Understanding Learning in Water Governance: The Process and Products of Learning through Participatory Decision Making, Adaptive Management, and Governance Learning.

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Abstract

Water is vital for humankind and ecosystems alike. However, population growth, agricultural intensification, urbanization, and climate change embody potential hazards and pressures for water resources without existing long-term solutions. For two decades now, policy and governance literature has increasingly emphasised the role of learning in finding solutions to environmental policy problems and effectively steering governance practices. Participation of non-state actors in decision making is widely considered to deliver learning products that support effective outcomes for environmental problems. Besides, the institutionalisation of participation through legislation opens up the necessity for (administrative) organizers to learn about participation as a governance mode in order to steer its effective working. Apart from participation, management approaches specifically aiming at driving learning, such as adaptive management (AM), are increasingly endorsed in water governance. Despite the current prominence of learning in the environmental governance literature, evidence is lacking on which learning approaches function effectively regarding outcomes, whether participation aids learning, and how learning about successful governance arrangements is most effectively promoted.

This doctoral dissertation aims to contribute to clarification of the potential of learning for water governance. The goal is to trace and understand the environmental impacts of learning through participation (research aim 1) and adaptive management (research aim 2), and the effect of learning on participation as a governance mode (research aim 3).

For this goal, I engage in a predominantly qualitative research design following the case study method. For every specific research aim cases are selected and analysed qualitatively according to conceptual categories and mechanisms which are defined beforehand. Quantitative studies are used to corroborate the results for research aim 1 and 2 in a mixed-method approach to enhance the validity of results. The empirical research context is European water governance, the implementation of the EU Water Framework and EU Floods Directive (WFD, FD) specifically. Eight cases of participatory decision-making across three European countries and five cases of AM in Northern Germany for WFD implementation are examined to identify whether learning in these processes enhanced environmental outcomes. To detect whether governance learning by public officials occurred, the design of participatory processes for FD implementation in ten German federal states is assessed.

The findings of research aim 1, understanding learning through participation and its effects on water governance, reveal that participatory planning led to learning through improved understandings at an individual and group level. Learning did, however, hardly shape effective outcomes. In the AM cases (research aim 2) managers and participants of implementing networks improved their knowledge as well as capacities, and spread the results. Nonetheless, environmental improvement was not necessarily linked to ecological learning. Regarding learning about participation as a governance mode (research aim 3) all interviewed public officials in German federal states reported some degree of governance learning, which emerged not systematically but primarily drawing on own experiences and intuition.

These findings are condensed into three overarching lessons for learning in water governance: (1) Interactive communication seems to form the overall frame for participant and group learning. Framing of learning experiences turned out to play an important and poten-

tially distorting role, for which professional facilitation and structured knowledge aggregation methods might be an important counterbalance. (2) Learning did not automatically enhance environmental outcomes. It may thus not be an explanatory variable for policy outcomes, but a conditioning or intervening variable related to collective action, motivation for participation, and situating the issue at hand at wider societal levels. (3) The concepts of puzzling and powering might help understand learning as a source for effectiveness in the long-term when complemented with interest-based debates for creating sufficient political agency of policy issues. Learning seen as puzzling processes might instruct acceptance and legitimization for new powering efforts. The perpetuation of learning in systematic ways and structures appears to characterize an alternative to this reflexive and strategic interplay, for which the water-related EU directives provide the basis.

These insights are of practical and policy relevance, particularly for policy makers and practitioners in the pursuit of learning. They may further contribute to the academic understanding of learning in water governance and its potential contribution to transforming and adapting water governance regimes, as envisioned in the European water-related directives.

Framework Paper

Understanding Learning in Water Governance: The Process and Products of Learning through Participatory Decision Making, Adaptive Management, and Governance Learning.

1 Introduction

Water is vital for humankind and ecosystems alike. However, approximately 52% of the world's population, 45% of the global gross domestic product, and 40% of global grain production are at risk by 2050, if current pressures on water resources, such as population growth, agricultural intensification, urbanization, industrial production and pollution, as well as climate change, continue unabated (UN Water 2018:10). Societies have acted collectively to control and distribute water to use the resource for consumption and agriculture since the origins of human settlement (Caponera 1992, Wittfogel 1957), yet, the numbers above highlight the urgency of the challenge to define and practice effective and sustainable solutions.

