matter but above all a demanding governance issue. As climate change has all the characteristics of a wicked problem, conventional strategies of governance do not seem to work. However, most conventional governance institutions are poorly equipped to enable, or at least tolerate, innovative strategies. This paper analyses the various strategies used to cope with the wicked problem of climate adaptation across scales, and the institutional conditions that enable or constrain such strategies. For this, it relies on a theoretical framework consisting of five governance capabilities that are considered crucial for coping with wicked problems: reflexivity, resilience, responsiveness, revitalization and rescaling. This framework is used to analyse the governance of adaptation to climate change at three different levels: the United Nations Framework Convention on Climate Change and its activities to assist adaptation; the European Union and its climate adaptation strategy; and the Netherlands and its Delta Program. The results show that conventional governance strategies are rather absent and that mixtures of reflexive, resilient, responsive, revitalizing and rescaling strategies were visible at all levels, although not equally well developed and important. In contrast to the literature, we found many examples of enabling institutional conditions. The constraining conditions, which were also present, tend to lead more to postponement than to obstruction of decision-making processes.

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## 1. Introduction

Climate change is expected to have serious impacts on socio-ecological systems throughout the world (Rockström et al., 2009). These systems are facing the challenge of adapting to climate change, defined as “the adjustment in natural or human systems in response to actual or expected stimuli, which moderates harm or

exploits beneficial opportunities” (IPCC, 2007). Adaptation involves both infrastructural adjustments, such as flood defences or water storage capacity, and broader processes of societal change, such as adjusted land use planning or agricultural transitions. Because climate change exhibits many features of wicked problems (Rittel & Webber, 1973), it has been called a ‘wicked problem par excellence’ (Jordan, Huitema, van Asselt, Rayner, & Berkhout, 2010; Termeer, Dewulf, & Breeman, 2013). Adaptation is highly interconnected with many different policy fields as varied as water management, spatial planning, infrastructure, agriculture, energy, industry, nature and health. Important uncertainties persist about the nature and scale of risks, and the effectiveness of solutions (Dewulf, 2013). Adaptation has no “stopping rule” (Rittel & Webber, 1973, p. 162), particularly because the benefits of adaptation can

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take a considerable time to become evident, so it is very hard for actors to assess how much adaptation is enough. What is more, adaptation strategies can result in unintended dynamics in other parts of the socio-ecological system, often triggering new problems. Obviously, disagreement on both goals and facts makes climate adaptation prone to controversies which inevitably result in power plays, as stakes are high (Hoppe, 2011).

The wicked problem of adaptation to climate change poses considerable governance challenges. We define governance as the interactions between public and/or private actors ultimately aimed at addressing collective issues. It is now widely recognized in the literature that conventional governance approaches are not suitable for addressing wicked problems (Head, 2008; Rittel & Webber, 1973). To fill this gap, scholars have provided various alternative strategies (Duit & Galaz, 2008; Head, 2008; Koppenjan & Klijn, 2004; Roberts, 2000). When these strategies are used in practice, tensions often emerge between these new approaches and the formal and informal rules and values of existing governance systems, reflecting complex power configurations (Hendriks & Grin, 2007). In general, most conventional governance institutions are poorly equipped to enable, or at least tolerate, alternative strategies (Head & Alford, 2015; Hendriks & Grin, 2007). We assume that this is especially true in the case of climate adaptation, because most governance institutions date back to a time when the climate issue was of hardly any importance (Gupta, 2010).

To analyse these specific challenges of wicked problems, we developed the theoretical framework of the Five R Governance Capabilities (Termeer, Dewulf, Breeman, & Stiller, 2015; Termeer & Dewulf, 2014). A governance capability is defined as governance actors' ability to act wisely when facing wicked problems, and the ability of the governance system to enable such acting. The framework consists of five capabilities, namely, reflexivity, responsiveness, resilience, revitalization and rescaling, and of several characteristic strategies and enabling institutional conditions linked to each capability (Termeer & Dewulf, 2014; Termeer et al., 2015). This framework is expected to aid analysis for the following reasons. First, it addresses both the various governance strategies to cope with wicked problems and the hindering or enabling conditions of the governance institutions that constrain or encourage these strategies, as well as their mutual interplay. Second, it acknowledges that a single approach is not sufficient to cope with wicked problems. Therefore, it relies on a set of five governance capabilities, each based on a different strand of literature and addressing a different feature of a wicked problem. Third, it starts from the criterion of wisdom (Weick & Sutcliffe, 2001; Weick, 1984). One of the most demanding characteristics of wicked problems is that they cannot be solved once and for all and that people thus have to develop modes to live with, or even embrace, them (Rittel & Webber, 1973; Xiang, 2013). As a consequence, the usual criteria to objectively evaluate governance strategies and institutions, such as good and bad or effectiveness and efficiency, do not make sense (Churchmen, 1967; Rittel & Webber, 1973; Wexler, 2009). To cope wisely with wicked problems, one must acknowledge one's limited understanding, take multiple perspectives for analysis and interventions, be sensitive to institutional complexity, and recognize and appreciate small wins (Termeer et al., 2015; Weick & Sutcliffe, 2001; Weick, 1984).

This capabilities framework is used as an analytical lens through which to analyse the governance of the wicked problem of adaptation to climate change. Given the multi-level nature of this issue and the existing governance activities in different jurisdictions, we analyse governance institutions and strategies across three different levels: the United Nations Framework Convention on Climate Change, its approach and associated activities to assist adaptation; the European Union and its climate adaptation strategy; and the Netherlands and its Delta Program. This paper thereby aims to

address two research questions: (1) What insights does the framework provide into the strategies to cope with the wicked problem of climate adaptation and into the institutional conditions enabling or hindering these strategies? (2) To what extent is the framework useful for analysing wicked problems in multi-level contexts?

## 2. Adaptation to climate change at three different levels

In this section, we briefly introduce the adaptation policies at the three chosen levels. We discuss both the main adaptation policies and the institutional characteristics of the broader governance system at each level. The descriptions and analyses are based on earlier work by the authors based on interviews, participatory observation and document analysis (Boezeman, Vink, & Leroy, 2013; Dewulf, 2013; Termeer, Biesbroek, & van den Brink, 2011; Vink et al., 2015; Vink, Boezeman, Dewulf, & Termeer, 2013) and additional document analysis.

### 2.1. The United Nations Framework Convention on Climate Change and its adaptation policy

The United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol are treaties agreed after negotiations among participating parties (states). After their adoption, climate mitigation took centre stage, and adaptation was very much backstage for almost twenty years (Biesbroek, Swart, & van der Knaap, 2009). The first concrete action under the UNFCCC was the setting up of three funds in 2001 to support adaptation: two administered by the Global Environment Facility and one financed by proceeds from the Clean Development Mechanism of the Kyoto Protocol (Verschuuren, 2013). Their priority is to channel resources to the most vulnerable countries for adaptation planning processes and concrete projects. Additional resources are supposed to be added via the Green Climate Fund. This fund was conceived at the Copenhagen summit in 2012, and developed countries promised to mobilize a flow of 100 billion USD per year to this fund by 2020 (Verschuuren, 2013).

