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Key Conditions of Adaptive Governance for Resilient Urban Areas: Insights from the Markermeer-IJmeer Region in the Amsterdam Metropole Region, the Netherlands

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Abstract

Climate change, ecological degradation and socio-economic developments are increasingly putting pressure on people's living environments. Societies, regions and cities need to increase their resilience through adaptive governance, which is their capacity to adapt to changing relationships between society and ecosystems. In this article, we explore how three core conditions for adaptive governance, referred to as; 1) discourse arenas, 2) epistemic networks and 3) leadership, have proved to be useful in the shaping of the Markermeer-IJmeer region, part of the Amsterdam Metropole Region in the Netherlands. We find that discourse arenas and epistemic networks have set the scene for societal actors to invest in a sustainable transformation of the area. Moreover, they were a push factor for the transformation of opinions how to govern and plan the area. Actors identified links to overcome the division between socio-economic development and environmental conservation in the Amsterdam Metropole region. Actors from the industry took steps to include nature conservation. We recommend that adaptive governance should be enhanced with notions such as discourse, learning, trust, responsibility and leadership in future research and policy making for resilient urban areas.

Keywords: Urbanisation, Social-ecological systems, Adaptive governance, Discourse, Learning, Leadership, Networks

1. Introduction

Increasingly, our societies must deal with new challenges related to climate change, ecological degradation and increased economic and technological developments (Biermann et al., 2012). Urban areas face many complexities and uncertainties and show increased efforts to build resilience against the vast challenges they are facing (e.g. Pahl-Wostl 2004; Horlings and Padt 2010; Berkes and Folke, 1998). Resilience (Djalante et al., 2011) is interpreted as the long-term capacity of a system, e.g. a city, a rural area or an urbanised region, to deal with change and disruptions in the end (Resilience Alliance 2000). Dietz et al (2003) introduced the concepts of adaptive governance and the region as a social-ecological system to increase its resilience. While governance as such can be defined as "the interactions between public and/or private entities aiming at the realization of collective goals" (Termeer et al., 2010), adaptive governance is a particular form of governance that emphasizes the capacity of actors to adapt to changing relationships between society and ecosystems (Resilience Alliance 2010).

Adaptive governance acknowledges the complexity of interactions between society and ecosystems (Folke et al., 2005) and emphasizes the capacity of stakeholders and ruling institutions to adapt to this complexity.

Current management strategies that focus on the optimal use and control of natural resources have often failed, which has led to more adaptive approaches that can deal with complexity, uncertainty and abrupt change in the natural and social environment (Boyd and Folke 2012; Liu et al., 2007). In this respect, the notion of adaptive governance is increasingly mentioned as a useful framework for analysing and informing multilevel governance modes that enable ecosystem stewardship and increase regional resilience (Boyd and Folke 2012; Crona and Parker 2012). Actors start design experiments that involve multiple actors and encourage learning and innovation (Berkes and Folke 1998; Olsson et al., 2004). Still, at present, the underlying mechanisms of adaptive governance to increase regions resilience are still poorly understood.

Against this background, in this article we explore how adaptive governance conditions can be useful to enhance regional resilience. We first introduce three possible conditions for adaptive governance, namely 1) discourse arenas, 2) epistemic networks and 3) leadership, based on Folke et al (2005). Thereafter, we examine these three conditions in a case study in the Markermeer-IJmeer area, in the heart of the Dutch Metropole Region Amsterdam in the Netherlands. In this region, resilience is at stake due to interrelated phenomena of climate change, ecological degradation and socio-economic developments. A social-ecological system approach typically involves the interaction of ecological and social elements at multiple levels (Walker et al., 2004). The Markermeer-IJmeer region in the Netherlands provides a good case because of comprehensive experiences with challenging planning processes.

In the next section, we briefly introduce the research method of the study, and continue with introducing the three conditions for adaptive governance. We follow with an analysis of these conditions before we finally provide some concluding remarks.