For two decades now, policy and governance literature has increasingly emphasised the role of learning in finding solutions to environmental policy problems and effectively steering governance practices (Armitage et al. 2018, Gerlak et al. 2017, Heikkila & Gerlak 2016, Rietig & Perkins 2018). The growing interest in learning reflects an underlying recognition of the importance of knowledge, beliefs, and ideas in shaping policy processes, in shifting political agendas, and in the selecting among policies and related instruments (Rietig & Perkins 2018). Water is the most commonly discussed policy problem in the literature on learning in environmental governance (Gerlak et al. 2017). This literature has not yet developed a fixed core of concepts, but the main assumptions can be summarized to the process and products of learning benefiting the environment (Heikkila & Gerlak 2016), mainly through knowledge gain and/or changed beliefs that help to reach better-informed decisions, overcome deadlocks, or find solutions to complex problems (Ansell 2016, Connick & Innes 2003, Muro & Jeffrey 2008, Reed et al. 2010, Siebenhüner 2008).

Across diverse forms of learning processes, one major ingredient is widely assumed to be the participation of non-state actors in decision making, which can deliver learning products that support effective outcomes for environmental problems (Leach et al. 2013, Muro & Jeffrey 2012, Reed et al. 2010, Weible & Sabatier 2009). Public and stakeholder participation has been integrated into water policy since the 1970s (Akhmouch & Clavreul 2016, Woodhouse & Muller 2017), and from the outset, a key rationale for this was to include the knowledge of water users as constructive input for planning decisions (UN 1977). A clear trend in water governance among OECD countries is a shift from ad-hoc exercises of participation towards institutionalized forms through legislation, guidelines, and standards (Akhmouch & Clavreul 2016). Such institutionalisation opens up the necessity for (administrative) organizers to learn about participation as a policy instrument or governance mode in order to steer its effective working. Apart from participation of non-state actors in decision making, management approaches specifically aiming at driving learning, such as adaptive management, are increasingly endorsed in water governance (Gunderson 2015, Holling 1978, Meffe et al. 2002). Adaptive approaches involve the adjustment of (experimental) interventions to gradually re-

duce uncertainty, and to learn about successful solutions leading to the results anticipated to improve management practices (Gunderson 2015, Holling 1978, Meffe et al. 2002).

Despite the current prominence of learning in the environmental governance literature, evidence is lacking on which learning approaches function effectively regarding outputs and outcomes, whether participation aids learning, and how learning about successful governance arrangements is most effectively promoted (Armitage et al. 2018, Gerlak et al. 2017, Heikkila & Gerlak 2016). Conceptually, a diverse, overlapping terminology contributes to a prevailing analytical ambiguity, and methodologically learning is frequently assumed to happen automatically (Radaelli 2009, Rietig & Perkins 2018). Particularly the question of whether learning actually leads to effective policy and governance outcomes is often ignored, given normative assumptions about the inherent value in striving for knowledge and improved understanding (Armitage et al. 2018, Gerlak et al. 2017, Rietig & Perkins 2018).

Through evidence-based, in-depth research, this doctoral dissertation aims to contribute to clarification of the potential of learning for water governance. The two-part goal is to trace and understand the environmental impacts of learning through participation and adaptive management, and the effect of learning on participation as a governance mode. In response to this overarching goal, the dissertation project is structured according to the following, specific aims:

1. **Understand learning through participation and its effect on water governance**: The aim is to identify mechanisms and factors through which participatory planning and decision making can lead to learning conducive to effective outcomes in water governance.
2. **Understand learning through adaptive management and its effect on water governance:** The goal is to identify in which ways the different aspects of adaptive management may contribute to learning and effective results for water governance.
3. **Understand the process of learning about participation as a governance mode**: The aim is to shed light on how public officials responsible for policy planning and implementation learn about participatory planning as a new mode of environmental governance.
4. **Synthesis of results:** The concluding goal is to bring together the results of the research in a holistic and synergistic way to draw overarching lessons for the impact and potential of learning in water governance.

As an empirical context the implementation of the EU Water Framework Directive (WFD) and EU Floods Directive (FD) offer an ideal study field: Both directives mandate participatory planning (Newig & Koontz 2014) in water and flood risk governance throughout all European Member States, aiming to improve the status of water bodies and mitigate flood risk across Europe. By affording considerable leeway to the responsible authorities for implementation, the WFD also opened up space for new approaches, such as adaptive management. Planning and implementation are prescribed to take place within iterative six-year policy cycles, which provides ample opportunity for organizers of participatory approaches to learn from and about them.