In order to access adaptation funds, developing countries have to identify projects for adaptation. National Adaptation Programs of Action (NAPAs) support the least developed countries in doing this. As of May 2012, 49 countries had submitted NAPAs to the UNFCCC Secretariat ([http://unfccc.int/adaptation/workstreams/national\\_adaptation\\_programmes\\_of\\_action/items/7572.php](http://unfccc.int/adaptation/workstreams/national_adaptation_programmes_of_action/items/7572.php)). In 2010, the parties to the UNFCCC adopted the Cancun Adaptation Framework under which all parties are expected to plan, prioritize and implement adaptation actions, strengthen institutional capacities for adaptation, and build the resilience of socio-economic and ecological systems. An Adaptation Committee was established to support implementation of this framework and to function as an overall advisory board. The following year, the parties decided on the parameters for National Adaptation Plans (NAPs) (Decision 7.CP.7 FCCC/CP/2011/13 Add. 1. 43–45). The decisions to develop more detailed recommendations on how countries should work on adaptation and to set up an institutional structure on adaptation within the UNFCCC regime have laid the foundation for strong and continued attention to this theme.

### 2.2. The European Union (EU) and its climate adaptation strategy

In April 2013, the European Commission presented its strategy on adaptation to climate change (European Commission, 2013). Until then, the EU focus had been on encouraging and supporting member states to develop and implement adaptation strategies. The overall aim of the 2013 Adaptation Strategy is "to contribute to a more climate-resilient Europe" (European Commission, 2013). This is split into three goals, supported via eight actions. The first

goal is to promote and support member states to develop national adaptation strategies and take concrete actions via the provision of guidelines and funding to support capacity building. The second is to ensure better informed decision making by filling knowledge gaps on adaptation costs and benefits, risk assessments, decision support models, tools and frameworks, monitoring and evaluation methods, as well as further developing the CLIMATE-ADAPT portal (a web-based portal that helps member states to access and share information on climate adaptation). The third is to climate-proof EU action by mainstreaming climate adaptation in EU policies and programs. For this third purpose, the strategy is accompanied by documents on adaptation in specific sectors and policy areas, such as migration, marine and coastal areas, health, infrastructure, agriculture, cohesion policy and insurance. In the near future, other policies like the Common Agricultural Policy, the Common Fisheries Policy and the Cohesion Policy will follow.

The mandates and responsibilities of all EU institutions are laid down in treaties, which are the foundation of everything the EU does. Treaties are agreed by the presidents and/or prime ministers of all 28 EU member states, and ratified by their parliaments. As the EU has a limited mandate in the field of adaptation, the EU cannot force member states to take action and develop national adaptation strategies. This is a major reason for mainstreaming climate adaptation in EU sectors in which the EU does have a strong mandate (European Environment Agency, 2013). The latest EU Multiannual Financial Framework (2014–2020) states that 20% of the budget should be climate (mitigation and adaptation) related; this will be achieved by mainstreaming climate in all the major EU spending programs (European Commission, 2013).

### 2.3. The Netherlands and its Delta Program

In response to alarming signals about climate change and possible negative effects for the Netherlands' long-term prosperity, the Dutch cabinet established a Delta committee to oversee these challenges and formulate recommendations. The Dutch government adopted most of the committee's recommendations, including the Delta Act that came into force on 1 January, 2012 and constitutes the basis for the Delta Program, the Delta Fund, and the Delta Commissioner (Boezeman et al., 2013; Vink et al., 2013). The decision to set up a separate program structure to climate-proof the Netherlands was deliberate, with the objective of bypassing existing administrative structures as enabled by the Dutch constitutionally rooted layered governmental system.

The Delta Program aims to guarantee the safety and the attractiveness of the Netherlands, now and in the future, and that the freshwater supply is adequate. It consists of three parts: implementation programs for strengthening dikes and protecting the coast as well as making room for rivers; trajectories for preparing five key Delta Decisions; and nine regional and thematic sub-programs that propose regional or thematic advice for the long term. These sub-programs are led by steering committees of decision makers and stakeholder consultation bodies.

Funding is arranged through the Delta Fund, in which money is set aside to implement the Delta Program's measures. From 2020 onwards, the Delta Fund will receive a minimum of €1 billion a year. The Delta Commissioner serves as a liaison between the government (local authorities, water boards, provincial authorities and ministries), civil society organizations and the business community. His main task is to ensure that an annual Delta Program is drawn up, that progress is achieved and that cohesion between the various components of the Delta Program is organized. He acts under the direct responsibility of the Minister of Infrastructure and Environment, provides advice to all involved cabinet members and may participate in the advisory council of the Council of Ministers.

## 3. Governance capabilities for climate adaptation strategies and institutions

In this section, we discuss the five governance capabilities – reflexivity, responsiveness, resilience, revitalization and rescaling – and use them to analyse the climate adaptation strategies and institutions across different levels. The characteristic strategies and main features of enabling institutional conditions for each capability are set out in Table 1. This not-exhaustive list is used as a checklist for our empirical analysis. The kind of analysis envisioned in this framework is not a quantitative score for each capability, but qualitative insights into the strategies and institutional conditions in the governance of the particular wicked problem of climate adaptation.

### 3.1. Reflexivity

Reflexivity addresses the wicked problem feature of problems being hard to pin down because people disagree about the formulation of the problem (Rittel & Webber, 1973, p. 161). Rather than being a single problem, climate change adaptation poses a confusing set of interrelated problems, resulting in competing frames on the issue (Dewulf, 2013; Hulme, 2010). In interactive processes, actors discuss and negotiate which frames will dominate the policymaking process (Chong & Druckman, 2007; Dewulf et al., 2009; Schön & Rein, 1994). This process of framing involves an interplay between 'puzzling' – to develop plausible storylines and solutions – and 'powering' – to decide whose frames are most relevant (Hoppe, 2011; Vink et al., 2013). As Rittel and Webber have already noted, "it should be clear that the expert is also the player in a political game, seeking to promote his private vision of goodness over others" (p. 165). Reflexivity is the ability to appreciate and deal with problems and multiple frames. If this variety is not addressed, there is a risk of tunnel vision and intractable controversies between powerful players.

