Connective Capacity in Water Governance

Introduction and conceptual exploration

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Introduction

Water governance is an upcoming stream in public administration. Water governance is more then preventing the people from floods. It becomes an integral part of spatial planning and regional development. Water governance requires combining different spatial functions and values (nature, recreation, agriculture, housing, economy and infrastructure) with measures to increase water retention capacity, safety against floods, estuarine dynamics, and so on.

Water governance is especially about connective capacity. Water governance concerns multi-level issues. Water doesn't stop at borders or jurisdictions. It crosses local, regional/provincial, national and European/international institutional borders. Moreover, water concerns citizens, NGOs, and private actors. So it is not only a public/governmental issue, but also a societal and private sector issue. But how can we bring the three spheres (public, private and society) together? Water is also a multi-domain issue: other (spatial or policy) domains have to be taken into account to accomplish water governance. A variety of governmental and non-governmental actors have to be mobilized and their actions have to be synchronized.

Subsequently, how do we effectively interlink different frames of actors, ways of knowing, ambitions and values? What different timelines/horizons do actors use in solving water issues? How can we combine the short with the long term in coping with climate change in water governance? In what way cause formal procedures (such as EIA) and informal processes (interactive processes) fragmentation of complex decision-making? How are processes and procedures interconnected in practice?

This book deals with the question how to deal with the various sources of fragmentation in water governance by organizing meaningful connections and developing 'connective capacity'. What 'ticks connective capacity': what are its determinants, how is it manifested in practice and how can we mobilize, use, and consolidate the capacity to connect different scales, domains, levels, actors, agendas, processes, etc? Connective capacity does have many components: personal, relational, organizational, and institutional.

In this introduction four types of connections are conceptualized and empirically demonstrated:

- between different sectors and domains;

- between different government layers and levels;
- between public and private spheres;
- between the long and the sort term.

But first we define our scope on water management through the concept of Water Governance (Edelenbos, 2010; Van Buuren, Edelenbos & Klijn, 2010) in the next section.

Water governance: a positioning from a public administration point of view

Water management and climate change are uncertain, dynamic and complex issues that are interrelated. For example, predictions for the exact amount of sea level rise vary greatly. A sea level rise of 50 centimeters by the year 2100 requires particular climate measures that may differ at lot from measures for a sea level rise of 130 centimeters. The future is uncertain, unknowable and cannot be clearly predicted (Flood, 1999; Teisman, 2001). A strategy of defensibility tries to limit or exclude uncertainty and risk. This is known as the 'robustness principle' (Wildavsky, 1988, p. 116). A strategy of adaptability, on the other hand, accepts uncertainty and assumes that problem analyses and solutions have to be adjusted to new insights gained during policy formulation and implementation. The dynamic, uncertain and complex nature of the water issue urgently requires our abilities as humans, directors, politicians, official, experts and citizens to adaptively manage it.

Climate change demands governments that are able to explore and exploit a way of governance that provides resistance towards external disturbances, but also creates adaptability for reorganization when external circumstances becomes too disturbing and threatening. Water governance is about dealing with the climate change in a two-fold way, by resistance (robustness) and adaptability. In other words, cities have to become resilient: they have to become able to continue their core business and by protecting that. But at the other hand cities have to reorganize that it is important to face external shocks that are highly uncertain and cannot be resisted. Tompkins and Adger (2004: 234) argue the following: "Emerging insights from adaptive and community-based resource management suggest that building resilience into both human and ecological systems is an effective way to cope with environmental change characterized by future surprises or unknowable risks". The climate change issue is complex and interconnected problem that is characterized by high uncertainty. There is uncertainty about on the magnitude, the time frame, the impact, the duration and the locus of the change. There is at least certainty that there is a problem. We require water governance approaches and arrangements that doesn't have the capacity to predict the future, but needs to build a qualitative capacity to devise the system that can absorb and accommodate future events in whatever unexpected form they might take (c.f. Holling, 1973: 21).