This framework paper brings together the results of five peer-reviewed articles and one published book chapter, in order to tackle the research questions posed above. It proceeds as fol-

lows: In chapter 2, I lay down the conceptual grounds on which this thesis builds for addressing the first three specific research aims. Chapter 3 describes the empirical context of the WFD and FD as an apt empirical setting for the study. In chapter 4, I outline the methodology and research design, and explain the structuring of the articles mentioned above according to the specific aims that these address. The findings of the articles are summarized, discussed, and synthesized in chapter 5. Chapter 6 details the key insights from the research, their relevance and potential contribution to theory and practice in water governance, and avenues for future research.

2 Conceptual setting

2.1 Studying learning in water governance

That water is the most studied policy field in the environmental learning literature (Gerlak et al. 2017) seems to be no coincidence when one examines the development and characteristics of the policy field. Predominantly through engineered solutions to control water flows – the so-called hydraulic paradigm – water management was traditionally strictly under state control (Molle et al. 2009, Gupta 2009). By the end of the 20th century, a paradigm shift has been observed in the water field, mirroring the shift from government towards governance (Woodhouse & Muller 2017). The latter includes more and different actors than the central government in policy making and implementation, since national states were not perceived as monolithic entities with sole sovereignty anymore (Rhodes 1996). Modes of governance gained momentum as (formal or informal) network structures between interdependent public, private and civil society actors in continuous interaction, allowing for different degrees of autonomy from the state, including in some cases self-organization (Kooiman 2005, Pierre & Peters 2000, Rhodes 1996). Several authors perceive a continued role for the state in steering society, but rather in the fashion of setting the rules of the game instead of a command-and-control approach (Kjaer 2004, Rhodes 1996, Stoker 1999).

This perception is reflected in a widely cited definition of governance that I will draw on: Governance comprises the "governing arrangements encompassing institutions and actors both within and beyond government, wherein the traditional roles and responsibilities of various actors become increasingly blurred, and governments make greater use of instruments and techniques to 'steer and guide', rather to command and control" (Stoker 1999:18). In addition, the definition of water governance that I will draw on brings effectiveness and sustainable resource use to the forefront: water governance is understood as "[…] the social function that regulates development and management of water resources and provisions of water services at different levels of society and guides the resource towards a desirable state and away from an undesirable state" (Pahl-Wostl 2015:25).

In her studies on collective action in local water management Elinor Ostrom (1990) found collaboration on solidarity-based principles to be more effective for water management than state-centred solutions. Her highly influential research for the field of water governance stressed therefore the important role of collaboration or participation[1] of non-state actors as an

[1] In the following, I will refer to the concept exclusively as participation, not collaboration, which is more frequently used in the American context.

instrumental element of water management. The water governance practice echoes this perception: Many international guiding principles (Secretariat of Water and the Environment 1992, UN 1977, UN 1992 a, UN 1992 b, UNECE 1998), the World Water Forums (Akhmouch & Clavreul 2016), as well as the UN Sustainable Development Goals of 2016, embrace the concept and stress its critical, instrumental role for "effective and sustainable water management" (UN Water 2018: 14 et. seq.).

Participation can be defined as "[...] the involvement [of non-state actors] in collective decision making processes." (Newig & Kwarda 2012: 30). Participation is approached as a multidimensional concept, which includes (1) the breadth of involvement of different stakeholders, i.e. the actors (individual or collective) potentially affected by the underlying environmental problem and possible solutions, (2) the way communication and collaboration take place regarding the direction (uni-,bi-, multi-directional) and intensity of information flows, and (3) the degree of power delegation or influence over decisions given to participants (Fung 2006, Newig & Kwarda 2012). Not only the view on participation as a means to an end, but also as an end in itself, providing legitimization and acceptance of policy decisions and a tool of citizen empowerment, shaped the water governance field substantially (Akhmouch & Clavreul 2016, Woodhouse & Muller 2017).