2. Research Method

The research methods applied comprise a series of different strategies. One strategy contains elements of action research (Wittmayer et al, 2014; Reason 1994), where the researchers contributed with their expert knowledge (e.g. about ecosystems and governance), while another strategy was based on the facilitation of interactions with the stakeholders, mutual knowledge exchange and learning. Two authors of this study took part in a Community of Practice (CoP) arrangement, which brought together practitioners with a different background to explore and learn about how to improve the resilience of the area. Their roles varied from a research role (doing formal interviews and observation) to action-oriented roles (facilitating processes and chairing meetings).

Data were collected through interviews and observations done during a series of project sessions including the CoP meetings. Data were collected within the frame of the Building with Nature innovation program (www.ecoshape.nl) through a combination of monitoring

(Lulofs et al., 2011) and keeping logbooks of participatory meetings. In addition, secondary material such as websites, policy documents and scientific reports were analysed.

3. Theoretical and Analytical Framework

3.1 An Adaptive Governance Perspective to Resilient Regions

The notion of adaptive governance draws on the literature from a variety of fields, including social-ecological systems theory (Folke et al., 2005; Walker et al., 2004; Gunderson and Holling 2002) and institutional analysis (Dietz et al 2003; Ostrom 2010). Although social and ecological principles are identifiable within the management of regional resources, they cannot easily be parsed for either analytical or practical purposes. While many scientific approaches separate ecological, political, social and economic systems, within theories of regionalization and urbanization, these systems are viewed as integrated (Soma et al 2016). Performance in these so-called “coupled social-ecological systems" in specified urban areas and regions is determined by the interaction of ecological and social elements at multiple levels (Walker et al., 2004).

A key characteristic of adaptive governance is learning-based issue management across different levels. Other characteristics include novel approaches to cooperation among stakeholders and innovative institutional arrangements (Resilience Alliance 2010). Adaptive governance relies on networks that connect individuals, organizations and institutions at multiple organizational levels. Spanning from local to higher organizational levels, these polycentric institutions can create a balance between decentralized and centralized planning and control (Imperial 1999). As such, multilevel governance modes are increasingly recognised for developments of resilience (Termeer et al., 2010, Gunderson et al., 1999; Berkes and Folke 1998).

3.2 Analytical Framework: Key Conditions for Adaptive Governance

Adaptation implies change, and no change will occur unless dialogues are facilitated among affected actors. An arena is needed that can support interactions among actors, where actors can meet and foster new storylines about desirable changes. This can be referred to as *arenas for discourse.* If such arenas tend to be exclusive to only some actors and some types of information, and do not allow for learning among a broad range of actors, the excluded ones will hamper change. Therefore, it is important that these arenas are inclusive to knowledge creation from a diversity of perspectives (Berkes & Folke 1998; Olsson et al., 2004; Folke et al., 2005), implying that the arenas are the spin off for *open and flexible epistemic networks.* Still, to avoid abating interactions, adaptive governance needs to establish direction, align, motivate and inspire people with the ultimate goal of producing movement or change. In other words, *leadership* is needed for change. As such, the three conditions (arenas for discourse, open and flexible epistemic networks and leadership) can enhance adaptive governance to emerge (Gunderson et al., 2006). In the following, we will discuss these conditions for analysing the planning process of the Markermeer-IJmeer region.

3.2.1 Discourse Arenas

Discourse arenas are places where actors can meet and create new stories for desirable change. They provide space for collaboration between actors from different institutions and backgrounds on the generation and testing of new ideas. Science, policy and management actors and their actions meet in discourse arenas. A discourse is an ensemble of story lines, actors that utters these story lines and practices that conform to these story lines (Hajer 1993). When storylines sound right and suggest a common understanding, they create opportunities for alignment, forming coalitions and avoiding conflicts in innovative experiments. Hajer states: "storylines fulfil an essential role in the clustering of knowledge, the positioning of actors and ultimately in the creation of coalitions amongst the actors of a given domain" (Hajer 1995: 63).

