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Published in:
Mitigation and Adaptation Strategies for Global Change

DOI:
10.1007/s11027-014-9630-z

IMPORTANT NOTE: You are advised to consult the publisher's version (publisher's PDF) if you wish to cite from it. Please check the document version below.

Document Version
Publisher's PDF, also known as Version of record

Publication date:
2016

Link to publication in University of Groningen/UMCG research database

Citation for published version (APA):
Gupta, J., Bergsma, E., Termeer, C. J. A. M., Biesbroek, G. R., Van Den Brink, M., Jong, P., Klostermann, J. E. M., Meijerink, S., & Nooteboom, S. (2016). The adaptive capacity of institutions in the spatial planning, water, agriculture and nature sectors in the Netherlands. *Mitigation and Adaptation Strategies for Global Change*, *21*(6), 883-903. https://doi.org/10.1007/s11027-014-9630-z

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Download date: 13-09-2026

Mitig Adapt Strateg Glob Change (2016) 21:883–903
DOI 10.1007/s11027-014-9630-z

ORIGINAL ARTICLE

The adaptive capacity of institutions in the spatial planning, water, agriculture and nature sectors in the Netherlands

J. Gupta · E. Bergsma · C. J. A. M. Termeer · G. R. Biesbroek · M. van den Brink · P. Jong · J. E. M. Klostermann · S. Meijerink · S. Nooteboom

Received: 3 June 2014 / Accepted: 16 December 2014 / Published online: 26 January 2015
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Abstract The climate change problem calls for a continuously responding society. This raises the question: Do our institutions allow and encourage society to continuously adapt to climate change? This paper uses the Adaptive Capacity Wheel (ACW) to assess the adaptive capacity of formal and informal institutions in four sectors in the Netherlands: spatial planning, water, agriculture and nature. Formal institutions are examined through an assessment of 11 key policy documents and informal institutions are analysed through four case studies covering each sector. Based on these ACW analyses, both sector-specific and more general strengths and weaknesses of the adaptive capacity of institutions in the Netherlands are identified. The

Electronic supplementary material The online version of this article (doi:10.1007/s11027-014-9630-z) contains supplementary material, which is available to authorized users.

J. Gupta (✉) · E. Bergsma
Amsterdam Institute for Social Science Research, Faculty of Social and Behavioral Sciences, University of Amsterdam, Nieuwe Achtergracht 166, 1018 WV Amsterdam, The Netherlands
e-mail: j.gupta@uva.nl

C. J. A. M. Termeer · G. R. Biesbroek
Wageningen School of Social Sciences, Wageningen UR, Wageningen, Netherlands

M. van den Brink
Faculty of Spatial Sciences, University of Groningen, Groningen, Netherlands

P. Jong
Faculty of Architecture and the Built Environment, Delft University of Technology, Delft, Netherlands

J. E. M. Klostermann
Alterra, Wageningen UR, Wageningen, Netherlands

S. Meijerink
Institute for Management Research, Radboud University Nijmegen, Nijmegen, Netherlands

S. Nooteboom
Faculty of Social Science, Erasmus University Rotterdam, Rotterdam, Netherlands

J. Gupta
UNESCO-IHE Institute for Water Education, Westvest 7, 2611 AX Delft, The Netherlands

paper concludes that the most important challenge for increasing institutional adaptive capacity lies in combining decentralized, participatory approaches with more top-down methods that generate leadership (visions, goals) standards, instruments, resources and monitoring.

Keywords Adaptation · Adaptive capacity · Climate change · Institutional theory · The Netherlands

1 Introduction

Through history, societies have developed institutions to manage their natural environment (Gupta and Dellapenna 2009). Global climate change is expected to lead to drastic changes in weather conditions for decades, if not centuries, to come (IPCC 2007). Societies will have to anticipate and respond to these changes faster than before. This poses new challenges to society's institutions. Institutions are 'systems of rules, decision-making procedures, and programs that give rise to social practices, assign roles to the participants in these practices, and guide interactions among the occupants of the relevant roles' (IDGEC 1999: 14). Adaptive capacity is not a characteristic usually ascribed to institutions (March and Olsen 1989). Institutions provide taken-for granted models for social interaction and have only demonstrated an ability to evolve over the long run (Clemens and Cook 1999: 144; Arts and Van Tatenhove 2004; Pollit and Bouckaert 2000). However, now we need institutions to respond at a speed commensurate with the changing climate (cf. Ostrovskaya et al. 2013; Engle 2011; Tol and Yohe 2006; Eriksen and Lind 2009; Pelling et al. 2008; Adger 2006; Folke et al. 2005; Vincent 2006; Paavola 2008; Nelson et al. 2008; Agrawal 2008; Berman et al. 2012; Brown et al. 2010; Duit et al. 2010; Glaas et al. 2010). This raises the question: To what extent do our institutions allow and encourage society to adapt to complex and uncertain climate change impacts?

This paper presents the integrated results of a 2-year study into the adaptive capacity of institutions in the Netherlands, a low-lying delta country. It applies the Adaptive Capacity Wheel—ACW a qualitative assessment tool developed within this study to assess formal institutions in the Netherlands through a document analysis of key policies as well as the informal governance patterns these policies translate into on the ground through case studies in four policy sectors: spatial planning, water, agriculture and nature.