The diversification of actors, such as through participation, and the diminished role of top-down regulation that follows the hydraulic paradigm in water governance have opened up considerable space for what Dunlop and Radaelli (2013) call 'reflexive' learning in policymaking: When problems are characterised by a high degree of uncertainty and the hierarchy between actors as potential teachers and learners is low, actors are prone to explore and adjust their fundamental preferences and strategies in policymaking. Water is a prime example of a complex and uncertain environmental problem, since water bodies cross human-made borders and therefore administrative boundaries, and encompass different policy sectors, policy interests, and value or belief systems (Young 1994, Smith 2003). Features like this make environmental issues "a fertile ground for the study of learning" (Gerlak et al. 2017: 335). Additionally, water is a common pool resource, which means that the resource use and at the same time the exclusion of users is limited (Ostrom 1990), increasing the complexity of its management. Single action by one entity, organization, or community hardly seems sufficient to deal with the high levels of uncertainty and complexity generally associated with such environmental policy problems (Gerlak et al. 2017).

Learning includes the reduction of uncertainty (Heikkila & Gerlak 2013). Management approaches such as participatory planning or adaptive management (AM) strive to tackle uncertainty and complexity through the involvement of diverse actors in planning or through a clear methodology for learning, which I will depict in detail in chapters 2.3 and 2.4. Besides, the institutionalisation of participation – for example in the case of the European Water Framework and Floods Directive (WFD, FD) – has seen the concept give rise to a participatory mode of environmental governance. The reduction of uncertainty is not exclusively linked to effective water management practices and outcomes but can also refer to new modes of governance. Learning by process organizers can shape and steer new modes of governance towards greater legitimacy and effectiveness (Challies et al. 2017). The policy learning litera-

ture focuses on lesson drawing about the viability of policy instruments (see Hall 1993, May 1992). Studies of learning in governance research originated mainly from this literature (Heikkila & Gerlak 2016). The main categories for the analysis of policy learning can also be found in the conceptual fabric of learning through participation and through AM. For this reason I will first introduce the policy learning literature in the following section and afterwards the literatures related to learning through participation and through AM.

2.2 The analytical lens provided by the policy learning literature

Learning, in a simple sense, can be defined as acquiring new knowledge. In a deeper sense, however, learning may involve the changing or updating of beliefs (Leach et al. 2014, Dunlop & Radaelli 2013). Learning is as such a form of information processing and knowledge generation (Newig et al. 2010). In the policy learning literature learners can be policy makers (Hall 1993), advocacy coalitions (Sabatier 1988), or epistemic communities of actors (Haas 1992) sharing and disseminating expertise on a certain issue.

In applying policy learning as an analytical device and conceptual lens to understand policy change, Bennett and Howlett (1992) emphasize the basic distinction between *who* learns, *what* is being learned, and *to what effect*. Hall's (1993) policy paradigms describe to what extent policy learning can induce first, second, or third order policy change, which includes respectively (1) altered levels or settings of policy instruments, (2) changed basic techniques used to achieve policy goals, and (3) restructuring of the hierarchy of goals behind policy.

Several authors criticise, however, that the scholarship on policy learning equates policy learning with policy change without further distinctions (Bennet & Howlett 1992, Heikkila & Gerlak 2013, Huitema et al. 2010). Moreover, the literature tends to concentrate on single policies rather than governance modes. A governance mode can be described as strategic interventions that support the achievement of certain goals (Scott & Thomas 2017). The process of learning is frequently left out in policy learning studies (Dunlop & Radaelli 2013), leaving the question on how policy makers learn and whether they learn in a rational or intuitive way. Their learning process is primarily seen as rational and intentional, based on instrumental policy feedback (King & Hansen 1999, Wood 2015). Lindblom (1959) established an opposing line of thought by assuming that policy makers draw rather on their own past experience in a non-systematic but incremental way by 'muddling through'. It is also questioned whether the incidence and substantive importance of learning may be exaggerated, since policy outcomes can arise through the skills and persuasion of policy entrepreneurs, or actors may simply not learn (Rietig & Perkins 2017). There might be no interest in changing beliefs and actions, and even when actors learn, this may not automatically translate into policy outputs due to e.g. organizational barriers, embedded interests, or institutionalized routines (ibid.).