At the beginning of the UNFCCC regime, the dominant frame on adaptation was one of expecting mitigation to be so effective as to enable societies and ecosystems to adapt autonomously. For a long time, addressing climate change policies from an adaptation perspective was even considered to be detrimental to mitigation commitments (Biesbroek et al., 2009; Dewulf, 2013; Schipper, 2006). Over time, the unfulfilled expectation of actual mitigation actions helped to recast this dominant frame. Through reflexivity, the mitigation and adaptation frames were connected and turned into policy-centred framing on the need to plan adaptation and put resources and institutions in place to implement those plans. This reflexivity is further illustrated by the ability of parties to sustain negotiations despite persistent frame differences on, for example, adaptation as a dimension of – voluntary – development aid versus adaptation as – obligatory – compensation for the 'injury' caused by developed countries via pollution (Moore, 2012). At institutional level, the UNFCCC regime thrives on ambiguity, or rather could not have been developed without it. This is exemplified by the absence of a definition of adaptation and vulnerability in the agreements (Moore, 2012) and leaving open which countries are considered vulnerable and who should get how much and why (Horstmann, 2011).

Similar processes can be witnessed at EU level, an institution that also thrives on ambiguity. In order to reach any agreement, the European Commission continuously needs to take into account the different frames of the member states and, since the Treaty of Lisbon, those of the European Parliament. Frames vary because of differences in vulnerability, progress in national adaptation policies and governance philosophies (Termeer et al., 2011). The EU strategy on adaptation to climate change is thus based on a consensus frame (Gamson, 1995) and leaves lots of room for member states to



**Table 1**  
Examples of general characteristic strategies and enabling institutional conditions for each of the five governance capabilities (Termeer & Dewulf, 2014; Termeer et al., 2015).

| Governance capability | Strategies  | Enabling institutional conditions   |
|-----------------------|---|---|
| Reflexivity           | Reconsidering problem frames<br>Enticing people into frames<br>Connecting frames<br>Negotiating despite frame differences   | Awareness of frame differences<br>Tolerance of ambiguity<br>Embedding reflexive activities<br>Providing room for changing problem definitions<br>Process skills |
| Resilience            | Learning by doing<br>Experimenting<br>Taking flexible measures  | Tolerance of uncertainties<br>Bridging arrangements<br>Appreciating certain levels of redundancy and flexibility<br>Improvisation skills                        |
| Responsiveness        | Deciding when to hold back and when to react<br>Communicating sensitively to a variety of publics   | Tolerance of information overload<br>Organized presence in a variety of venues<br>Parallel structures<br>Political-sensitivity skills                           |
| Revitalizing          | Motivating people<br>Addressing dysfunctional interactions<br>Interventions to unblock stagnation   | Tolerance of disappointments<br>Openness to questioning path dependency and lock-ins<br>Intervention skills   |
| Rescaling             | Linking cross-level interactions in the problem scale with cross-level interactions in the governance scale<br>Decoupling levels on the problem scale<br>Remodelling the governance scale | Tolerance of blurred responsibilities<br>Flexible jurisdictions to create and re-create fit<br>Openness to multiple scale logics                                |

develop their national strategies in the way they deem necessary. The strategy does not include specific reflexive actions, apart from the need to check member states' progress in developing national strategies.

With respect to the Dutch Delta Program that started in 2010, the first reflexive act involved revising the Dutch Delta committee's urgent call to action of two years earlier (Vink et al., 2013). This committee framed climate change as a problem threatening the future and well-being of the Netherlands, and thus requiring urgent action. The Delta Program reframed this issue into one of economic prosperity in relation to flood safety, omitting the term climate change from their press release altogether (Vink et al., 2013). These changes in problem frames can be understood by looking at the institutional characteristics of the governance system. The Delta committee was an independent committee and its distance from governmental responsibility gave it freedom to develop strong frames. The Delta Program, however, is a governmental program that needs to be realized within the Dutch tradition of building consensus through negotiation (Vink et al., 2013). This position favours the development of moderate consensus frames. However, the consensus tradition did not prevent the Delta Program from framing its goals as priorities of national public interest, and this conflicted with several regional problem frames (Vink et al., 2013).

### 3.2. Resilience

Resilience addresses the inherent uncertainties and inter-connectivities surrounding wicked problems, as "every wicked problem can be considered to be a symptom of another problem" (Rittel & Webber, 1973, p.65). Because of our incomplete understanding of how climate change affects socio-ecological systems, surprises, fluctuating conditions, sudden changes and irreducible uncertainties are fundamental aspects of the climate adaptation issue. Resilience is the ability to adapt flexibly to unpredictable and frequently occurring and changing circumstances without losing identity and reliability (Duit & Galaz, 2008; Folke, Hahn, Olsson, & Norberg, 2005; Pahl-Wostl, 2007). Adaptability requires, for example, a focus on outcomes rather than compliance with policy programs, and this might be difficult in polarized political contexts (Termeer & van den Brink, 2013).

The UNFCCC rules are the result of long-lasting negotiations among its 195 parties, who often have highly diverging interests. It took almost twenty years for the parties to agree upon a framework for adaptation. Consequently, these compromises are very slow to change but quite flexible in terms of how countries chose to interpret and comply with them. Countries are encouraged to develop national adaptation plans in a continuous, progressive and iterative process, thus providing room for monitoring and learning. The decisions finally adopted in the UNFCCC have some characteristics of resilience: a system for monitoring progress or lack of progress; an Adaptation Fund guided by a learning-by-doing approach (Horstmann, 2011); and programs that assist developing countries to improve their understanding of impacts and vulnerability, and make informed decisions on adaptation actions (Horstmann, 2011).

As in most international treaty-based institutions, there is less tolerance of uncertainty and flexibility. Uncertainty is always a handy argument for countries to postpone decisions, and it takes only a handful to do so in the consensus-based decision-making process. The room for flexibility is limited, as all decisions and revisions of decisions are the results of processes of negotiation in bodies composed of all parties. There is little openness to questioning path dependency; once organizations have been set up and strategies adopted, they are difficult to adapt, even when they do not work or situations have changed. The Global Environment Facility's funding criterion that projects should provide global benefits is, for instance, usually not seen as appropriate to apply to adaptation projects. On the other hand, the culture of only agreeing on a skeleton framework of policies, leaving the specification of more contentious details to the parties, provides room for adaptability.

The EU adaptation program shows similarities with the UNFCCC regarding resilience. Although the strategy officially aims for resilience, one can question whether the EU as an institution has the flexibility to quickly change rules and regulations. Therefore, capacity for resilience is built at member state level. Reinforced by its weak institutional mandates, the EU encourages member states to improvise and experiment, and facilitates learning by doing via financing local adaptation projects. Moreover, to facilitate learning among member states, the EU assists in bridging knowledge gaps through its web portal. The EU strategy further aims to increase

the resilience of infrastructure by developing new standards and guidelines and promoting “insurance and other financial products for resilient investment and business decisions” (European Commission, 2013). Mainstreaming adaptation in all policies may result in some redundancy, which further increases resilience.