2 Analytical framework

The Adaptive Capacity Wheel (ACW) was developed to assess the adaptive capacity of institutions. Based on the literature, the ACW identifies six dimensions of adaptive capacity (variety, learning capacity, room for autonomous change, leadership, resources and fair governance, shown in the inner circle of the wheel in Fig. 1) and 22 criteria as indicators of those dimensions (shown in the outer circle). We argue that adaptive institutions encourage variety (i.e. make space to incorporate different problem frames and solution strategies); allow for reflection and learning based on past experiences; create room for autonomous change so that social actors can independently adjust their behaviour to respond to challenges; encourage leadership for social responses (ranging from long-term visionary leadership to more pragmatic day-to-day entrepreneurial leadership); facilitate the generation of financial, human and decision-making resources; and help to establish a fair governance system taking into account legitimacy, equity, responsiveness and accountability.

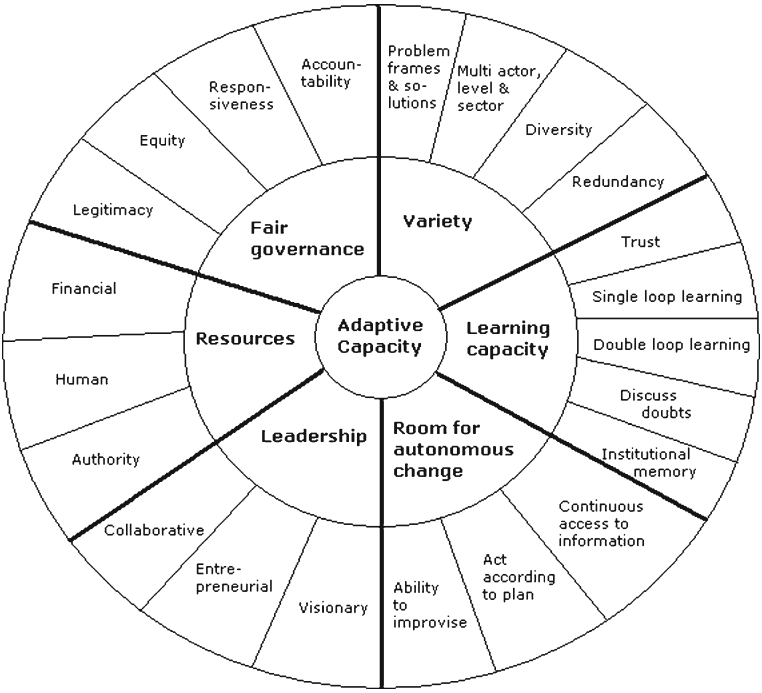

Fig. 1 The Adaptive Capacity Wheel (Gupta et al. 2010)

In ACW assessments, these indicators are scored (see Table 1) to indicate the strong and weak dimensions of adaptive capacity and their underlying factors. The ACW helps to assess whether institutions facilitate—or hinder institutional change. Our research assessed formal institutions through analysing the policy content of each selected policy document in relation to our indicators. For example, if the document allowed for policy monitoring and revision, this meant that it facilitated learning. If the document created a fund or a funding mechanism, this meant that it was supported by resources. For the case studies, we used stakeholder interviews and secondary literature to assess the adaptive capacity of the policy in stimulating behavioural change.

However, not every criterion can be applied alike. Consider, for example, the criterion of trust in the dimension of learning capacity. The fact that there are no institutional incentives that stimulate trust between parties does not directly obstruct adaptive capacity nor enhance it.

Table 1 Adaptive Capacity Wheel coding scheme

Effect of institution on adaptive capacity	Score	Aggregated scores for dimensions and adaptive capacity as a whole
Positive effect	2	1.01 to 2.00
Slightly positive effect	1	0.01 to 1.00
Neutral or no effect	0	0
Slightly negative effect	−1	−0.01 to–1.00
Negative effect	−2	−1.01 to–2.00

The assumption is that when there is nothing in place to enhance trust in institutional arrangements, this does not necessarily mean that parties distrust each other and therefore it would get a neutral score of 0. Now consider the criterion of financial resources in the dimension resources. The fact that the institutional structure does not allocate any financial resources for its implementation does hinder adaptive capacity. Here, the assumption is that when no institutional arrangements are made (in other words, when a gap exists), adaptive capacity is hindered. In this case, this criterion would get a score of −1. The category that is even more negative (with a score of −2) is reserved for situations in which the existing institutional structure actually obstructs adaptive capacity. A table that lists our interpretation of scores 0 and −1 for each criterion is included in the Supplementary Materials made available online. This document also lists our final arguments for assigning a value for each indicator. This was based on initial assessments recorded in background documents, which were discussed and debated within the research group, then discussed and debated with experts from the sector itself, and then discussed and debated with experts from all four sectors to see if there was comparative value.