In drawing a crucial analytical distinction, Bennett and Howlett's three categories equally apply to the learning literature more broadly according to Gerlak et al. (2017), and are also applied in empirical studies of learning in environmental, participatory decision making (see e.g. Huitema et al. 2010). Bearing in mind the frequently missing analysis of the process of learning in policy learning studies mentioned above, a fourth crucial category appears to be *how* policymakers learn. Drawing attention to the collective process of learning by actors in-

volved in governance arrangements, Gerlak and Heikkila describe learning in environmental governance as "(1) a collective process, which may include acquiring information through diverse actions (e.g. trial and error), assessing or translating information, and disseminating knowledge or opportunities across individuals in a collective, and (2) collective products that emerge from the process, such as new shared ideas, strategies, rules, or policies" (2011: 623). This definition highlights one challenge in identifying governance-related learning or using it as an analytical tool since it characterizes a process that is both individual/cognitive and social/relational (Armitage et al. 2017). Academic fields such as education and psychology have therefore also shaped the conceptual landscape of learning in environmental policy and governance (Lundholm & Plummer 2010). Learning of individuals, groups, and networks, also outside the sphere of state actors, are the focus of these academic fields, constituting the link to participation, which I will discuss in the following section.

2.3 The individual-centric and network-centric perspective on learning through participation

Participatory or collaborative forms of decision making are seen as offering an apt venue for generating learning, particularly in comparison to more traditional, top-down forms of policymaking (Leach et al. 2013, Muro & Jeffrey 2012, Reed et al. 2010, Weible & Sabatier 2009). Collective, social interaction is assumed to instigate learning, frequently referred to as social learning (Collins & Ison 2009, Ison et al. 2007, Pahl-Wostl 2007, Siddiki et al. 2017, Reed et al. 2010, Van Bommel et al. 2009).

Learning through participation can be examined through different conceptual lenses: An individual-centric perspective on social learning brings together principals of participatory democracy with behavioural psychology, building on the assumption that processes of internal reflection transform or change points of view and/or behaviour (Rodela 2011, see Mezirow 1995, 1996, 2000 on transformative learning). Particularly deliberation and critical reflection are perceived to go hand in hand: " 'Deliberative' is arguably the most pure or ideal-typical form of reflexivity […]; learning is not deduction, but the outcome of a process of communication, persuasion and invention" (Dunlop & Radaelli 2013: 607 ff.). Apart from this ideal type of the individual-centric perspective, participatory formats can bring together a diverse set of actors with expertise, capacities, or resources that can inform about the issue at hand and help to reach a shared understanding of challenges, others' perspectives, the issue in question, and possible solutions (Beierle & Cayford 2002, Connick & Innes 2003, Emerson & Nabatchi 2015, Huitema et al. 2010, Siddiki et al. 2017, Weible & Sabatier 2009).

Before turning to the network-centric perspective it is important to stress a crucial characteristic of social learning according to the literature, which is that a change or update of understanding goes beyond the individual and becomes situated at a group level or in wider social units (Reed et al. 2010, Fazey et al. 2013, Muro & Jeffrey 2008). Apart from potentially improved interpersonal relations, the salient outcome of learning through participation is cognitive learning related to knowledge gain (Leach 2014, Muro & Jeffrey 2012, Koontz 2014). Cognitive learning as a learning output can manifest in behavioural and normative change in values and beliefs (Heikkila & Gerlak 2013, Huitema et al. 2010, Wood 2006), or have an instrumental function for environmental outcomes (Muro & Jeffrey 2008, Reed et al. 2010, Siebenhüner 2008) – the latter being the main focus of this dissertation project. Particularly in

situations with high uncertainty or long-standing deadlocks, learning can lead to innovative solutions (Ansell 2016, Connick & Innes 2003), also frequently called double-loop learning. Double-loop learning entails reflection that questions underlying values, beliefs, or the status quo and explores innovative approaches – in comparison, single-loop learning refers to the improvement in existing practices without overhauling belief or value systems (Argyris & Schön 1978, 1996, Fabricius & Cundill 2014).

Moreover, social learning or learning through participation is associated with collective action (Costanza et al. 1999, Ison et al. 2007, Leach et al. 2014, Ostrom 1990). Acceptance of and support for decisions can develop (Huitema et al. 2010), catalysing shared motivation for collective action (Emerson & Nabatchi 2015, Innes & Booher 2004). The involvement of actors in participatory endeavours can further aid capacity building that can enhance implementation of or compliance with policies or management actions (Brody 2003, Innes & Booher 2004, Newig 2007). This view mirrors what Rodela (2011) calls a network-centric perspective on social learning, building on the notion of experiential learning (see Kolb 1984) that puts emphasis on learning through experience, observation, and experimentation e.g. among communities of practice (Wenger 1990, see also March & Olson 1975, Senge 1990, Simon 1991).