The Dutch Delta Program puts a lot of emphasis on dealing with uncertainties, by focusing on robustness and flexibility. The considerable uncertainties about future developments are taken into account by relying on four delta scenarios, by constructing multiple adaptation pathways, and by considering timing and sequence by keeping options open. The institutional context of a temporary program to bypass existing organizations has enabled new forms of policy development and thus provides room for experimenting with adaptive forms of management. The locally well-embedded regional sub-programs enhance a high degree of mutual learning on how the water system works and what changes might be expected, resulting in a mixture of flexible and robust water management measures. However, the institutional context in which the Delta Program will be implemented in the future is not yet clear. Whereas regional administrators express the need to maintain the regional steering committees to enable continuous adaptations, national authorities tend towards abolishing the program organizations and falling back on existing formal procedures.

### 3.3. Responsiveness

Responsiveness addresses the feature of wicked problems having no stopping rule. Wicked problems have a virtually unlimited number of aspects that call for attention on the societal and policy agenda, and that attention can change quickly (Jones & Baumgartner, 2004). The climate change issue appears to be very sensitive to changes in political attention, hype and mobilization through (social) media (Maibach et al., 2012). Strong public outcries to address wicked problems make it tempting – but morally questionable – for policymakers to treat a wicked problem as though it were a tame problem (Churchmen, 1967; Hisschemoller & Hoppe, 1995; Rittel & Webber, 1973). Responsiveness is the ability to respond in a legitimate manner to continuously changing agendas and public demands (Wexler, 2009). In the absence of responsiveness, policymakers run the risk of either neglecting citizens' concerns or overreacting to them, with in both cases the risk of losing legitimacy.

The UNFCCC shows a high tolerance of information overload. The Intergovernmental Panel on Climate Change (IPCC) was established, amongst other things, to channel information. The institutionalized series of meetings provide consecutive venues for a variety of public and civil society actors to organize media attention on the topic of climate adaptation. Overall, responsiveness is difficult to associate with global governance through a multilateral treaty like the UNFCCC where negotiations among its 195 parties are often painstakingly slow. Most meetings result in disappointing press releases. Nonetheless, at its own pace, the UNFCCC regime is beginning to address the adaptation issues that are being put on the agenda by lobbying civil society organizations and vulnerable countries. Because of a failure to communicate sensitively, this slow responsiveness is not very visible. The UNFCCC-related decisions are adopted in a legalistic language that is rather inaccessible to the vulnerable communities that it is ultimately addressing.

The EU, whose 28 member states have different and dynamic political agendas, inherently faces difficulties in responding swiftly to new policy problems and societal demands. Consequently, it took a long time for the EU to finally present its adaptation strategy. Once the policy problem is addressed, the EU has the power position to set the agenda to a large extent and, more importantly, to guarantee attention on climate adaptation in the longer term. The policy of mainstreaming climate in other policies might help the EU to

observe and react faster on sector-specific climate demands. However, it might slow down overall responsiveness as many sector policies would have to be adjusted when demands change. Just like the UN, the EU faces difficulties in sensitively communicating its responses to public demands, often resulting in a perceived lack of legitimacy.

At national level, we expect a higher level of responsiveness. In this respect, the Delta Program provides an interesting test case, because by the time that program started, climate change had already dropped from the political agenda and was not an issue for the new coalition government (Vink et al., 2013). The press releases about the launch of the Delta Program in 2010 are a good example of political responsiveness in that they avoid any reference to climate change (Vink et al., 2013). The institutional structure of the Delta Program contains some elements that are likely to enable societal responsiveness. It deliberately aims to integrate citizens' concerns through social media and other platforms. The involvement of many public and private actors in steering groups and workshops can help to detect new demands in a timely fashion and to communicate sensitively to a variety of publics. However, the dominance of water engineers in the many sub-programs and the related technical logics may hinder the inclusion of a broader public.

### 3.4. Revitalization

Revitalization addresses the feature that wicked problems can be overwhelming (Weber & Khademanian, 2008) and “frustrating as hell” (Roberts, 2000). In such stressful situations, actors may revert to more defensive strategies (Termeer & Kessener, 2007) that run the risk of becoming part of the problem (Rittel & Webber, 1973). Climate change adaptation, with its history of stagnations and postponement of important decisions, runs the risk of people losing interest or becoming cynical. Revitalization is the ability to unblock stagnations and reanimate deadlocked policy processes. Without revitalization, there is the risk of regression, or of undertaking futile attempts to apply ‘more of the same’ solutions. However, revitalization is not simple, as it often involves changing established patterns of behaviour that are the outcome of (former) power plays.

The UNFCCC negotiations are in the hands of the parties. The chairs selected by the parties are not authorized to steer the process in any direction except towards what emerges as consensus. The secretariat is expected to stay in the background. There are, however, several examples of revitalization through unblocking stagnation. One is the breaking of the stalemate caused by those countries who wanted the adaptation agenda to include adaptation to the impacts of mitigation measures (primarily OPEC countries). In the 2007 Bali Action Plan, the impact of mitigation measures was moved out of the adaptation text (Khan & Roberts, 2013), thus making new progress possible. The process is also considerably tolerant of disappointments; although the USA left the Kyoto Protocol and no legal instruments were adopted in Copenhagen in 2012, negotiations continued. UNFCCC decisions are seldom formulated in a way that excites anyone. On the other hand, they provide for national processes to develop adaptation plans that are expected to be inclusive, thus potentially creating space for actors with insights and passion.

From several issues, for example the recent Euro crisis, we have learned that the EU moves slowly and has problems addressing dysfunctional interactions. In the case of adaptation, the EU needs the cooperation of its member states, but it might be difficult to inspire these if they do not see the need to take action. Therefore, the EC threatens to propose a legally binding instrument to force member states to develop national strategies if they have not done so by 2017. This big stick may encourage member states to act.

The Dutch Delta Program structure deliberately aims to enhance and safeguard new ways of thinking and acting. Therefore, this institution might have potential for revitalizing stagnated policy processes. When, for example, policy deliberations become deadlocked in short-sighted vested interests, introducing the long-term perspective of several decades ahead could cast a completely different, forward-looking light on policy issues. There are several examples of revitalization through opening up deadlocks. When the Delta committee put the freshwater issue on the agenda, it suggested that Lake IJssel should become a freshwater reservoir for the metropolitan areas of Rotterdam and The Hague. It therefore recommended a water level rise of 1.5 m that would flood historical fishing towns, industrial harbour areas and nature reserves, and accordingly sparked opposition among regional governments and stakeholders. It took two years to unblock this deadlock. A technical cost-benefit analysis ruled out the 1.5 m water level rise on economic grounds. This revitalized regional learning processes to develop alternative plans on combining the preservation of cultural heritage and the lake's functions as a reservoir for scarce freshwater during increasing summer droughts and a buffer for excess river water during periods of heavy rainfall.