3.2.2 Open and Flexible Epistemic Networks

Successful transformations towards adaptive governance can be encouraged by the emergence of informal open and loose networks that help to facilitate information flows, identify knowledge gaps and create relevant knowledge and expertise for ecosystem management (Olsson et al., 2004). To emphasize the role of knowledge, Haas (1992) refers to these networks as epistemic networks, i.e. a set of actors sharing a common goal of knowledge creation. Epistemic networks require a heterogeneous set of participants bringing in different perspectives (Cohendet et al., 2001). These networks often arise from scientific or technical groups whose focus is on learning. Their power comes from questioning assumptions and synthesizing information with little or no constraints. Olssen et al (2006) highlight the importance of epistemic networks to develop and reside adaptive approaches for governing social-ecological systems. Gunderson (1999) emphasizes their role as incubators for new approaches to increase the resilience of social-ecological systems.

In discourse arenas and epistemic networks, learning is an important asset *(*Scholz and Stiftel 2005). Three types of learning can occur: incremental, adaptive (or lurching) and transformational (Gunderson et al., 1995; Westley 2002). Incremental learning occurs as plans, models and policies are implemented and evaluated. Some authors refer to incremental learning as single-loop learning ("following the rules") that aims to improve a way of working within a given set frame of thought. Underlying principles are not questioned. The focus is on solving problems and on making techniques more efficient (Westley 2002; Usher and Bryant 1989). Adaptive learning is more discontinuous in time and space. This type of learning occurs for instance after environmental crises in which policy failure is undeniable (Gunderson et al., 1995). In this case, adaptive learning is similar to what Argyris and Schön (1996) described as double-loop learning ("changing the rules"): a type of learning in which underlying models, principles, values, rules and assumptions are questioned. Transformative learning goes one-step further into triple loop learning ("learning how to learn") and involves a process through which people change their views on the world and themselves. Such a transformation often occurs in response to an external 'trigger', when faced with a disorienting dilemma, which cannot be explained, by old ways of knowing and learning. Transformational learning involves critical reflection and eventually leads to reframing of

problem domains and perspective transformations (Westley 2002). It requires open social networks that link the heterogeneity of understanding ecosystems across social and ecological scales. To learn and innovate through transformational learning, actors must therefore be open and tolerant of failure (Gunderson et al., 2006).

3.2.3 Leadership

Adaptive governance requires so called transformational leadership, which Kotter (2007) defines as "a process to establish direction, align people, motivate and inspire with the ultimate goal of producing movement or change." Scheffer et al., (2002) point out that key persons such as charismatic leaders may be catalyser of opinion shifts, which can reduce the time lag between problems and solutions. Leadership includes many other skills such as building trust, managing conflict, initiating partnerships, developing and communicating vision, mobilizing broad support for change, gaining and maintaining the momentum and institutionalizing new approaches (Berkes et al., 2003; Olsson 2004; Folke et al., 2005). Leadership can be concentrated in one or a few people, or dispersed in networks of actors across scales.

3.2.4 Analyses by Means of the Three Conditions

In the case study we analyse adaptive management in the Markermeer–IJmeer region by investigating the three conditions; discourse arenas, epistemic networks and leadership. First, we examine whether specific discourse arenas can be identified. We also analyse the storylines i.e. narratives on social reality, perspectives, goals and visions that these discourse arenas are working on and have developed over time. Second, to describe and analyse adaptive governance in terms of networks, we examine the epistemic networks in the area and the types of learning that take place. Third, to describe and analyse adaptive governance in terms of leadership, we identified leadership shaping the adaptive governance process in the Markermeer–IJmeer region.

4. The Markermeer-IJmeer Region

4.1 Markermeer-IJmeer Region as Social-ecological System and Its Challenges

The Markermeer-IJmeer region is composed of two connected lakes in the South-west corner of one of the largest fresh water lake systems in Europe: called the Ijsselmeer region. The region is north of the Randstad Region and central to the city of Amsterdam and the provinces of North Holland and Flevoland with 2.4 million inhabitants (figure 1).

Before the 'Afsluitdijk' was completed in 1932, the Ijsselmeer was a brackish inland sea. The damming created safety against storm surge flooding and provided fresh water storage, both indispensable conditions to reclaim large new polders. Markermeer and IJmeer were separated from the Ijsselmeer in 1976 when the 'Houtribdijk' was built. This dike was the first phase in the reclamation of the Markermeer polder, which was destined to be the last polder in the Ijsselmeer reclamation project. Around 1970, the reclamation plans for the Markermeer polder were put on hold because of heavy societal opposition against the plan. At that time, there was a heated national debate on environmental protection, overproduction

in agriculture and loss of income from fishery.