The pros and cons of this qualitative method has been provided in Gupta et al. (2010). Here, we want to highlight that in contrast to mainstream institutional analyses that aim to explain institutional dynamics (i.e. institutional stability and change), the ACW focuses on institutional change, which is considered crucial for climate change adaptation. It focuses on the qualitative aspects of adaptive capacity which normally get overlooked in quantitative analyses. In addition to common in-depth and context-specific analyses of adaptive capacity, the ACW offers a method to compare between different contexts because it offers a standardized assessment framework which provides robust and verifiable results. It can communicate vast amounts of qualitative information in a simple traffic light (where green is very adaptive and red is not adaptive) diagram and has thus strong communicative value as well.

Our study applied the ACW to assess the adaptive capacity of the spatial planning, water, agriculture and nature sectors in the Netherlands. As these sectors are governed by international to local institutions (Kabat et al. 2005), our project analysed international and national formal institutions through a detailed content analysis of 93 policy documents and conducted nine in-depth case studies to assess the impact of these formal institutions on the development of informal institutions on the ground. For this paper, we have short-listed 11 policy documents (see Table 2) based on whether the policy (a) was seen as influential by social actors, (b) had an overarching character or a national scope, (c) was the most recent version, (d) has an unlimited time frame, and (e) was among the most important documents in the sector. Out of the nine case studies, we selected four cases (one per sector) for discussion here.

Table 2 Data: policy documents and case studies per sector

	Spatial planning	Water	Agriculture	Nature
Main policy documents in the Netherlands	National Spatial Strategy, Spatial Planning Act, Strategic Environmental Assessment	National Water Plan, Water Act, Water Assessment,	Agenda for a Living Countryside, Rural Areas Development Act	Nature Protection Law, Flora and Fauna Law, National Ecological Network
In-depth case studies and sub-cases	Climate-Proof spatial planning in the Zuidplas polder	Local water management in Delft	Land consolidation in the agricultural polder De Wijde Wormer	Nature management in the Wadden Sea area

3 The adaptive capacity of institutions in four sectors

3.1 Spatial planning sector

Although the Netherlands actively promoted climate change adaptation discussions in the global arena in the late 1990s, adaptation was prioritized domestically only later (Klostermann et al. 2010; Bergsma, Gupta, and Jong 2012). Initially, the potential consequences of climate change for the water sector were highlighted. Subsequently, awareness of climate change impacts reached the national level and spilled over to other policy sectors. Since 2000, recognition of missing policy links between different sectors (cf. Commission on Water Management in the 21st century; Lemstra 2005; WRR 2006) led to a comprehensive adaptation strategy where spatial planning is put forward as an integrative element. The National Adaptation Strategy frames adaptation as a problem that needs local, time and place specific solutions, and presents decentralized spatial planning as the overarching framework that should facilitate local actors in finding tailor-made solutions (VROM 2007). Thus, spatial policies are given a crucial role in climate change adaptation in the Netherlands. But is the formal institutional framework in this sector adaptive?

The ACW shows that the spatial planning sector is densely regulated and uses multiple tools and instruments. The National Spatial Strategy (VROM 2006) lays out the policy goals and instruments of spatial planning until 2020 with an outlook to 2030. Different impacts of climate change are recognized, although most are water-related (e.g. rainfall extremes and droughts). Water is also seen as the integrating aspect of spatial planning solutions to adaptation. The Strategy calls for contextualizing spatial planning, according to the principle—decentralize where possible, centralize where needed. While the State should provide visionary leadership, policy development and implementation is left to local collaborative partnerships in which the State is a partner. The strategy introduces the concept of area development which should stimulate consortia of land owners, stakeholder groups and authorities to develop integrated land development plans.

The National Spatial Strategy scores well on variety and learning (see Fig. 2). Its contextual approach encourages local actors to autonomously adapt while providing leadership at national level. However, this leadership is not backed by financial and other resources, which creates a reliance upon the willingness and resources of local actors to implement adaptation solutions. This reliance may be problematic, as there are no clearly defined targets or end goals for adaptation, and no actor can be held accountable for the successes and failures of adaptation through spatial planning. Besides, the strategy does not provide any blueprints for adaptation solutions through spatial planning for local actors to use in responding to climate change.

While decision-making in the spatial planning sector is highly decentralized, important national-level steering instruments are compulsory assessments. Most importantly, medium to large-scale spatial developments require project developers to prepare strategic environmental assessments to map the expected environmental consequences of a project and list alternatives that could mitigate these consequences. Such assessments were already required under the 1994 Environmental Management Act for spatial plans in their final stage. A 2006 amendment now also requires these assessments in initial phases of the planning process so that these plans can be adjusted to mitigate or better anticipate the negative consequences. While an analysis of a project's impacts on climate change adaptation is not mandated in assessment reports, there is room to incorporate such concerns.

An ACW analysis shows that strategic environmental assessments consider alternative options, encouraging variety and learning. By requiring a description of the aspects that can be used to evaluate the project once implemented, it strengthens accountability. Reports are

Fig. 2 The National Spatial Strategy

open for public consideration for at least 4 weeks, and final reports must describe how the plan has dealt with public concerns, further facilitating fair governance and variety. However, the Strategic Environmental Assessment remains a rather bureaucratic instrument produced by project developers and evaluated by state bureaucrats. Links with social actors are not deliberatively pursued, and while officially open to the public, assessment reports are not commonly disseminated to social actors directly impacted by spatial planning projects, such as farmers or residents. Also, there is no state funding; project developers and planners must pay for the procedure themselves (Fig. 3).