### 3.5. Rescaling

Rescaling addresses the wicked problem feature of interconnectivity across scales and the lack of “a natural level” (Rittel & Webber, 1973, p. 165). Adaptation to climate change is a significant governance challenge at all temporal and spatial scales (Adger, Benjaminsen, Brown, & Svarstad, 2001). The long-term character of the phenomenon requires decisions to be taken now in order to be prepared for a changing future. Whereas climate change mitigation puts the global and the national level central, climate adaptation mostly focuses on local and regional responses (Adger et al., 2001). At the same time, adaptation is the topic of transnational and global policy processes. Rescaling is the ability to address mismatches between the scale of a problem and the scale at which it is governed. Without rescaling, scale mismatches result in less optimal solutions. Obviously, rescaling has far-reaching consequences in terms of responsibilities and inclusions or exclusions of actors, and thus power positions (Van Lieshout, Dewulf, Aarts, & Termeer, 2014).

The UNFCCC institutions were developed to address issues that are inherently global and in which joint actions should provide global benefits. However, as mentioned above, adaptation is often seen as an issue with inherent local dimensions. The clash between local and global scales and the inflexibility of institutions to rearrange connections became most apparent in the problems of funding adaptation via the Global Environment Facility, whose council made explicit that projects had to yield primarily global benefits (Horstmann, 2011). The perceived scale at which the roots of the problem around adaptation are located is also dependent on how one looks at the drivers of vulnerability: is this a local problem or one exacerbated by an unjust world order?

The scale implications of UNFCCC-related decisions on adaptation are completely different for developed and developing countries. The former are expected to provide resources, capacity building and adaptation technology to particularly the most vulnerable developing countries. The latter are given support for NAPAs and NAPs at national level. However, NAPAs and NAPs are explicitly country-driven, and thus rescaling is in the hands of national governments. These are in turn expected to enable input from lower levels through participatory processes. Assigning responsibilities is an ongoing battle in UNFCCC negotiations, where developed countries continuously seek to blur the boundary between developed and developing countries and assign more responsibility for action to the latter group. The question as to who is responsible for future generations is an open one.

According to the subsidiarity principle, most actual adaptation should be done at EU member state level. However, the EU sees a role for itself when, for example, lack of adaptation in one country might negatively affect neighbouring countries; but this rather abstract argument needs further elaboration on the basis of national adaptation strategies. The EU is also involved in global climate adaptation, for instance via the UN and the EU's development and cooperation policies, as global impacts of climate change affect the EU via food prices and migration. The EU thus bridges national and global climate adaptation policies and initiatives.

The Dutch Delta Program provides some arrangements for organizing connections across different spatial levels and scales. Firstly, the Delta Commissioner liaises between the different governance scales and plays an active role in international forums to offer Dutch knowledge on climate-proofing to cities and regions around the world. Secondly, the directors of the sub-programs act as liaison officers between regional and national decision-making arenas. They face the challenge of negotiating regional interests in the national arena, and of defending national decisions in the regional arena. Despite these liaison officers, important cross-level challenges are likely to arise when the Dutch Delta Program has to integrate the results of its regional programs. To a certain extent, the Dutch governmental system, as already discussed, enables the emergence of flexible jurisdictions to create and re-create fit, such as the Delta Program.

The Delta Program also addresses an important mismatch between the temporal scale of governance processes and the temporal scale of climate change and its impacts. Budgets are dependent on political decision-making cycles that have a much shorter term than processes of climate change. It is typically tempting for politicians to postpone difficult, or expensive, long-term decisions. The independent Delta Fund has been established to overcome this mismatch.

## 4. Discussion

The first aim of this paper was to provide insights into the strategies to cope with the wicked problem of climate adaptation and into the enabling or constraining institutional conditions. Table 2 summarizes our findings.

We started this paper by arguing that conventional governance strategies do not work for wicked problems and that the inherent variety of wicked problems requires a commensurately large variety of more advanced governance repertoires. Indeed, our analysis of climate adaptation shows that conventional governance strategies, such as top-down regulation or strict planning schemes, are quite uncommon and only used as a threat or a big stick to wield against complacency. At all levels, we saw mixtures of reflexive, resilient, responsive, revitalizing and rescaling strategies. This does not mean that all strategies are equally well developed and important. Overall, we can conclude that most attention is given to reflexivity strategies. This can be explained by the current policy phase of the climate adaptation issue. In the agenda and policy development phase, the emphasis is inevitably on framing the problem, particularly in wicked problem settings, which are surrounded by controversies.

We also started by referring to the assumption that existing governance institutions are, in general, poorly equipped to enable alternative governance strategies that deal with wicked problems (Head & Alford, 2015; Head, 2008; Rittel & Webber, 1973), and that this is especially true for climate change because it is a new policy issue (Gupta, 2010). Our analysis suggests that both of these assumptions should be nuanced. The institutions at the different levels manifest various enabling conditions, such as a tolerance of redundancy and room for learning and experimenting.

**Table 2**  
Main strategies and institutional conditions for climate adaptation governance.

| Governance capability | Level | Main strategies  | Main enabling and constraining institutional conditions  |
|-----------------------|-------|--|--|
| Reflexivity           | UN    | Connecting adaptation and mitigation frames<br>Ongoing negotiation despite strong frame differences<br>Developing general policies while leaving interpretation to parties   | Agreements on UN treaties made possible through relying on ambiguity   |
|                       | EU    | Taking into account different frames<br>Leaving room for alternative interpretations   | EU decision rules favour consensus frames  |
|                       | NL    | Reframing: from climate-proofing the Netherlands to continued prosperity of the Delta  | Dutch consensus-based negotiation traditions favour moderate frames  |
| Resilience            | UN    | Facilitating learning at the parties' level<br>Flexible implementation through learning by doing<br>Monitoring progress  | Little tolerance of uncertainty as it means postponement of decisions<br>Negotiated frameworks are very slow to change but quite flexible in terms of compliance |
|                       | EU    | Building learning capacity at member state level<br>Facilitating learning by doing via financing local adaptation projects<br>Bridging knowledge gaps  | Weak institutional mandate triggers encouraging resilience at member state level<br>Redundancy through mainstreaming climate adaptation in other policy domains  |
|                       | NL    | Using scenarios<br>Constructing adaptation pathways<br>Deliberately keeping options open   | Institutional bypass creates room for experimentation<br>Long-term viability of institutional bypass unclear<br>Locally well-embedded arrangements               |
| Responsiveness        | UN    | Deciding to postpone action until the ongoing push becomes too high<br>Organizing attention to climate adaptation during each summit<br>Guaranteeing attention to climate adaptation over a longer period                          | Tolerance of information overload<br>Slow response to changing societal demands<br>Legalistic culture hinders sensitive communication                            |
|                       | EU    |  | Slow response to changing societal demands<br>EU faces general problem of perceived lack of legitimacy   |
|                       | NL    | Involving many public and private actors<br>Sensitively communicating to a variety of publics<br>Integrating citizens' concerns  | Institutional bypass prevents politicians from reacting hastily to new public demands<br>Dominance of technical logic limits inclusion of the broader public     |
| Revitalizing          | UN    | Unblocking stagnation by putting new topics on the negotiation agenda  | Tolerance of disappointments   |
|                       | EU    | Stay in the background   | Reluctance to make active use of power position to resolve stalemates  |
|                       | NL    | Motivating stakeholders through events<br>Introducing new perspectives to overcome deadlocks caused by short-sighted vested interests<br>Cost-benefit analysis to unblock regional learning processes                              | Program structure to deliberately enhance and safeguard new ways of thinking and acting  |
| Rescaling             | UN    | Supporting states to involve local stakeholders<br>Scaling to strategically assign responsibilities to other actors  | Global level far removed from sites of action on the ground<br>Institutionalized battlefield between developing and developed countries                          |
|                       | EU    | Intervening when lack of adaptation in one country might negatively affect neighbouring countries<br>Bridging national and global initiatives  | The principle of subsidiarity  |
|                       | NL    | Organizing connections across different spatial levels and scales through liaison officers<br>Incorporating long-term concerns in short-term decisions<br>Organizing connections across time scales by establishing the Delta Fund | Flexible jurisdictions to create and re-create fit   |