Several conditions have been tested to explore how they might foster the process of learning through participation, such as procedural settings that allow for open and fair dialogue, trust, respected leadership and facilitation (Connick & Innes 2003, Fazey et al. 2013, Heikkila & Gerlak 2013, Hurlbert & Gupta 2015, Siddiki et al. 2017). There is no conclusive evidence to date on what types of participatory activity (e.g. decision making, implementation or monitoring) may lead to learning (Armitage et al. 2018). Stakeholder diversity is, however, one factor that has been found to sometimes enable and sometimes hinder learning (Siddiki et al. 2017). Moreover, learning formats and methods are frequently equated with actual learning processes (Reed et al. 2010). Scholars see a concrete need to distinguish better between conditions that facilitate social learning and the potential outcomes of such processes, and to gather evidence of effective learning products that go beyond mere assumptions (Armitage et al. 2018, Rodela et al. 2012, Rodela 2011, Muro & Jeffrey 2008, Siddiki et al. 2017). Apart from the clear delineation of *who* (individual participant level and group level) learns *what* (sustainable resource use and management practices), the *how* and to *what effect* seem to be largely underexplored to date.

2.4 Experiential and organizational learning through adaptive management

Experiential learning through experience, observation, and experimentation is evident in adaptive management (AM) approaches. Adaptive management represents the second most researched approach after social learning in the literature on learning in environmental governance (Armitage et al. 2008, Gerlak et al. 2017). The approach highlights experimentation and iterative observation: AM resembles a scientific research project put into practice, meaning that policy or management options are designed as experimental interventions that are implemented, monitored, and evaluated (Gunderson 2015, Holling 1978, Meffe et al. 2002). The approach is cyclical and procedural starting with defining problems and potential solutions for which existing knowledge is synthesized and assessed to plan design decisions. Subsequently, they are implemented, monitored, evaluated and, if necessary, adjusted before the

next management cycle starts again (see figure 1). Interventions are adjusted when anticipated outcomes are not achieved until they reach their desired effects. Effectiveness is therefore ingrained into the learning endeavour. In this way managers learn to understand the underlying uncertainty of an environmental problem, and how to address it (Rist et al. 2013, Williams & Brown 2016).

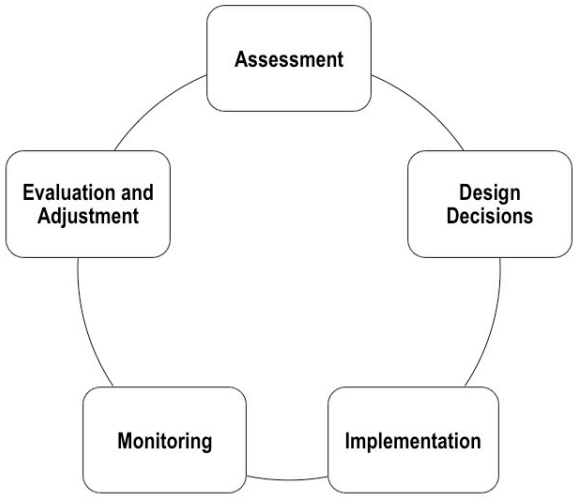

Figure 1: The adaptive management cycle (adapted from Chaffin and Gosnell 2015).

The adaptive learning process is similar to organizational learning, which entails the integration of new, viable, and effective insights and findings into organizational or institutional structures (Thomas & Allen 2006). Whether those insights are discovered individually or collectively is not important. As such, AM was in the past predominantly seen as navigated by scientific or expert knowledge as well as by modelling and deductions (Fabricius & Cundill 2014, Foxon 2009, Holling 1978, Walters 1986). For the same perceived benefits of social learning, learning through participation is increasingly recommended as an integral part of AM (Armitage et al. 2008, Cundill 2010, Plummer 2009, Stringer 2006). Diverse knowledge sources are integrated to form a solid knowledge base, fostering learning (Armitage et al. 2009, Pahl-Wostl et al. 2007, Plummer et al. 2012) and acceptance for the experimental approach (Graham & Hicks 2015). Learning by stakeholders may also promote AM by spreading knowledge on successes (ibid.).