Figure 1. Map of the Markermeer/IJmeer region

From 2006 onwards, the national government decided to incorporate the lake in the Randstad Urgent Program, a program an urban network of cities in the west of the Netherland (the Randstad metropolis with 8 million inhabitants and including Amsterdam, Rotterdam, The Hague and Utrecht). The government recognized the value of a large 'empty space' right at the northern boundary of the Randstad metropolis. The national government defined several challenges for the region, e.g. the improvement of the transportation infrastructure between Almere, Lelystad, Amsterdam and Schiphol Airport, with an option on a new public transport connection right through the IJmeer. Other plans involved the urban development of Almere including the construction of 60.000 houses possibly located along the coast and on new islands in the lake. The Dutch government aimed to align these urban developments and infrastructure with the demands to maintain the ecological quality of the lake. The lake region became designated as Natura 2000 area and therefore certain species of birds and habitats received a protected status.

However, monitoring results of the protected species in the lake region showed a downward trend. A research program called ANT (Autonomous Downward Trend) started to monitor and study the ecosystem with the aim to understand trends and developments in the food web. Results showed that what is called a downward trend might very well be a regime shift of the lakes' ecosystem under influence of phosphate reductions, climate change and some other factors (see www.deltares.nl/en/project/1210645/). Therefore, the urgency to put the state of the lake's ecosystem on the public agenda became apparent.

4.2 Planning for a Robust Ecosystem

Figure 2 shows two important phases in the planning process for the development of the lake as a resilient social-ecological system. The first phase (referred to as 'Future Perspective') took place from 2006 to 2009 and resulted in the creation of a 'Future Perspective.' The 'Future Perspective' was submitted in 2009 by the regional Markermeer-IJmeer platform to the council of Ministers of the Netherlands (TMIJ, 2011). At the end of 2009, a second phase (referred to as 'Flexible Implementation') started that lasted until 2012. The term 'Flexible Implementation' reflects the new way of thinking on how to develop a Markermeer-IJmeer region: resilient to the adverse effect of urbanisation, new infrastructure and climate change.

Figure 2. distinguishes between discourse arenas and epistemic networks, which will be discussed in the analysis section. The arrows show the times in which actors in the discourse arenas and epistemic networks started their activities and produced important results.

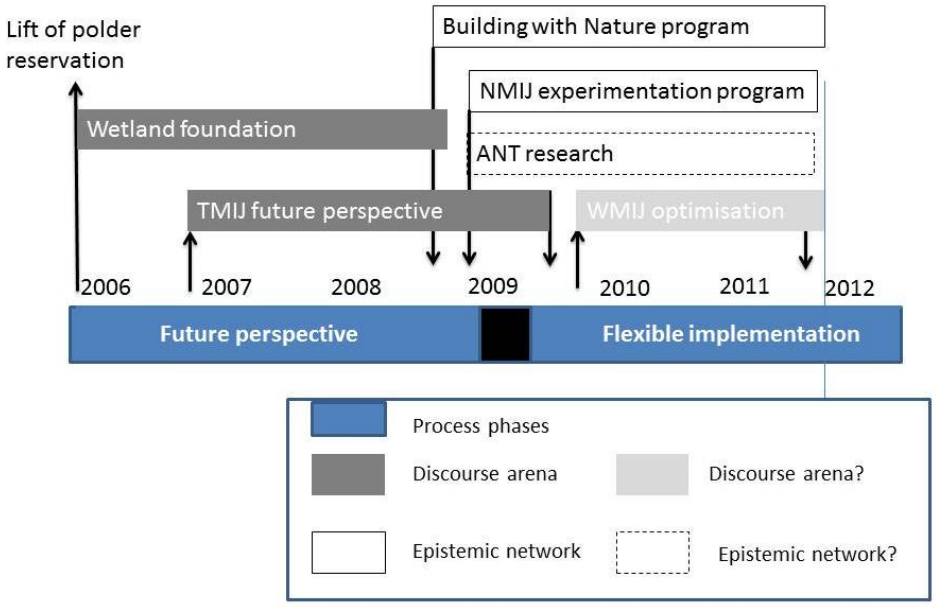

Figure 2. Time line with phases of planning, discourse arena's and epistemic networks