The adaptive approach constantly explores and considers – while collaborating with others within society, including governments and the market – how situations can be countered and reckoned with. In this way, adaptive capacity and connective capacity are

highly interrelated. Adaptive capacity is an inter-organizational concept. Because of the complex network character of society, adaptibility is realized in cooperation between organizations and actors from governmental, private and societal institutions. Connective capacity is therefore a prerequisite for realizing adaptive capacity in coping with uncertain developments. Water and climate issues are multifaceted and connected to many other social, environmental, and economic problems. The search for solutions to the climate and water problems requires the recognition of these connections between issues. The ambition for full control seems useless with regards to the issue of climate change. It is an overestimation of our knowledge and abilities. The climate issue is simply too complex and compounded. They are connected with a variety of other land management and societal issues. Consider the following example from the past: the blending of gasoline with ethanol from corn to create the transition to bio fuels in order to realize a reduction in CO_2 emissions. This had the unintended, unforeseen and undesirable side effect of increasing the price of corn. This caused the so-called 'tortilla wars' in Mexico, for example, which resulted in an additional 150 million people starving, all because of this well-meant but woefully inadequate extracting measure (Edelenbos, 2010).

From prior research we know that monocentric government models and approached are incapable to handle persistent uncertain situations as the climate issue confronts us. Multi or polycentric governance models are more equipped for this, because these models give more room for variety of actors, ideas and frames. Therefore, these governance models are more capable to handle the fundamental uncertainties of climate change (Weick and Sutcliffe, 2001; Folke et al, 2005).
Climate change and adaptation do not occur in a vacuum (Edelenbos, 2010). The urgency of the climate issue is generally supported. It leads for example to water problems, on quality (fresh water) and quantity (flooding, water retention). However, the contents of water policies are subject to intense discussion and negotiation. The conflict between values is played out here, especially between safety, spatial development, and environmental and ecological qualities. The issue of water safety touches the possibilities for the development of agriculture, nature, urban areas, infrastructure, and recreation areas.
A system-wide governance perspective is required (Teisman et al, 2009). Water fulfills various functions for very different audiences and interest groups. Sometimes it is a difficult condition for housing and economic development. It can also be a desired quality for recreation and nature. Sometimes it is a threat that should be banned. Then again, it is vital for agriculture and horticulture. In other words, water is valued differently by various groups of stakeholders.
Scholars speak of a shift from government to governance (Kickert et al, 1997; Kooiman, 1993), which involves the recognition that modes of governing are multiple and includes processes and institutions that transverse scales as well as networks of actors that cannot easily be characterized by the state/nonstate dichotomy (Betsill and Bulkeley, 2006). Water governance is then about the ability to connect different frames, values and ambitions. The connective capacity also relates to the ability to connect the local (city) with the regional, the metropolitan area. Moreover, it is all about the capacity to connect different processes from society, market and government (Van Buuren, Edelenbos &

Klijn, 2010). Water governance demands interaction and collaboration among various actors. This approach emphasizes horizontality and reciprocity. Water governance is the set of interplay of processes of coordination and cooperation and the set of interfaces between various actors (Edelenbos, 2010). It is multi-level, multi-scale, multi-process and multi-actor. '... the speed of interactions and the multiplication of linkages among elements in the biophysical, technical, and human systems at a number of spatial scales seems to be increasing, creating a global "time-space" compression' (Duit and Galaz, 2008: 311). Resilient water governance implies connective capacity. Moreover, crossovers between frames, scales and levels do not add up in a linear, predictable manner. Negative and positive feedback loops between (temporal and spatial) levels and scales result in unexpected consequences that need adaptive capacity (Gunderson, 2003). Water governance implies connective capacity. In the remaining of this introduction we elaborate four types of connections:

- between different sectors and domains;
- between different government layers and levels;
- between public and private spheres;
- between the long and the sort term.