A third key instrument is the Spatial Planning Act (2008). The Act calls for setting national water-related goals and forwards decentralized spatial planning approaches as the means to tune different interests to each other around these national targets. In response to growing municipal powers, it provided national and provincial governments with more power over local spatial planning activities. The State and provincial governments may set preconditions for the development of local spatial plans, may comment on draft local plans and may change local planning after the fact to ensure compatibility with national priorities, especially on water. While the law has clear rules and procedures, its decentralized approach is ambiguous about who can be held responsible for what. It does not include basic learning mechanisms or mandate structural evaluation, monitoring or research. However, there is scope for deliberation between governments (collaborative leadership) and economic actors involved in planning (entrepreneurial leadership) (see Fig. 4).

Spatial planning policies score quite well in the ACW (Figs. 2, 3 and 4), especially on variety and visionary leadership. They promote decentralized development and participatory approaches VROM (2006). However, spatial planning policies typically do not provide much

Fig. 3 Strategic Environmental Assessment

Fig. 4 Spatial Planning Act

resources. And while there are many actors, solutions and problem frames involved, it is unclear who is responsible (and accountable) for the implementation of policy goals.

3.2 Water sector

Unlike other developed countries, private parties such as the insurance industry hardly play a role in water management in the Netherlands. Being a low lying delta country, the water sector is highly regulated, focused on flood protection through large-scale and interlinked infrastructural projects. In recent years, prompted by climate change, the policy framework has moved towards a more dynamic perspective (Jong and van der Brink 2013). Long-term goals and middle-term strategies for national water management are outlined in the National Water Plan (NWP) (Ministry of Transport, Public Works, VenW and LNV 2009). Moving beyond the second Delta Commission's (2008) recommendations to evolve to a more dynamic but still largely technical approach to water safety (e.g. by improving and strengthening coastal defence safety norms, creating discharge outlets and storage reservoirs), the NWP emphasizes institutional solutions. Recognizing the uncertainty of climate change impacts, the plan encourages regional development processes which incorporate different public goals (e.g. economic, recreation, environmental) and context-specific solutions. The NWP furthermore presents a new layered flood strategy, which breaks away from the past focus on technical measures; next to structural measures for flood prevention, a second layer of sustainable spatial planning employs new techniques in flood-proof building, and a third layer of disaster preparedness are included.

The NWP involves many levels, sectors and actors. With its regional focus, it facilitates collaboration and learning through periodic monitoring and improvement of implemented projects and strategies. While the NWP has a regional approach, its national level aims and targets are backed by sufficient financial resources. However, it remains unclear how regional water plans will be financed. It is worrying that the plan does not actively engage the private sector, as is being done in other countries. Although the plan calls for a variety of solutions, the reliability of the continued focus on technical measures is not discussed, hampering double-loop learning (see Fig. 5).

Whereas the NWP outlines the government's vision on the water sector, the Water Act (2009) is its main instrument. This Act replaces and integrates (aspects of) several other water laws. Although it does not mention climate change, climate change is a reason behind this integrative effort. The Act provides safety norms with which primary dikes must comply; it outlines the importance of, and some guidance for, decision-making on water quality norms and describes how water managers should deal with water scarcity and provides financial and human resources (VenW, VROM & LNV 2009).

The law introduces elements to enhance the water sector's adaptive capacity, namely the regional multipurpose water management approach laid down in the strategic NWP. The term integrated water management is adopted to integrate different water management and societal goals in regional water plans. The Water Act improves the connections with other policy domains, especially spatial planning. It arranges that national and regional water plans are considered as structural visions under the Spatial Planning Act, which provides them with legal status. It specifies the responsibilities of national and provisional governments in flood safety. While this integrative approach encourages collaboration between different sectors and levels, the law does not make provisions to stimulate local-actor involvement and facilitate visionary or entrepreneurial leadership in the development of regional water plans. It strengthens learning capacity by prescribing a 6-yearly test of primary dikes as well as a 12-yearly update of their safety norms and 6-yearly updates of national and regional water plans.

Fig. 5 National Water Plan

While room for autonomous change is not extensively addressed, the Act requires that the public is informed on high water levels and alarming situations to improve disaster preparedness (see Fig. 6).

To further integrate water concerns into spatial planning processes, a water assessment was launched in 2001 (RIZA 2003). The Water Assessment aims to anticipate, and where possible, prevent the negative effect of spatial plans on the local water system in an early phase of the spatial planning process. It allows water managers and planners to cooperate in planning processes. Regional water boards are involved in developing water assessments; based on the outcomes, they advise municipalities, provincial governments and the State on the feasibility of spatial plans. However, this advice is not binding. The water assessment has been formally integrated into the Spatial Planning Act; however, this requires that project initiators take the impacts on the local water system into account. While water assessment provide information for project developers to act on, this information remains fragmented and there is no mechanism to learn from experiences in previous situations or other locations (see Fig. 7). Providing a blueprint, or increasing the diversity of options to integrate spatial and water goals, are also not pursued; water assessments principally aim to increase the efficiency of the planning process and do not come with any additional human or financial resources.