Of course, we also revealed many constraining conditions, such as for example slow institutional response capacity and reluctance to actively address stalemates. So far, these institutional hindrances have tended to lead more to postponement than to obstruction of decision-making processes. Also, the novelty of the issue has not prevented governance actors from addressing the climate adaptation problem within existing institutions. However, the norms and rules of existing institutions certainly have narrowed the framing of the issue and thus limited reflexivity. In the Netherlands for example, the adaptation issue was embraced by the traditionally strong water management institutions, and, in the UNFCCC, adaptation became a topic after that institution had focused primarily on climate mitigation for many years.

Both the UNFCCC and the EU are treaty-based institutions, in which decisions result from lengthy negotiations between parties and member states, respectively. At first sight, the reflexive, resilient, responsive, revitalizing and rescaling capabilities of treaty-based institutions are rather weak. This is mainly reflected in slow and long-lasting decision-making processes, and – once compromises have been reached – a lack of flexibility to adapt these decisions to new problem frames, uncertainties, concerns and

lock-ins. Nonetheless, our analysis has also shown some examples of how these institutions enabled stable attention on the problem, learning and monitoring, and opening up some deadlocks (while leaving others). Furthermore, we found that the treaty-based institutions' institutionalized tolerance of ambiguity, information overload and disappointment is a strength and a weakness at the same time. On the one hand, it encourages endurance and enables the accommodation of a variety of frames, concerns and uncertainties. On the other hand, this endurance can turn into cynicism; consensus frames can hinder a redefinition of action perspectives; and variety is easily misused to postpone or avoid decisions.

The decision to set up a new governance structure, consisting of a national and several regional programs to climate-proof the Netherlands, fitted into the Dutch institutional context that enables the emergence of flexible institutions to create fit across regional and temporal levels. The design of these temporal institutional arrangements enabled reflexivity, resilience, responsiveness, revitalization and rescaling. Indeed, there was plenty of room to reconsider dominant frames, learn, communicate sensitively and unblock stagnations. However, these temporary institutions certainly have their weaknesses also, amongst others because in the



end the decisions must be implemented in regular policy structures that do not possess these favourable institutional conditions. Needless to say, our conclusions regarding the national level may be different in the context of developing countries or other developed countries with different state traditions, as many institutions and strategies are either not available or function differently in other scenarios.

Our second aim was to reflect on the capabilities framework as an analytical tool, in particular in multi-level contexts. The five capabilities provide different conceptual lenses that helped us to observe different strategies and institutional conditions that go beyond usual descriptions of climate adaptation governance that are more focused on policy outcomes (e.g. agreements or plans), specific governance strategies (e.g. collaboration or science–policy interfaces), single phases (e.g. agenda setting or negotiation) or specific barriers (e.g. knowledge or finance). Although other scholars have linked climate adaptation with the issue of framing, scaling or resilience (Cash et al., 2006; Dewulf, 2013; Jordan et al., 2010; Pahl-Wostl et al., 2007), until now, no integrated analyses have been published. Using the capabilities framework, we applied multiple theories addressing all features of the wicked problem in one study. A drawback of this integrated analysis across three governance levels is the lack of space for providing detailed information about the empirical cases.

An added value of the framework is that it analyses both the governance strategies and the institutional conditions that enable or hinder these strategies. Whereas the strategies provide insight into current activities, the institutional analysis provides insights into abilities to deal with the climate adaptation issue in the near future. In applying the framework, we inevitably faced the methodological issue of the dependent and the independent variable. Do we start our analysis with the institutional conditions or with the strategies? If the Netherlands exemplifies all five groups of governance strategies, does that automatically lead to the conclusion that Dutch institutions possess all five capabilities? Or conversely, if the revitalization capability of UN institutions is weak, does that mean that we cannot expect the UN to employ revitalizing strategies? To overcome this classical structure–agency dichotomy, we follow Giddens' (1984) concept of duality of structure: agency (actors' strategies) shapes structure (institutions) and structure gives actors the ability to act. We have analysed the relation between strategies and institutions as a dynamic interplay, in which the elements do not determine, but mutually influence, one another. As climate adaptation is a typical multi-level problem, we applied the framework to an analysis across levels, assuming that we would find some linkages between the three levels. At first sight, the adaptation processes in the Netherlands are hardly affected by UNFCCC and EU policies. However, a more in-depth analysis shows how the discussions within the UNFCCC-related fora (in particular the IPCC) and the early announcement of EU adaptation policies were an important incentive to start the Dutch Delta Program. Through global governance institutions and international treaties, vulnerable developing countries were able to put adaptation funding on the agenda of richer entities, like the EU and the Netherlands. On the other hand, the Netherlands has strongly influenced global and European climate adaptation policies, reflecting their reflexive capacity; for example, the EU adaptation strategy mentions the Dutch Delta Program as best practice.

The governance capability of rescaling is very relevant in this multi-level context. At all levels, examples can be found of strategies that deliberately try to match the geographical and temporal dimension of the problem scale to the governance scale. The international and national adaptation funds, for example, translate long-term concerns into short-term decisions. These funds thus challenge the institutionalized focus on short-term and four-yearly policy cycles. Also, the recurrent discussion on the geographical

level at which adaptation challenges should be addressed contributes substantially to the governance capability of rescaling. However, scale is not pre-given but a way of framing wicked problems (Dewulf, Mancero, Cardenas, & Sucozhanay, 2011; Kurtz, 2003; Lieshout, van, Dewulf, Aarts, & Termeer, 2012). Many of the identified frame controversies involve conflicts of scale. Whereas the conflicts at global and European level concern distribution of responsibilities between developing and developed countries and between the EU and its member states, the conflicts at national and regional level concern the definitions of the problem as a regional or a national interest. This example also indicates how the reflexivity capability supports rescaling, and how, more generally, different capabilities can strengthen one another.