Several factors are associated with enabling each management phase, which I will discuss in detail in chapter 5.2. Nevertheless, there are several gaps in empirical research on AM. First of all, learning is not clearly defined, and who learns what and how is understood very differently in the literature (Allan & Watts 2018, Fabricius & Cundill 2014). Further, there is no clear consensus on measurements for success in AM, e.g. whether it is the reduction of uncertainty, a sound process including all procedural requirements, or learning (ibid., Chaffin & Gosnell 2015, Rist et al. 2013). Moreover, there is a substantial lack of empirical studies reporting on completed implementation of AM projects in the sense that they actually passed through the whole management cycle presented in figure 1 (Chaffin & Gosnell 2015, Fabricius & Cundill 2014, Keith et al. 2011), which could provide a firm basis for studying the intricacies of learning and effectiveness through adaptive management.

The interest in learning, and particularly in the process of learning, is rapidly growing in the policy and governance literature (ibid., see e.g. Heikkila and Gerlak 2016). Yet, the whole research field on learning (comprising policy, social, and adaptive learning in environmental governance) is still emerging, with several early syntheses, but still limited evidence (Armitage et al. 2018, Dunlop & Radaelli 2013, Heikkila & Gerlak 2011, 2016, Gerlak et al. 2017). What stands out in the conceptualisation of the three learning types in this chapter are the analytical categories of *who* are the learners, *what* is learned *how* and *to which* effect, which I will use to structure the presentation and discussion of results. The next chapters introduce the empirical research field of the two European water-related directives and the overall research design.

3 Empirical Research Field

European water governance provides an ideal test-bed for investigating the role of learning in participatory decision making and adaptive management, and for studying participation as a policy instrument. In 2000, the EU Water Framework Directive (WFD, Directive 2000/60/EC) set a turning point in European water governance, aiming at harmonizing and transforming it throughout all Member States (Boeuf & Fritsch 2016; Kaika 2003, Voulvoulis et al. 2017) with the goal of attaining 'good' water status for European ground and surface waters (Art. 1). The Directive is an example of European legislation that has given effect to the Aarhus Convention on access to information, public participation in decision making and access to justice in environmental matters of 1998 (UNECE 1998). Further, the WFD contributed to the embedding of participation in environmental planning, decision making, and implementation through 'mandated participatory planning' (MPP) (Newig & Koontz 2014). Participation is mandatory (Art. 14) in the preparation of so-called programmes of measures (PoMs, Art. 13) and river basin management plans (RBMPs, Art. 11), which guide water management in six-year policy cycles that include an assessment of current water status and the identification of significant pressures. After implementing and monitoring measures, an update of the assessment of water bodies shows potential advancements in water quality and quantity as the foundation for planning in the next policy cycle.

EU Member States are afforded considerable leeway in designing and running participatory processes (Liefferink et al. 2011, Uitenboogaart et al. 2009): Information supply and consultation are mandatory, but 'active involvement' of 'interested parties' in the preparation of RBMPs and PoMs is merely 'encouraged'. MPP expresses the stronger emphasis on decentralisation and proceduralisation in European policymaking as a reaction to implementation deficits (Challies et al. 2017). The Common Implementation Strategy, which provides guidance for WFD implementation, clearly frames participation as instrumental, "as a means to improve decision-making" (EU 2003: 14), and not as an end in itself. "The use of stakeholder knowledge, enhanced creativity and social learning" are stated as key benefits that can be achieved through participation (ibid: 14).

Through mandatory, procedural elements and the flexibility afforded to Member states in terms of implementation, the WFD introduced an experimentalist approach to water governance (Von Homeyer 2010), providing a framework for adaptive management (Michanek &

Christiernsson 2013, Voulvoulis et al. 2017). The introduced flexibility opened up a window of opportunity for experimental approaches on the ground, and "in particular, the integrated approaches […], combined with the cyclical review process, are all consistent with the ideals of adaptive management" (EU 2009: 39 ff.). Cyclical learning relates not only to the effectiveness of measures, but also to participation as a policy instrument. RBMPs must include a summary of the participatory processes applied (WFD, Annex VII), which is explicitly justified as providing "a tool to improve public participation in the next planning cycle […], introducing a learning process" (EU 2003: 46). The possibility for this kind of learning was furthered through the WFD's so-called 'daughter directive' (EU 2009), the EU Floods Directive (FD, 2007/60/EC), which came into force in 2007. The FD is largely a replication of the WFD, also operating in six-year policy cycles with the same procedural steps as the WFD, but applied to flood risk management (see figure 2). Proceduralisation is further extended, without the FD demanding a fixed goal, but instead the protection of human health, the environment, cultural heritage and economic development. As with the WFD, information supply and consultation are compulsory, but 'active involvement' of 'interested parties' is to be 'encouraged' (Art. 10), and also coordinated with WFD participatory processes (Art. 9) (Albrecht 2016).