[nb, discussion on fragmentation/specialisation - integration/synchronisation]

Water governance crosses sectors and domains

Climate change has many origins. CO2 is one of them. However, also other societal developments have their impact on climate change. Urban heat island effects are also influenced by the degree of urbanization, ageing population, and air pollution. These aspects are interrelated and negatively reinforce each other. Climate change and urban area development are interrelated and have many causal relationships. Global warming and related climate changes are likely to significantly increase the weather-related risks facing human settlements, including floods, water and power supply failures and associated economic collapse into so-called ‘failed cities’ (Muller, 2007, 99). Because of the interconnected nature of climate change a more holistic approach is needed, such as the Integrated Regional Water Management (IRWM) or Integrated Water Resources Management (IWRM) approach. These approaches recognize that there are multiple and interconnected pathways to building resilience and seem a key institutional action for mainstreaming adaptation or ‘climate proofing’ (Muller, 2007).

Urban areas rely upon a complex set of nested systems to provide human, environmental, and economic services, such as: flood control, water supply, drainage, transportation, energy, and constructed facilities for residential commercial, and industrial activities (Kirshen et al, 2008, 105, 106). One of the main features of complex urban areas is that the different domains or subsystems are close to each other and have the potential to positively interact (enforcing feedback loops) (Teisman et al, 2009). The interdependent domains can affect each other both negatively and positively, and negative cumulative impacts can even disrupt whole urban systems (Kirshen et al, 2008). On the other hand, when a cross sector solution is realized this means at the same time that potential positive

reinforcing effects can be realized. For example, in Rotterdam much policy attention is for the development of green or vegetation roofs, which are able to absorb water (rain fall), have a cooling effect (fighting heat island effect) and absorb CO2 (mitigation), and provide for good building isolation (energy reduction). This kind of measures has the potential to improve environmental, social and economic conditions.
Interrelationships call for an integrated approach to addressing the problem of climate change through mutually supportive adaptation and mitigation measures (Kirshen et al, 2008, 119). Adaptation requires integration of many sectors: water, agriculture, nature, environment, building, infrastructure, etc. Therefore horizontal networks and network approaches are important to develop and implement adaptation policy.

However, climate change and adaptation is a difficult and challenging problem/issue, because solutions have to be found in sections and domains where climate adaptation is not the main goal, but at the highest a secondary object. Climate change is an extra claim on the complex issue of water management and regional development.

Climate change heavily depends on other domains and sectors, because climate doesn't have a traditional own domain. It is therefore important to build and develop effective and legitimate relations between different domains and sectors. Domains are interconnected and interdependent, and need constant coordination and fine-tuning. Climate policy needs to be embedded in other policy fields as water, infrastructure, urban development and agriculture. Climate needs and regional and integrated approach and system synchronization (Teisman and Edelenbos, 2010). A study from Van Buuren, Edelenbos and Klijn (2010) researched 8 Dutch water related regional development projects indicate that regional development is a multi-functions issue. All the researched cases show to a certain extent the interconnected nature of regional governance. In these projects it is attempted to combine or integrate different functions, such as: agriculture, nature development, water quality, water quantity, urban development, environment, business area development, etc.

We discuss shortly the case of the Bay Area Integrated Regional Water Management program (Bay Area IRWM) in California USA to illustrate the challenge of meeting climate change and domain and function integration. California is nowadays constantly faced with floods and droughts, while living in a world of such grave prospects as earthquakes, energy en budget crises, population growth, and climate change (Tanaka et al, 2006). Several studies have indicated that California's climate is variable over history and in the present (Cayan et al, 1999), is experiencing sea level rise, and may experience significant climate warming (Snyder et al, 2002). Climate change is foreseen to have an impact on the entire inter-tied California water system, including ground and surface waters, agricultural and urban water use, environmental flows, hydropower, and water supply infrastructure and management (Tanaka et al, 2006, 362).