Water policies have a positive effect on adaptive capacity (Figs. 5, 6 and 7). The Netherlands' policy switch from hard technological measures to a more decentralized perspective potentially increases the variety of actors involved and contributes to learning. However, the key instruments devised for implementing this more regional and multipurpose approach (the Water Act and the Water Assessment) do not specifically engage local actors or make space for entrepreneurial and visionary leadership.

Fig. 6 The Water Act

Fig. 7 The Water Assessment

3.3 The agricultural sector

The Netherlands' agricultural sector is hugely influenced by the World Trade Organization, the European Union's (EU) Common Agricultural Policy (EC 2009) and global markets. Farmers have a long history of coping with the vagaries of nature. International and national institutions reflect this tradition and provide a framework within which innovation and the market can flourish. Protection against local floods is a responsibility of the individual farmer; it is only in case of large-scale disasters that the government steps in.

The Agenda for a Living Countryside (Ministry of Agriculture, Nature and Food Quality, LNV 2004) describes the government's vision on countryside developments. Precise goals and instruments are included in the accompanying Multi-year Programme for a Living Countryside. The Agenda sets the general goals for the agricultural sector, leaving the local level with autonomy regarding how to achieve these goals. The national government encourages a regional approach that diversifies agricultural production and creates multifunctional landscapes, inter alia, to better prepare for climate impacts. The agenda identifies several climate-related challenges, including high water levels, saline intrusion and crop damage from extreme weather events and droughts. Notably, it refers to non-agricultural policies for solutions. For example, drought should be combated through the National Ecological Network (Section 3.4) and water-related problems should be tackled through water management solutions. However, the Agenda sees a role for the agricultural sector on water retention as retention claims space from cultivatable land.

In the multiyear program, national-level aims are further specified in norms that should be achieved within 7 years. The norms for the multiyear program for 2007–2013 were set through discussions between the national government and each provincial administration to see which (part) of the national aims could be taken on by that province. These negotiations resulted in provincial multiyear programmes, specifying agreed objectives and necessary (national, provincial and other) budgets. All provinces have drafted a management plan which is being implemented. Provinces then designate tasks to other actors like water boards and municipalities. The multiyear program fixes norms and discourages redundancy. The program does establish effect-indicators to evaluate the annual progress on the provincial programs. While this strengthens accountability and allows for reflection on the implementation (single loop learning), it does not explicitly facilitate a reflection on the aims itself (double-loop learning), nor does this arrangement provide much room to discuss doubts. The approach encourages the inclusion of many actors, although most are from the government. While the program generates detailed plans for local governmental actors to act on, it does not provide information or other incentives to engage farmers and other local nongovernmental actors in its daily implementation (see Fig. 8).

The Rural Areas Development Act (2007) provides provincial governments with instruments to achieve the goals set in their multiyear programmes. First, it creates rural area investment budgets to support relevant provincial efforts. When, after 7 years, provinces have not achieved these goals, the province can be held accountable and the rural investment funds can be discontinued. Second, the Act emphasizes land consolidation (in existence since the 1980s) as a strategy to achieve the targets in the multiyear program. Land consolidation facilitates the rearrangement of a privately owned local area by allowing for the exchange or swap of grounds between different private, or private and governmental, actors. Based on their multiyear program goals, provincial governments are to adopt a land consolidation plan specifying public functions (e.g. agricultural, environmental or water functions) for different sub-areas and to work with local actors to rearrange local areas when necessary. While the Act grants a leadership role to the provincial government in managing climate-related affairs in the

Fig. 8 Agenda and multi-year program for a Living Countryside

agricultural sector, this is not backed by much authority at the central level. In addition, climate-related challenges are presented as zero sum games; as space is limited and land consolidation should seek the most efficient solution, which means that redundancy is not pursued. However, little effort is made to actually provide local actors with the information needed to become involved in provincial land consolidations (see Fig. 9).

Generally, the ACW assessments of agricultural policies are positive (Klostermann et al. 2010; Figs. 8, 7 and 9). They call for decentralization to increase the creativity and innovative capacity of farmers. Collaboration between different actors and sectors is stimulated as policy goals are general and linked to other policy domains. However, reflecting the market-orientation of the agricultural sector in general, the focus is on increasing efficiency and not redundancy. Policies demonstrate little deliberative effort to include local non-governmental actors.

3.4 The nature sector

The Netherlands is densely populated and nature reserves are concentrated in small areas. Nature regulations are of recent origin and mostly stimulated by the EU. The 1967 Nature Conservation Act enabled the protection of natural areas and species. International and European regulations (e.g. the International Convention on Biodiversity, Natura 2000 and the Birds and Habitat Directives) required a new Nature Conservation Act in 1998 focusing on area protection. Protection of species is regulated through a separate Flora and Fauna Act (see below).

The Nature Conversation Act (1998) aims to conserve national nature areas, which include Natura 2000 areas, protected national nature monuments and wetlands. It prohibits the disruption of protected areas; only overriding national interests can justify interference but the state must compensate for this by investing in the same type of nature at a nearby location.