Future Perspective: 2006-2009

In 2006, the NGO 'Wetland Foundation' developed a trajectory to enhance a sustainable future for the Markermeer-IJmeer. The NGO aimed to find ways to combine socio-economic developments with preservation of nature values. The Wetland Foundation called its approach 'creating and facilitating discourse communities' (Sas 2009). They facilitated a dialogue among societal actors because they felt the urgency to focus on the prevention of ecological degradation of the Ijsselmeer region and develop a shared vision on a sustainable future of the lake.

The Wetland Foundation's initiative soon was followed by a planning process in 2007 when the national government took the lead to start a future visioning process for the Markermeer-IJmeer. Two provinces, that were responsible for the lake, developed a 'TMIJ Future Perspective' for landscape, ecology and recreation. The provinces decided to form a

multi-stakeholder platform, which involved municipalities, ministries, water boards and nature conservation and recreation organisations. Many actors involved in the Wetland Foundation 'community' continued their discussions in this new platform.

The two provinces took care to engage as many actors as possible. After a process of study, stakeholder consultations and platform meetings, a 'Future Perspective' was produced in 2009, departing from the 'green/blue before red/grey' principle. This principle meant that first a robust ecosystem with a surplus of Natura2000 species needed to be visualized and constructed, before urbanisation and infrastructural interventions were allowed. The reasoning behind this principle was that any intervention would block until the ecology and habitats were at the required state.

The stakeholders proposed that an integrated program for ecological improvements was needed and that, in order to get to the necessary robust ecosystem, the construction of 6.000 – 10.000 ha of wetlands was needed to increase the area with gradual land-water gradients. Other interventions they proposed were to increase the connectivity between the lake and the hinterland and to reduce turbulence of the water by construction of artificial lee structures. These measures would improve also the recreational and landscape conditions.

In November 2009, the Dutch council of Ministers informed the Dutch Parliament about its decision for the Amsterdam-Almere-Markermeer region. "The three leaps in scale (living and working, accessibility, ecology) are connected through space and reinforce each other. Development of a sustainable metropolis cannot be achieved when one of them is missing or receives less attention. The green/blue system first must be improved, because it forms the basis for the infrastructure and urban development. This is not only necessary to realize a good environmental quality, but is also legally required before other developments can take place. (RAAM-brief cited and translated from Werkmaatschappij Markermeer-IJmeer, 2011). The cost of implementation of a robust ecosystem alone was budgeted at 1 billion euro. (Werkmaatschappij Markermeer – IJmeer, 2011).

Flexible implementation: 2009 - 2013

The second stage started. The Dutch council of Ministers decided to approve and continue with this nature development program, under the new condition that important budget cuts could be achieved. They asked a platform of representatives of different parts of the country (often local governments) to optimize the ecological development program and to find cost savings.

This national platform reconsidered the green/blue principle as the first principle and made a new proposal. They proposed a 'flexible implementation and phasing approach' where investments in nature development were to be made step by step, each step depending on the actual state of the ecosystem. The proposed program did not define a detailed end design for a robust ecosystem, nor fixed deadlines anymore (Werkmaatschappij Markermeer – IJmeer 2011).

5. The Planning Process from an Adaptive Governance Perspective

5.1 Discourse Arenas

During the planning process three discourse arenas played a role in the visioning and planning for a 'robust ecosystem', referred to as 1) Wetland Foundation discourse arena, 2) 'Future Perspective' discourse arena and 3) 'Flexible Implementation' discourse arena.

First, in 2006 the Wetland Foundation played an important role as a catalyst to bring together a diverse group of actors. Within this discourse arena, adaptive learning took place. The discourse allowed room to discuss the conflicts between the actors (urban planners, regional development agencies, policy makers and environmentalists) involved. It also discussed the assumptions, values and goals underlying the frequent conflicts between these actors. It allowed for second and third loop learning. Within this discourse arena, diverging views and interests were used as source of inspiration for finding new ways to combine social-economic development with ecological conservation. The actors developed a narrative about the lake as an ecological system. They succeeded in breaking through the traditional conflicts between representatives of nature conservation and economic development and as such, they contributed to transformative learning. The Wetland Foundation discourse arena developed a storyline based upon the 'blue/green before red/grey' principle, implying that first a 'robust ecosystem' needs to be constructed before urbanisation and infrastructural development can take place.