The water system can be approached as a complex system in which different functions and domains interrelate and show interdependencies at multiple scales (local, regional and (sub)national level). Decisions and (implementation) actions in the one domain will influence other functional areas. For the Bay Area IRWM we see fragmentation and interrelation on the following functional areas: water quality, water supply, waste water, urban development, flood protection, storm water management, and habitat protection/restoration (Lubell & Lippert, 2011). In the Bay Area the IRWM

approach is started especially to try to integrate the different abovementioned function areas, functions or domains. IRWM is one of the main strategies of the overall state plan, with the ambition to set up funding programs to promote integration at the regional level. IRWM was approached as a way to solve many of the climate, urban and environmental problems that were challenges to more centralized, command-and-control institutions (Lubell et al, 2002). IRWM is seen as a solution to the fragmentation and lack of cooperation and integration that typifies urban and regional development in the state California.

The most important watershed in California is the San Francisco Bay-Delta that is created by the confluence of the two largest rivers, the Sacramento, and the San Joaquin. The source of approximately seven million acre-feet of fresh water for drinking and irrigation, the Bay-Delta is the beating heart of the California urban and water system. More than 7,000 and two-thirds of California's population obtain water from the Delta (Lubell & Lippert, 2011; Lund et al, 2007).

Lubell and Lippert (2011) have studied the level of functional integration as a consequence of the IRWM approach in the Bay area. He shows the following results:

Figure 1 Perceived Integration of Watershed Functions (source Lubell and Lippert, 2011)

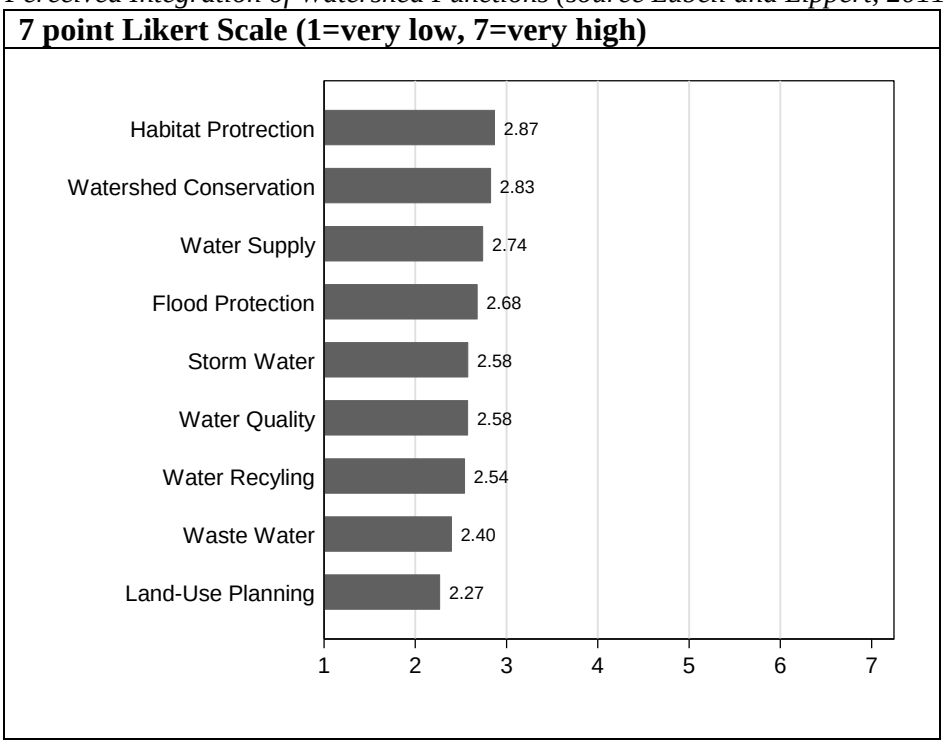

Figure 3 shows that IRWM largely fails to integrate different functional domains/functions. Not a single score is above the midpoint of the 7-point (Likert) scale; the participants on average perceive the IRWM program of making only small contributions to achieving increasing integration. The greatest integration was perceived for habitat conservation and watershed conservation.