Fig. 9 The Rural Areas Development Act

The Act assigns responsibilities to the central government to designate preservation goals and related management plans for protected areas. It specifies that with an interval of maximum 8 years, new national nature policy plans should be developed. While this contributes to single loop learning, the focus on protection and conservation of existing areas and species could hamper double-loop learning. The choice for protected areas should partly be based on a collaborative search for important nature values and management plans for protected areas should be developed in collaboration with local land owners, land users and other stakeholders. While this creates room for collaboration, the fixed character of nationally set goals and norms reduces opportunities for responsiveness and leaves little room for flexible nature management at the local level. The law has authority and legitimacy arising in part from EU regulation but displays little national visionary leadership. Private-sector involvement is not encouraged, while national funding is also not provided; the costs of nature protection have to be covered by landowners and the provincial government (Fig. 10).

The Flora and Fauna Act (1998) further develops and implements EU (Birds and Habitat Directive) and international (CITES agreement) regulations for the protection of plant and animal species. It lists species that should be protected and specifies rules for nature management, damage control, hunting, trade, ownership and other human activities that could potentially harm protected species. Like the Nature Conservation Act, the basic regulatory principle is no-unless; damaging activities are forbidden, unless there is no alternative and the activities serve the public interest. The law is backed by national resources. It creates a Fauna Fund to prevent damage to wild species, to compensate any damage that does occur and to fund scientific research and education on nature protection. In addition, the list of protected species is decided on by the Minister of Agriculture and Nature. However, the updating of this

Fig. 10 The Nature Conservation Act

list is mostly a reaction to new international regulations, displaying little visionary leadership. Lower-level governmental and nongovernmental actors have little room to influence this list, reducing the scope for collaboration and private-sector involvement. The whole law is rather top-down, including only one frame—that is, protection—leaving little room for autonomous local-level adaptation activities (see Fig. 11).

A third instrument in this sector is the National Ecological Network (NEN) introduced in the 1990 Nature Policy Plan in response to the increasing fragmentation of natural areas due to continued area development (LNV 1995). Consequently, species were confined to small natural areas which challenged their reproduction and biodiversity. The NEN aims to create ecological zones that link the fragmented natural areas, so as to allow animal and plant species to move from one natural area to another and maintain biodiversity. The NEN contains a national map that demarcates natural areas and ecological zones. NEN goals are generally included in provincial multiyear programs; the daily management of NEN areas is usually delegated to environmental organizations who receive finance from the rural area investment budget. NEN management should follow the no-unless principle. Multiple interpretations of this principle in nature management practice led to a document in 2007 which defined this principle and related governance guidelines, which was prepared in collaboration with several non-governmental managing agencies. While this demonstrates a more collaborative approach to setting standards, this collaboration almost entirely occurs within the nature sector (see Fig. 12). Besides sustaining biodiversity, the NEN aims to increase the coping capacity of the ecological system in the event of crises. In the 1990s, this idea was not yet linked to climate change; however, it has since been extended to include robust ecological corridors and natural climate buffers to better account for climate extremes

Fig. 11 The Flora and Fauna Act

The application of the ACW to the nature sector (see Figs. 10, 11 and 12) show that both the Netherlands' and EU regulations focus on conservation - preserving nature in situ and improving its robustness against pressures from outside (Klostermann et al. 2010). Hence, regulations tend to be rigid, static and top-down. For example, the list of endangered species is strict, allowing for little flexibility in removing species from this list whose conditions might improve under climate change and in adding species whose possibilities for survival in a specific locality are decreased. Most decision-making procedures are limited to ecological experts, and top-down policy approaches allow little room for local actors to take their own adaptation measures. Consequently, there are dominant problem frames that pre-empt discussions about underlying assumptions and reduce the institutions' ability to change. At the same time, the strict top-down regulations imply high commitment from the national government to achieve nature goals, as demonstrated by a high score on authoritative resources, and moderately positive scores on human and economic resources.

3.5 A reflection on the formal institutions for climate change adaptation across different sectors

In the water and agricultural sectors, the Netherlands government responds to climate change through a less top-down and more decentralized policy approach which should encourage regional and local actors to develop contextual solutions to deal with climate change. The central government is gradually reducing its dominant focus on, and role in, water management for adaptation. Instead, spatial planning is entrusted with developing the overarching framework to guide contextual adaptation strategies. While the water sector has adopted local spatial approaches, for example, through the Water Assessment, and the agricultural sector

Fig. 12 The National Ecological Network

through land consolidation, the nature sector has not adopted a local contextual approach and remains rather centralized.

But how do these different formal institutions interact with informal institutions in the four policy sectors analysed above? The next section addresses this question through four case studies, one for each sector, that focus on one key element of the formal policy framework described above.