The second discourse arena, referred to as the provincial platform 'Future Perspective', also involved a diverse group of actors, including actors from the first discourse arena, the Wetland Foundation initiated. The second discourse arena was organised by the provinces who predominantly facilitated an incremental learning process. The design of the 'Future Perspective' fitted the aim to integrate multiple views into a one-vision document. So, although adaptive and transformative terminologies such as 'regime shift of the ecosystem' were used, this concept was embedded in a more incremental, first loop policy making processes. The more formal character of this provincial platform formed a context in which diverse actors designed a vision of a future-proof, robust and relatively maintenance free ecological system with scope for integrating various user functions. The actors decided that the 'blue/green before red/grey' principle should continue to be an important premise.

The third discourse emerged when preparation of the national spatial planning decision took place, a discourse that focused on finding ways to reduce costs, which was a clear assignment by the national government. Formal representatives of local governmental parties dominated this process, and a wider group of actors was regularly consulted and involved. This process resulted in adaptive learning and the dominant storyline shifted from the 'blue/green before red/grey' principle towards the notion of 'Flexible Implementation.' This included a systematic approach to investments in nature development as well as the need to search for win-win arrangements between ecology and other human ambitions such as urbanisation, infrastructural development, recreation or water safety.

5.2 Open and Flexible Epistemic Networks

Alongside the discourse arena's, two major epistemic networks emerged in the Markermeer-IJmeer: first, the More Natural Markermeer-IJmeer (NMIJ) experimentation program (including the network called Autonomous Downward Trend (ANT) and second, the Building with Nature program. These two epistemic networks mainly focused on knowledge creation and learning for a sustainable future of the lake. Both epistemic networks have stimulated learning about options for the region to address abrupt changes with cascading effects such as sea level rise, ecological degradation and infrastructural developments. In both epistemic networks, elements of incremental, adaptive and transformative learning were observed.

First, incremental (single loop) learning was obtained in the NMIJ experimentation project aimed to improve the ecological quality of Markermeer–IJmeer by stimulating innovative measures. Network members jointly developed new knowledge, shared concepts and a common language. The research was based on practices of "learning by doing" principles, as well as (field) experiments and monitoring. These experiments included test with floating marshes expected to perform as wave dampener to increase water safety and to reduce fine sediment concentrations. The experiments looked at ecological, technical, economical and governance perspectives. Each experiment brought together a network of researchers, companies, nature protection organisations, municipalities and provinces. The results of the experiments were used to provide knowledge to the national programme Markermeer–IJmeer. Incremental learning was also central in the ANT research, aiming at developing new knowledge that could inform the planning processes. This research programme facilitated a somewhat limited epistemic network of a rather closed research community in which new knowledge and a common language were constructed.

The second epistemic network was formed by the Building with Nature innovation program at the end of 2008 (www.ecoshape.nl). In the context of this programme a Community of Practice (CoP) was established which operated as a shadow network. The CoP established a suitable context for adaptive (second loop) learning that facilitated informal and open dialogues and created an environment where new ideas arose and flourished. The CoP enabled the co-creation of new knowledge based on an interplay between scientific insights, regional knowledge, policies and economics. Occasionally, transformative (third loop) learning occurred especially during evaluation sessions of the CoP. The members of this CoP were independent and therefore freer to develop alternative policies and practices, and dared to think creatively about how to resolve resource problems. These new contacts facilitated the questioning of dominant practices and stimulated innovative thinking. The CoP members also conducted several field studies and advised the 'Future Perspective' planning process. A good example of an outcome of the adaptive learning process that occurred in the CoP is the advice of the provincial platform 'Future Perspective' about the possibilities for cost savings by combining commercial sand mining and wetland construction. This public-private funded consortium of dredging companies, universities, consultants and research institutes aimed to change the actual regime of 'hard' infrastructural interventions (dikes, dams, groins, dredging) into a new approach in which ecosystem processes interact with engineering. This can be

regarded a third example of transformative learning. Through pilots, monitoring and reflection, the network members jointly developed new knowledge on innovative 'soft' forms of coastal protection for which maximum use is made of the dynamics of the natural system.