Lubell (forthcoming) offers us a number of explanations for this. First, the administration of IRWM at the California state level was perceived as confusing and inflexible. This is no surprise given how state guidelines were in flux at the time, and

funding for later stages of the IRWM project actually disappeared. Second, the complexity of the IRWM process was viewed as too time consuming, especially given the amount of grant funding available relative to the capital costs of the priority projects. Many stakeholders questioned the procedural fairness of the process, feeling their voices had little influence over decisions controlled by special interests. However, Lubell (forthcoming) sees some bright spots among this generally negative picture. Participation in IRWM is associated with a higher level of collaboration on implementation activities. The integrated approach had a small but positive influence on levels of collaboration and probably increased the breadth and density of policy networks in the Bay Area. However, this increased collaboration did not yet result in integration of functional areas and different interests stakeholders want to realize in developing the region in order to face climate change.

Climate change crosses governmental levels

Climate change and adaptation is a multi-level issue. It crosses local, regional and national borders and jurisdictions. Government is built up from multiple layers, the local, the regional and the national that need to be coordinated. This is called multi-level governance (Marks and Hooghe, 2004). Such networks are simultaneously global and local, state and nonstate. Multilevel governance, that emphasize the connections between vertical tiers of government an the one hand and horizontally organized forms of interactions on the other hand, provides a useful perspective for understanding the ways in which climate and environmental problems are governed within and across scales, layers and levels: the local, the regional, the national and the global (Betsill and Bulkeley, 2006, 149). Traditional analytical divisions between local, national, and global scales, and between state and non-state actors no longer suffice. Processes, programs and institutions are developed between levels and create new spheres of authority. Elaborating these arguments many authors stress the importance of cross-scale and multi-level interactions (Adger, Brown, & Tompkins, 2005; Olsson et al., 2006). Synchronicity focuses on how to interrelate actions, events and processes in surrounding subsystems. It implies thinking and acting up and down between self and a larger whole.

The multi-level aspect of climate change and urban development makes it difficult to realize climate adaptive measures. For instance: what should be decided for the urban development project Stadshavens in Rotterdam, which is an example of outer dike city development? Should we create a climate dike and raise the urban area Stadshavens with 4 or 5 meters? It this wise, when we should decided to close the New Waterway (on a regional level) as a measure to avert the problem of sea level rise? The creation of high dikes is not longer needed if measures on the regional level are taken. In The Netherlands a program ‘Rijnmond and Drechtsteden’ is especially developed to address the boundless issue of climate change and regional development. This regional program is part of the Dutch Deltaprogram which is a national program and consists of nine subprograms, of which six are geographical (Wadden area, Rivers, IJssellake, Southwestern Delta, Coastal Area, Rijnmond-Drechtsteden) and three are thematically (safety, fresh water, building and regeneration) oriented.

Another case is the Fraser Basin Council (FBC), in British Columbia, Canada (see Watson, 2007, 31-48). The Fraser Basin drains 1/4 of the provincial area, supports more than 2,5 million people, who generate 90 percent of Gross Provincial Product from what is still a largely resources based economy. In the last 200 years activities such as mining, timber production, fishing, agricultural settlement, port development and urban expansion have produced a complex mix of land and water-related problems together with climate challenges (Watson, 2007, 40). A first step was taken with the establishment of the Fraser Basin Management Program, which was based on a five-year agreement to pursue sustainability signed by representatives from the federal, provincial, and local tiers of government. The Program was developed through a multi-stakeholder Board, which included representatives for the four levels of government - federal, provincial, municipal, and First Nations - and economic, social and environmental interests from different parts of the Fraser Basin. Watson concludes that the success of this Program was not the installation of a new institutional structure, but the people who worked in the Program: '...it is people and not institutional structures (...) that determine the outcomes of collaboration. There are no substitutes for mutual respect, patience, dedication, trust, negotiation, skills, and endurance' (Watson, 2007, 44).