4 Adaptive capacity of informal institutions: four case studies

4.1 Case study Zuidplaspolder on spatial planning

In the Netherlands, being a low-lying delta country, flood management policies have always favoured engineered protection works. However, levees and other engineering solutions to flood protection can have counterproductive effects; they allow for continued development in protected areas, but when a flood breaches through protective structures, it results in extreme losses. Because climate change is thought to lead to more extreme weather conditions, the concept of multilayered safety was introduced in the National Water Plan (see Section 3.2) to expand the focus on flood protection to also include climate-proof spatial planning and disaster preparedness. The second layer of spatial planning is considered especially important for increasing the sector's adaptive capacity under the national spatial planning approach to climate change adaptation (van den Brink et al. 2011).

This case study analysed the development and implementation of this second safety layer in the Zuidplaspolder, the lowest-lying polder in the country. In this polder, a new residential area was planned but these plans met with resistance from local water managers who were concerned

about the impacts of this spatial development on the local water system and warned about the high flood risks that faced the polder. The province of Zuid-Holland initiated a research track to explore the possibilities of climate-proof building in the Zuidplaspolder and invited different stakeholders (e.g. planners, NGOs and potential residents) to participate. This research resulted in innovative building techniques such as floating homes and building on poles. However, the government authorities involved were reluctant to invest in climate adaptation measures, which are around 20 to 30 % more expensive, and most techniques were never applied.

This case study demonstrates that at the local level, a decentralized spatial approach promotes the inclusion of actors and perspectives, which positively affects the learning capacity in the water sector. This variety resulted from the provincial government's initiation of the research track. While different perspectives on how to build have been incorporated in the planning process as a result of this research project, these perspectives remained technocratic. The question of whether it is wise to continue building in flood prone areas was hardly discussed (Van den Brink et al. 2013).

4.2 Case study Delft on water management

The water sector case study examines the division of responsibilities between governmental and nongovernmental actors (e.g. individuals, private industry actors) in local water management. By promoting a more decentralized approach to climate adaptation in the water sector, the national government stresses the responsibility of the local level to cope with climate change impacts. However, responsibilities of different actors under this decentralized approach were not clearly delineated. To clarify responsibilities under this approach, the central government adopted the Municipal Water Tasks Act (2008). This Act stipulates that landowners are responsible for the drainage of their land but also specifies that the municipality should step in if circumstances do not reasonably allow landowners to carry out this responsibility. It furthermore reiterates the municipal duty of care for groundwater, wastewater and rainwater systems, and the responsibility of regional water boards to manage surface waters and water levels.

This case study analysed the impacts of this law in the city of Delft. The results indicate that local responsibilities for surface, waste and rainwater management are sufficiently clarified and accepted by all parties involved in Delft's local water management (Bergsma et al. 2012). However, groundwater management responsibilities are divided between different parties: landowners must establish good drainage of groundwater on their land; the Water Board should make sure that there is sufficient space for landowners to drain their groundwater into; the province issues permits for the withdrawal of deep groundwater; and the municipality has a vaguely described duty of care to evaluate whether it can reasonably be expected that landowners establish good drainage and if this is not the case to take over this responsibility from the landowner. As the responsibilities are diffuse, in practice, it is difficult to hold any actor accountable for groundwater problems. Furthermore, the case study demonstrates that while the municipal government tries to increase the (awareness of the) array of options available to residents in groundwater management, individuals prefer to turn to experts (e.g. contractors, architects) to provide solutions in this regard. However, the results also indicate that it is extremely difficult for residents who do want to inform themselves on local water conditions to find this information.

4.3 Case study on agricultural management in De Wijde Wormer

The third case focuses on the implementation of the concept of area development (Section 3.1) which stimulates the formation of local collaborative networks to develop spatial plans, and the

instrument of land consolidation (see Section 3.3) which allows different local stakeholders to exchange land. It focuses on the agricultural polder—De Wijde Wormer. The regional Water Board selected this polder to create an extra 38 ha of open water to absorb the expected impacts of climate change. At the same time, other parties also made claims on the polder. Farmers who own the majority of polder land wanted to improve the agricultural structure, nature organizations wished to enhance the ecological quality and the municipality aimed to improve recreational facilities. In 2005, the Water Board established a steering group formed by local stakeholders to integrate their different goals in a win-win solution. Land consolidation was seen as the key instrument to realize this goal.

The case study indicates that this integrated area development approach encouraged local collaboration and the search for win-win solutions (Bergsma et al. 2012). However, there was no incentive to actually come to action. In De Wijde Wormer, when farmers exchange land with the local water board, farmers are only compensated for reduced income. This does not move them to action; why should they change their habits when the (financial) end result is the same? The water board is aware of this situation, but can only compensate for loss in market value because it has to answer for spending the taxpayer's money. In addition, the case study results indicate that these open networks create little institutional memory to learn from past experiences.

4.4 Case study on nature management in the Wadden Sea

The fourth case studied an important ecosystem in the Netherlands—the Wadden Sea—a system of islands, sandbanks, sludge plates and gullies stretching from the north of the Netherlands along the German coast to Denmark. It is the habitat for shellfish, fish and migrating birds and is officially a protected area under the Nature Conservation Act (see Section 3.4). While this area attracts tourists, its ecosystem is under pressure from sea level rise, commercial fishing, shipping and pollution. This case study analysed the adaptive capacity of local institutions to the challenges faced in the Wadden Sea.