5.3 Leadership

The functioning of leadership developed slightly differently across the discourse arenas when compared with the epistemic networks. The epistemic networks largely functioned as self-organizing entities while in the discourse arenas, the facilitators had a large role to play.

In the epistemic networks, self-organisation took place, without the performance of facilitators promoting strong personal visions. Instead, project leaders took the role as facilitators, with emphasis on the process as it developed among the participants. In this way, the facilitators of the CoP fulfilled an important role in inspiring and motivating its members to develop new solutions.

However, across the three discourse arenas, the facilitators exerted more leadership and were motivated by own visions that they brought into the process. For instance, in the beginning of the 'Future Perspective' phase (2006-2009) the Wetland Foundation pushed their ideas on developing a shared vision on a sustainable future of the region (Sas 2009). Especially the director of the Wetland Foundation had a decisive role and aimed to create synergy between the opposing views of urban planners, policy makers and environmentalists. In this discourse arena, the actors were encouraged to combine socio-economic development with preservation of nature and asked to change their core values and opinions. The process encouraged trust building, conflict management, vision developments, and support for change. It was remarkable that the process managed to break the impasse between proponents of social–economic developments and ecological conservation. The leadership was dispersed in a network of actors, although the process depended on the facilitating capacity of one leading person.

Whereas the Wetland Foundation promoted a strong vision in the first discourse arena, the following discourse arena had a more neutral setting, with mediators who focused at the level of stakeholder's interactions and dialogues. Therefore, at the end of 2006, when the national government decided to start a future visioning process for the Markermeer–IJmeer, the role in leadership changed. Two provinces had taken the lead responsibilities for the planning process, and actively involved diverse local actors and groups to have a lead in the development of a future perspective for the lake area. In addition, groups opposing the 'Future Perspective' (such as yacht owners who preferred open water) were given space to express their doubts and interests. As such, leadership became dispersed in a network of actors across scales. The leadership of this multi-actor network enhanced an exchange of opinions, experience and knowledge, which has contributed to the development of a future-proof perspective for the lake area with scope for absorbing, and integrating various user functions, which was broadly accepted by almost all regional and local stakeholders.

In the final phase the leadership shifted to government-initiated leadership as the main question was formulated by the local governments how to implement measures and how to

cover costs. This gradual shift is connected to the question about the budget needed for the execution of the proposed program.

6. Discussion

Our study shows different conditions that enhanced adaptive governance of the Markermeer-IJmeer region as a socio-ecological system. It makes a distinction between discourse coalitions and epistemic networks. Discourse coalitions are actors that make a shared narrative about the region as a socio-ecological system while the networks are driven by knowledge creation and learning.

Discourse arenas appear to be promising when they serve as a deliberate intervention of organising a process of engaging actors in (re)framing issues at stake, picturing possible futures, storytelling and planning for a more resilient social-ecological system. These actors come from a region at stake, but also involve relatively 'outsiders' who can actively construct a regional discourse arena to put the process in motion, taking actions to link discourse arenas with epistemic networks to stimulate learning.

This study supports the earlier findings that epistemic networks in which different types of learning can occur are important for building regional resilience (Olsson et al., 2006). The value of the epistemic networks relates with the idea that actors with diverse knowledge backgrounds become involved in learning experiments to test out innovative ideas (Pahl-Wostl and Hare 2004).

The case shows an overlap between the concept of discourse arenas and epistemic networks, which complicates their use as modus operandi to understand, analyse and improve the resilience of a region. Experimentation for improving the fit between knowledge and action plays an important role in both discourse arenas as in epistemic networks. Crucial for discourse arenas and epistemic networks is the encounter between actors from different backgrounds (e.g. science and policy) that meet each other and encourage the different types of learning.