Climate change crosses public - private - society spheres

Climate change and adaptation doesn't stop at the borders of public organizations like local governments. It concerns also other actors in the playing field like private actors, NGOs, and (organized) citizens. Water governance means that government structures are more open for self-organizing processes from the private sector (citizens and private companies). In the past we have seen all kind of initiatives that illustrate this development: citizen participation, public private partnerships, etc (Teisman and Klijn, 2003; Edelenbos and Teisman, 2008). These developments calls for a governance approach that sets social and market self-organization in motion by providing stimulating conditions for this process to occur. Moreover, it calls for a government that is able to move in tandem with processes of self-organization, and dares to surf on spontaneous waves from society and the private sector (Edelenbos, 2010). For example the case of Stadshavens concerns a lot of actors including the Harbour of Rotterdam. This private company has own ambitions for this project and has the necessary means and resources (for example money) for developing and implementing this project. This makes the Harbour of Rotterdam an important actor in this project.

The following case, Dike reallocation in Nijmegen/Lent, illustrates this even more. Nijmegen/Lent is situated in the southeastern part of The Netherlands. In this case the river Waal runs through the cities Nijmegen and Lent, and is considered a bottleneck in case of high water discharge. In 1993 and 1995 many inhabitants had to be evacuated due to near flooding. This project is also in the Program Space for the Rivers (see case Bypass Kampen). In this program it was decided by local, regional and national government that the river Waal had to be broadened by dike reallocation (insert figure?). However, the area was also allocated for the creation of new housing (VINEX, Waalsprong), these national (another Dutch national Ministry of Housing, Spatial Planning and Environment) and local plans had to be altered. The private housing

corporation and the local government Nijmegen was not happy with this change of plans. However, in close harmony between private (housing companies and public sector (national, regional and local level) a new plan was developed, the dike reallocation plan, in which urban development, water safety, infrastructure (a new viaduct across the river Waal) were the main aspects (Van Buuren, Edelenbos and Klijn, 2010)

However, local inhabitants in the village Lent were less happy with the new ambitions for city development. The reallocation of the dyke had consequence for 53 households; their houses had to broken down. The heavily resisted the governmental plans, but also developed their own local plan 'Lents Warande'. However, this plan didn't meet the long-term ambitions of Rijkswaterstaat (discharge of 18,000 cubic meters per second). Although the citizen's initiative was taken along in the Environmental Impact Assessment, and scored in general as good as the dyke reallocation plan, the national government decided that this plan would not be considered any longer as a feasible alternative because of the long term effects due to expected climate change and higher river discharges in 2030. Governmental actors didn't put much energy in bringing in the local interest in their dyke reallocation plan, which was decided on in an early stage of the decision-making process (Van Buuren, Edelenbos and Klijn, 2010). Local stakeholders were not convinced of these long term prognoses, but had to give up in the end as the national government (House of Representatives) decided in favor of dyke reallocation.

This case illustrates that water governance means connecting public, private and societal spheres, but tensions go along with it. It also illustrates that orientation on public-private connections, goes at the expense of public-society connections.

Climate change crosses time frames: connecting the long with the short term

The time frame is making things even more complex. Connecting the present to possible futures is necessary before good choices can be made (Petersen, et al, 1997). Climate change brings new challenges. Some of the challenges are brought about by issues related to the rate (and magnitude) of change of climate, the potential for non-linear changes and the long time horizons. All these issues are plagued with substantial uncertainties, which makes it difficult to implement adaptation strategies (Dessai and Van der Sluijs, 2007). Burton et al (2002, 154) argue that ‘the essential starting point is the present’. However, the future is uncertain. Burton et al stress that presuppose adaptation to short-term climate variability and extreme events in order to reduce vulnerability to longer-term climate change.

The problem is that different actors hold different time frames. Private actors, such as investors in real estate (for example developing business areas), hold time frames of 15 years or longer, whereas politicians and governments hold time frames of four years (‘election cycles’). ‘Time horizons of a century, and over continental scales, are not compelling to most policymakers’ (Someshwar, 2008, 367). Primary temporal planning and policy horizons are from one season to at the most a decade ahead. It is difficult to cope with problems on the long term, because or democratic system is built on periods of four years. This makes it difficult to set goals for the long run. The challenge of climate change is that big that regional and local parties question where to start and within what

time horizon. Moreover, the problem is that climate change forecasts are the global and national level. They need to be developed to subnational, regional and local levels in order to draw up programs of adaptation. Adaptation policies and programs need to be contextualized in place and time. Governments find it difficult to bring this place and time contextualization into practice, because it is not common practice.