Although the nature sector is essentially top-down, this case study revealed a local collaborative approach to Wadden Sea management plans. The fact that protection is mandated draws together different actors from multiple sectors and levels, who are collaborating to develop an integrated approach for the Wadden Sea region. Conflicts are increasingly resolved through social dialogue with different stakeholders and innovative governance experiments like the Mussels Covenant and the Wadden Sea Fund have been established (Klostermann et al. 2010). While stakeholders are hindered by strict norms and unclear responsibilities for norm implementation especially where nature itself turns out to be dynamic, the case study demonstrates an ability to approach fixed end goals (nature protection) with some flexibility. However, there remain serious limits to accountability, visionary leadership and access to information, and there are few fall back policies—leading to low redundancy.

5 Discussion and conclusions

This paper has analysed whether institutions in the Netherlands allow and encourage society to adapt to complex and uncertain climate change impacts. In line with developments at international and EU level, adaptation policies in the Netherlands frame adaptation as a local problem that should be addressed through tailor-made solutions. This is promoted through decentralized spatial planning which should bring relevant local actors from different sectors together to develop context-specific approaches for dealing with climate impacts. Using the ACW, we have analysed formal institutions (national policies) as well as informal institutions

(i.e. the implementation of national policies) on the ground that should guide the Netherlands adaptation framework in moving to this decentralized approach to spatial planning.

Our analysis demonstrates that in the last decade, links between the water, agricultural and nature sectors and the decentralized approach promoted by the spatial planning sector have been improved. These links are oldest and strongest in the water sector as recent policies like the National Water Plan and the Water Act emphasize decentralization and the Water Assessment tool links water and spatial aims in local practice. Recent policy developments in the agricultural sector also emphasize this decentralized spatial approach; the Agenda for a Living Countryside sets national targets but allows regional autonomy in their implementation and the Rural Areas Development Act establishes the instruments to support this approach. Formal institutions in the nature sector use a (spatial) planning orientation, but remain top-down and inflexible compared to the other sectors. Because decentralized spatial planning is expected to guide climate adaptation, spatial planning, water and agricultural institutions not only demonstrate adaptive capacity on paper, but also in practice.

Our analysis shows that a more decentralized approach in the spatial planning sector, integrated with decentralized approaches in the water and agricultural sectors can encourage different actors to collaborate and learn, and create abundant opportunities to promote a variety of solutions for adaptation. However, in practice, local actors do not have a clear plan on how to use spatial planning instruments in responding to changes in weather patterns. Our analysis of the nature sector furthermore shows that rigid, centralized institutions are less able to include a variety of actors and perspectives that are so important to continuously reconsider policies in the light of new circumstances like climate change.

However, our analysis also demonstrates that top-down approaches may provide leadership (in the form of clear policy goals) and resources for practitioners to work towards these goals. The conclusion that the nature sector should be reformed to bring under the spatial planning approach to climate change adaptation may therefore be too simplistic. A tension between bottom-up and top-down approaches emerges. Our case studies, in particular, have demonstrated the difficulties with fully relying on bottom-up and integrative approaches. Actors involved in local collaborative networks have suffered from a lack of resources; they were forced to look for solutions that are profitable in the short-term or needed to prepare for future impacts of climate change by taking measures on their own premises. Since goals have to be set within these networks but accountability is often unclear and leadership is missing, such projects face long-term delays and inactivity, in effect actually hampering the capacity to adapt. Also, questions may be raised with regard to the ability of such a decentralized approach to adequately respond to long-term problems that pose a threat to the agricultural sector as a whole, like increased salinity, periodic floods and droughts.

Top-down policies such as the ones regulating the nature sector or the dominant technical focus on water safety also have their drawbacks for adaptive capacity. This may create institutional path dependency; a lock-in to the protection of certain species at certain places while new conditions may present new and improved opportunities for nature conservation, or a continued focus on hard infrastructural measures and building in vulnerable areas and thereby not considering other ways to accommodate rising water levels and increasing precipitation. And these are precisely those weaknesses that can be addressed through more bottom-up adaptation approaches.

Both bottom-up and top-down approaches have their strengths and weaknesses for adaptive capacity. While hierarchical arrangements may ignore new knowledge and innovative ideas, horizontal arrangements may lack the authority to accelerate the adaptation process. In adapting to climate change, a balance between these two approaches should be found, so as to allow the institutions to evolve in a way that the adaptive capacity is increased.

Decentralized decision-making may need to operate in the shadow of hierarchy (Scharpf 1997: 202) which influences the direction of decentralized decision-making by leading, setting standards, ratifying outcomes, providing financial and other resources and monitoring progress without being actively involved. Because actors anticipate this influence, the higher hierarchical level only needs to cast this shadow and does not need to interfere directly, thereby making optimal use of local knowledge. The regulatory threat of hierarchical interventions creates institutional incentives for actors to develop their networks and take appropriate action.

Acknowledgments The authors acknowledge that the research was undertaken in the course of the project - IC12: Institutions for Adaptation: The Capacity and Ability of the Dutch Institutional Framework to Adapt to Climate Change', which was funded by the Netherlands BSIK-Programme Climate *changes* Spatial Planning (CcSP).[1]

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