The case study shows that in a series of identified discourse areas and epistemic networks, the attitudes towards a social-ecological system did change by means of dialogues in multi-stakeholder settings. For instance, the one discourse arena created by the NGO Wetland Foundation resulted in breaking through the impasse in the conflicting relationship between social–economic development and ecological conservation. This was also the case in the epistemic network Building with Nature when notable steps towards industry – conservation solutions were accomplished, which was not possible at earlier stages. This was not dependent on a specific role of leadership, as this differed in the two processes. Whereas the Wetland Foundation promoted a strong vision during dialogues, the Building with Nature was carried out in a neutral setting, with mediators who focused at the level of stakeholder's interactions and dialogues.

The whole planning process resulted in shifts in environmental attitudes within the region. Well-organised and planned discourse arenas and networks were organised, where multiple stakeholders could meet, discuss and deliberate about the issues. These processes must have

ensured establishments of trust, even among people who heavily disagreed, while the setting also encouraged responsibilities in a long term. In this context, the role of leadership is not so much about the actual role of one person, or physical structure of the process, but about the abilities that some people have to create a forum and setting where trust is dominant even with strong conflicts.

7. Concluding Remarks

In this article, we explore three conditions of adaptive governance and their usefulness to build a resilient region. They are referred to as; 1) discourse arenas, 2) epistemic networks and 3) leadership and studied in the case study of the 'Markermeer-IJmeer region'. We considered the Markermeer-IJmeer urban region as a social-ecological system, which has been governed to create a resilient system i.e. capable to deal with interrelated phenomena such as ecological degradation of the lake, climate change and economic and infrastructural developments.

Our case study supports the current findings of the literature that discourse arenas', epistemic networks and 'leadership' are useful perspectives to organize adaptive governance for resilient regions. These three conditions can be used as tools to design, implement and reflect on the way actors manage an urban region with the aim to increase its resilience to stress and future surprises. They can help to create awareness about the platforms required to bridge organizations, sectors, and scales (Stockholm Resilience Centre, 2012). Actors with a different knowledge base, paradigm can make use of these concepts to enhance collaboration, experimentation and learning.

Incremental changes in a region require institutions promoting stability and efficiency while abrupt changes in a region are likely to require self-regulation, flexibility, transformative learning and responses to cascading effects (Boyd and Folke 2012; Dedeurwaerdere 2005). Supported by Olsson et al., 2006, our case study shows that to anticipate or respond to such complex changes, epistemic networks are crucial. Actors within epistemic networks develop the capacity to be reflective and to develop transformational learning skills. The ideal situation is to enhance learning by means of a portfolio of experiments that reinforce each other and contribute to the different resilience objectives of the involved actors in significant and measurable ways. More case study research is needed to increase understanding about the specific requirements for epistemic networks, its actors and practices to bring about system transformations and, how these requirements differ from those needed for making incremental changes. Especially the role of experiments and pilots need to be considered and how these can contribute to flexibility and adaptability in the light of dealing with future uncertainties.

In line with Sandström and Rova (2007), we recommend that there is need for future research on specific features of discourse arenas and their impact on adaptive governance to increase a region's resilience. This includes topics such as leadership, trust, responsibility, influence and power and their relations with adaptive governance.

Our study supports earlier findings on the critical role of leadership to enhance the

effectiveness of discourse arenas and epistemic networks (Olsson et al., 2006). Effective leaders are able to span multiple discourse arenas and networks across scales and are able to engage key individuals operating in and outside these networks. Effective leaders are capable to recognize windows of opportunity and promote experimentation and innovation Gunderson et al 2006). Our case study also confirms that leadership is continuously changing and it emerges in different people or is dispersed in a network (Olsson et al., 2006). The advantage of a social- ecological system with dispersed leadership is that it is likely to be less vulnerable than a system that depends on one or a few individuals only.

In the Markermeer-IJmeer case study, the number of discourse coalitions and epistemic networks and especially the rapidly growing amount of projects and experiments has led to the call for more coordination in the area. Questions, whether leadership can be fulfilled by a bridging organization or how to institutionalize it, are still subject of discussion. Research that is more empirical is needed to better understand the causal relationship between transformative leadership, adaptive governance and resilience. Important research questions include 'what characterizes transformative leaders', 'how can the emergences of transformative leaders be supported' and 'what are effective ways to diversify and institutionalise leadership'.

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