For example, we see in the Netherlands that different municipalities as Dordrecht and Rotterdam are developing outer dyke urban development and taking safety measures. But these processes of local self-governance are being frustrated by the fact that national government has not yet set the norms for water safety for the future. This will probably not be realized before 2017. This doesn't stimulate proactive regional climate adaptation.

It is important that national government facilitates the local and regional initiatives that counter climate challenges and water management issues. If national governments don't make steps in making policy for the long run, for example policy with the necessary safety criteria and norms, local initiatives comes to a stand still. Wait and see behavior flourishes. It is important that proactive and adaptive local policymaking and implementation is stimulated in time.

Closing: Water governance as connective capacity

Urban systems show a high degree of adaptability when actors have the capacity to reorganize the urban system in a desired state as a response to changing conditions and developments. Adaptation is the ability of government and society to adjust to changing conditions and insights (Gleick, 2003; Young et al, 2006). Many scholars look for enhancing this capacity in new management models and approaches, like: adaptive co-management (Olson et al, 2004), adaptive governance (Folke et al, 2005) and resilience management (Walker et al, 2002). Adaptation in this view is then about a co-evolving processes between climate, water and urban regional development. Interconnectivity plays an important role in this process of co-evolution (Teisman et al, 2009).

However, there are limits to connective capacity. Not everything can be connected at the same time with the same level of intensity (Edelenbos, 2010). Energy and time effort put in one connection cannot be invested in another connection at the same time. It is about a delicate balance between exploring and exploiting relations and connections (March 1991, 1999; Duit & Galaz, 2008). Exploitation is about the use and replication of existing information and practices (March, 1991; Van Olffen & Romme, 1995). Exploitation is about the search and development of new information, knowledge and practices (March, 1999). It is about a selective activation of relations (e.g. Scharpf, 1978), but at the same acknowledging that the activation is a temporary connection leading to certain focusing, structuring and segmentation. Any selection connection means inclusion of certain actors, domains and sectors and at the same time excluding other actors, domains and sectors. A selective connection (exploitation) then is every time a new starting point for exploring new connections. In this way integration doesn’t lead to fragmentation of climate, water and urban development, and ‘real’ adaptive urban governance systems can emerge in which a high capacity for exploration with an equally

high level of capacity for exploitation os realized (e.g. Duit & Galaz, 2008: 321; Benner and Tushman, 2003).

An outlook to other chapters

In this book we want to discuss the notion of Connective Capacity. What is Connective Capacity and how is it positioned in the fields of public policy, management and administration? The paper will introduce a number of aspects of connective capacity which are considered to be of importance in the case of Water Governance. In the book a number of 'connection directions' are discussed, i.e.:

- Connecting levels: water issues are crossing different layers and levels of government;
- Connecting domains: water involves other domains as housing, agriculture, nature development, etc.;
- Connecting water aspects: water governance involves water quality and water quantity issues ('too much, to little and to dirty water');
- Connecting spheres: water intersects the public, private and societal sphere;
- Connecting scales: water often crosses administrative jurisdictions and also country border;
- Connecting time frames: water issues intersects the long and the short term;
- Connecting procedures and processes: water involves following different procedures and laws and cooperation processes;
- Connecting frames: different actors are involved with different problem and solution frames.

These potential connections are described and elaborated conceptually, and taken up in the different book chapters, both empirically and theoretically.

References (to complete)

Peterson, G., G.A. De Leo, J.J. Hellmann, M.A. Janssen, A. Kinzig, J.R. Malcolm, K.L. O'Brien, S.E. Pope, D.S. Rothman, E. Shevliakova, and R.R.T. Tinch. 1997. Uncertainty, Climate Change, and Adaptive Management. Conservation Ecology [online] **1**(2): 4. Available from the Internet. URL: http://www.consecol.org/vol1/iss2/art4/