## 5. Conclusion

We have applied the Five R Governance Capabilities framework to analyse the various strategies used to cope with the wicked problem of climate adaptation on different scales, and to understand which institutional conditions hinder or enable these strategies. In contrast to the literature, we saw that conventional governance strategies were rather absent and that the institutional conditions for new coping strategies were less constraining than expected. Indeed, we identified mixtures of reflexive, resilient, responsive, revitalizing and rescaling strategies at all levels, although not equally well developed and important. The constraining conditions, which were also present, tend to lead more to postponement than to obstruction of decision-making processes.

The question remains as to whether we may widen the scope of our findings to the ability of the UN, the EU and the Netherlands to deal with wicked problems in general. To some extent, the identified institutional weaknesses and strengths elucidate the abilities of these institutions to deal with other wicked problems. However, every wicked problem is essentially unique (Rittel & Webber, 1973, p.164), and the specific complexities of climate adaptation, such as its long-term character and its fragmented multi-level context, give rise to some restraint and cautiousness.

The framework was helpful for analysing existing governance strategies and institutions in terms of strengths and weaknesses. We certainly believe that the framework has the potential to be used as an assessment tool. For this, more operationalization and interaction with policymakers is needed. In future research, the capabilities framework could be elaborated into an interactive tool for supporting institutions to see which capabilities they need to develop in order to be better able to address wicked problems such as climate change adaptation.

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## References

- Adger, W. N., Benjaminsen, T. A., Brown, K., & Svarstad, H. (2001). Advancing a political ecology of global environmental discourses. *Development and Change*, 32(4), 681–715. <http://dx.doi.org/10.1111/1467-7660.00222>
- Biesbroek, G. R., Swart, R. J., & van der Knaap, W. G. M. (2009). The mitigation–adaptation dichotomy and the role of spatial planning. *Habitat International*, 33(3), 230–237. <http://dx.doi.org/10.1016/j.habitatint.2008.10.001>
- Boezeman, D., Vink, M. J., & Leroy, P. (2013). The Dutch Delta Committee as a boundary organisation. *Environmental Science & Policy*, 27, 162–171. <http://dx.doi.org/10.1016/j.envsci.2012.12.016>
- Cash, D. W., Adger, W. N., Berkes, F., Garden, P., Lebel, L., & Olsson, P. (2006). Scale and cross-scale dynamics: governance and information in a multilevel world. *Ecology and Society*, 11(2) [article 8].

- Chong, D., & Druckman, J. N. (2007). A theory of framing and opinion formation in competitive elite environments. *Journal of Communication*, 57(1), 99–118. <http://dx.doi.org/10.1111/j.1460-2466.2006.00331.x>
- Churchmen, C. W. (1967). Wicked problems. *Management Science*, 13(4) <http://dx.doi.org/10.1287/mnsc.14.4.B141>, B–141–142
- Dewulf, A. (2013). Contrasting frames in policy debates on climate change adaptation. *Wiley Interdisciplinary Reviews: Climate Change*, 4(4), 321–330. <http://dx.doi.org/10.1002/wcc.227>
- Dewulf, A., Gray, B., Putnam, L., Lewicki, R., Aarts, N., Bouwen, R., & van Woerkum, C. (2009). Disentangling approaches to framing in conflict and negotiation research: a meta-paradigmatic perspective. *Human Relations*, 62(2), 155–193. <http://dx.doi.org/10.1177/0018726708100356>
- Dewulf, A., Mancero, M., Cardenas, G., & Sucozhanay, D. (2011). Fragmentation and connection of frames in collaborative water governance: a case study of river catchment management in Southern Ecuador. *International Review of Administrative Sciences*, 77(1), 50–75. <http://dx.doi.org/10.1177/0020852310390108>
- Duit, A., & Galaz, V. (2008). Governance and complexity emerging issues for governance theory. *Governance*, 21(3), 311–335. <http://dx.doi.org/10.1111/j.1468-0491.2008.00402.x>
- European Commission. (2013). *An EU Strategy on adaptation to climate change*. Brussels (Belgium): European Commission.
- European Environment Agency. (2013). *Adaptation in Europe. Addressing risks and opportunities from climate change in the context of socio-economic developments*. Copenhagen: European Environment Agency.
- Folke, C., Hahn, T., Olsson, P., & Norberg, J. (2005). Adaptive governance of social-ecological systems. *Annual Review of Environment and Resources*, 30(1), 441–473. <http://dx.doi.org/10.1146/annurev.energy.30.050504.144511>
- Gamson, W. A. (1995). Constructing social protest. In H. Johnston, & B. Klandermans (Eds.), *Social movements and culture: social movements, protest, and contention* (pp. 85–106). Minneapolis: University of Minnesota Press.
- Giddens, A. (1984). *The constitution of society: outline of the theory of structuration*. Cambridge: Polity Press.
- Gupta, J. (2010). A history of international climate change policy. *Wiley Interdisciplinary Reviews: Climate Change*, 1(5), 636–653. <http://dx.doi.org/10.1002/wcc.67>
- Head, B. W. (2008). *Wicked problems: the implications for public management*. Public Management.
- Head, B. W., & Alford, J. (2015). Wicked problems: implications for public policy and management. *Administration & Society*, 47(6), 711–739. <http://dx.doi.org/10.1177/0095399713481601>
- Hendriks, C. M., & Grin, J. (2007). Contextualizing reflexive governance: the politics of Dutch transitions to sustainability. *Journal of Environmental Policy & Planning*, 9(3–4), 333–350. <http://dx.doi.org/10.1080/15239080701622790>
- Hisschemoller, M., & Hoppe, R. (1995). Coping with intractable controversies: the case for problem structuring in policy design and analysis. *Knowledge, Technology & Policy*, 8(4), 40–60.
- Hoppe, R. (2011). *The governance of problems: puzzling, powering and participation*. Bristol: The Policy Press.
- Horstmann, B. (2011). Operationalizing the Adaptation Fund: challenges in allocating funds to the vulnerable. *Climate Policy*, 11(4), 1086–1096. <http://dx.doi.org/10.1080/14693062.2011.579392>
- Hulme, M. (2010). *Why we disagree about climate change*. Cambridge: University Press.
- IPCC (2007). Climate change 2007 synthesis report.
- Jones, B. D., & Baumgartner, F. R. (2004). A model of choice for public policy. *Journal of Public Administration Research and Theory*, 15(3), 325–351. <http://dx.doi.org/10.1093/jopart/mui018>
- Jordan, A., Huitema, D., van Asselt, H., Rayner, T., & Berkhout, F. (2010). *Climate change policy in the European Union: confronting the dilemmas of mitigation and adaptation?* Cambridge: University Press.
- Khan, M. R., & Roberts, J. T. (2013). Adaptation and international climate policy. *Wiley Interdisciplinary Reviews: Climate Change*, 4(3), 171–189. <http://dx.doi.org/10.1002/wcc.212>
- Koppenjan, J. F. M., & Klijn, E.-H. (2004). *Managing Uncertainties in Networks. A network approach to problem solving and decision making*. New York: Routledge.
- Kurtz, H. E. (2003). Scale frames and counter-scale frames: constructing the problem of environmental injustice. *Political Geography*, 22(8), 887–916. <http://dx.doi.org/10.1016/j.polgeo.2003.09.001>
- Lieshout, M., van Dewulf, A., Aarts, N., & Termeer, C. J. A. M. (2012). Doing scalar politics: interactive scale framing for managing accountability in complex policy processes. *Critical Policy Studies*, 6(2), 163–181. <http://dx.doi.org/10.1080/19460171.2012.689736>
- Maibach, E., Leiserowitz, A., Cobb, S., Shank, M., Cobb, K. M., & Gullette, J. (2012). The legacy of climategate: undermining or revitalizing climate science and policy? *Wiley Interdisciplinary Reviews: Climate Change*, 3(3), 289–295. <http://dx.doi.org/10.1002/wcc.168>
- Moore, F. C. (2012). Negotiating adaptation: norm selection and hybridization in international climate negotiations. *Global Environmental Politics*, 12(4), 30–48. <http://dx.doi.org/10.1162/GLEP.a.00138>
- Pahl-Wostl, C. (2007). Transitions towards adaptive management of water facing climate and global change. In *Integrated Assessment of Water Resources and Global Change: A North-South Analysis*, Springer (Vol. 21, pp. 49–62). doi:10.1007/978-1-4020-5591-1-4.
- Pahl-Wostl, C., Craps, M., Dewulf, A., Mostert, E., Tabara, D., & Taillieu, T. (2007). Social learning and water resources management. *Ecology And Society*, 12(2), article 5
- Rittel, H. W., & Webber, M. M. (1973). Dilemmas in a general theory of planning. *Policy Sciences*, 4, 155–169.
- Roberts, N. (2000). Wicked problems and networks approaches to resolution. *International Public Management Review*, 1(1), 1–19.
- Rockström, J., Steffen, W., Noone, K., Persson, A., Chapin, F. S., Lambin, E. F., & Foley, J. A. (2009). A safe operating space for humanity. *Nature*, 461(7263), 472–475. <http://dx.doi.org/10.1038/461472a>
- Schön, D. A., & Rein, M. (1994). *Frame Reflection: towards the resolution of intractable policy controversies*. New York: Basic Books.
- Schipper, E. (2006). Conceptual history of adaptation in the UNFCCC process. *Reciel*, 15(1), 82–92.
- Termeer, C. J. A. M., Biesbroek, G. R., & van den Brink, M. (2011). Institutions for adaptation to climate change: comparing national adaptation strategies in Europe. *European Political Science*, 11(1), 41–53. <http://dx.doi.org/10.1057/eps.2011.7>
- Termeer, C. J. A. M., & Dewulf, A. (2014). Scale-Sensitivity as a governance capability: observing, acting and enabling. In F. Padt, P. F. M. Opdam, C. J. A. M. Termeer, & N. Polman (Eds.), *Scale-sensitive governance of the environment*. Wiley. <http://dx.doi.org/10.1002/9781118567135>
- Termeer, C. J. A. M., Dewulf, A., Breeman, G., & Stiller, S. J. (2015). Governance capabilities for dealing wisely with wicked problems. *Administration & Society*, 47(6), 680–710. <http://dx.doi.org/10.1177/0095399712469195>
- Termeer, C. J. A. M., Dewulf, A., & Breeman, G. E. (2013). Governance of wicked climate adaptation problems. In J. Knieling, & W. Leal Filho (Eds.), *Climate change governance* (pp. 27–39). Berlin, Heidelberg: Springer Berlin Heidelberg. <http://dx.doi.org/10.1007/978-3-642-29831-8>
- Termeer, C. J. A. M., & Kessener, B. (2007). Revitalizing stagnated policy processes: using the configuration approach for research and interventions. *The Journal of Applied Behavioral Science*, 43(2), 256–272. <http://dx.doi.org/10.1177/0021886306294902>
- Termeer, C. J. A. M., & van den Brink, M. (2013). Organizational conditions for dealing with the unknown unknown. *Public Management Review*, 15(1), 43–62. <http://dx.doi.org/10.1080/14719037.2012.664014>
- Van Lieshout, M., Dewulf, A., Aarts, N., & Termeer, C. J. A. M. (2014). The power to frame the scale? analysing scalar politics over, in and of a deliberative governance process journal of environmental policy & planning. *Journal of Environmental Policy & Planning*, 1–24. <http://dx.doi.org/10.1080/1523908X.2014.936581>
- Verschuuren, J. (2013). Climate change adaptation under the United Nations framework convention on climate change and related documents. In J. Verschuuren (Ed.), *Research handbook on climate change adaptation law* (pp. 16–23). Edward Elgar.
- Vink, M. J., Benson, D., Boezeman, D., Cook, H., Dewulf, A., & Termeer, C. J. A. M. (2015). Do state traditions matter? Comparing deliberative governance initiatives for climate change adaptation in Dutch corporatism and British pluralism. *Journal of Water and Climate Change*.
- Vink, M. J., Boezeman, D., Dewulf, A., & Termeer, C. J. A. M. (2013). Changing climate, changing frames. *Environmental Science & Policy*, 30, 90–101. <http://dx.doi.org/10.1016/j.envsci.2012.10.010>
- Weber, E. P., & Khademian, A. M. (2008). Wicked problems, knowledge challenges, and collaborative capacity builders in network settings. *Public Administration Review*, 68(2), 334–349. <http://dx.doi.org/10.1111/j.1540-6210.2007.00866.x>
- Weick, K. E. (1984). Small wins: redefining the scale of social problems. *American Psychologist*, 39(1), 40–49. <http://dx.doi.org/10.1037//0003-066X.39.1.40>
- Weick, K. E., & Sutcliffe, K. M. (2001). *Managing the unexpected: assuring high performance in the age of complexity*. San Francisco: Jossey-Bass.
- Wexler, M. N. (2009). Exploring the moral dimension of wicked problems. *International Journal of Sociology and Social Policy*, 29(9/10), 531–542. <http://dx.doi.org/10.1108/01443330910986306>
- Xiang, W.-N. (2013). Working with wicked problems in socio-ecological systems: awareness, acceptance, and adaptation. *Landscape and Urban Planning*, 110, 1–4. <http://dx.doi.org/10.1016/j.landurbplan.2012.11.006>