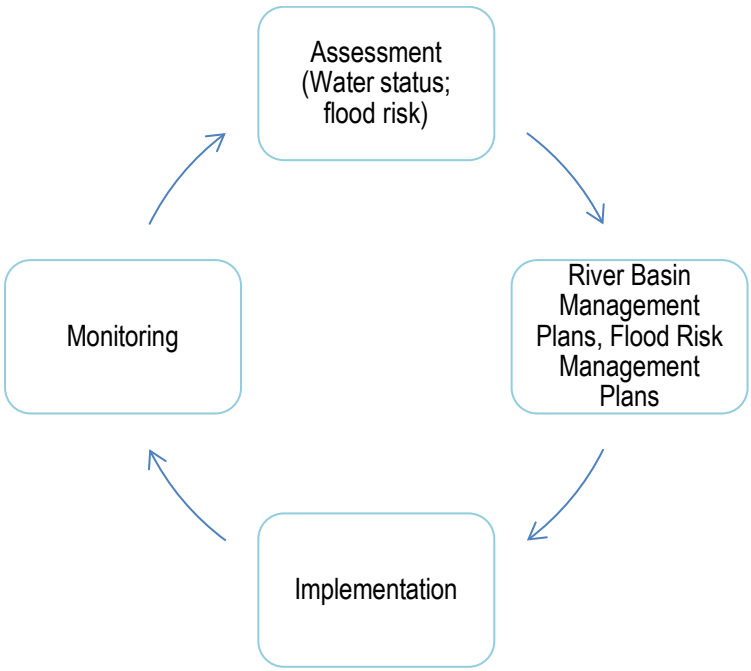

Figure 2: Steps in the policy cycle of the WFD and FD (own depiction).

The cyclical policy approach distinguishes the FD together with the WFD as an excellent empirical context for research on learning about participation as a policy instrument or governance mode. Additionally, the WFD with its fixed goal of good water status provides a perfect empirical setting for research on participation and learning, as well as adaptive management and learning, in relation to effectiveness. These research areas remain highly relevant for the implementation of both directives; currently 60% of all surface water bodies do not achieve good status, as the overall ecological status of surface water bodies actually decreased between the production of the first RBMPs in 2009, and end of the following cycle in 2015 (EEA 2018). Despite generally high expectations of the directives in the literature (Carter 2007, Josefsson 2012, Johnson 2012, Tippett 2005), several authors are questioning their

overall effectiveness (Josefsson 2012, Moss 2008, Boscheck 2006). Much WFD scholarship initially shared an enthusiastic view on social learning and adaptive management (Ison & Watson 2007, Mostert et al. 2007, Pahl-Wostl et al. 2008, 2007, Pahl-Wostl 2006), but empirical evidence of a link to effective directive implementation is mainly lacking (Boeuf & Fritsch 2016).

4 Research Design

The articles gathered under this framework paper are a selection of co-authored papers that predominantly were written in the context of the ERC-funded research project 'EDGE – Evaluating the Delivery of Participatory, Environmental Governance Using an Evidence-based Approach'. The research focus of this project was to assess the effectiveness of participatory, environmental governance. The following articles are the ones that additionally contribute to the understanding of learning processes and products:

Article 1: Newig, J., E. Challies, N.W. Jager, **E. Kochskämper** and A. Adzersen. 2018. The Environmental Performance of Participatory and Collaborative Governance: A Framework of Causal Mechanisms. Policy Studies Journal, 46 (2), 269-297.

Article 2: **Kochskämper**, **E.**, E. Challies, J. Newig and N.W. Jager. 2016. Participation for effective environmental governance? Evidence from Water Framework Directive implementation in Germany, Spain and the United Kingdom. Journal of Environmental Management 181, 737-748.

Article 3: **Kochskämper**, **E.**, N.W. Jager, J. Newig and E. Challies. 2018. Impact of participation on sustainable water management planning: Comparative analysis of eight cases. In E. Kochskämper, E. Challies, N. W. Jager, & J. Newig (Eds.), Participation for Effective Environmental Governance: Evidence from European Water Framework Directive Implementation. Oxon [u.a.]: Routledge. 117-148.

Article 4: Newig, J., Jager, N., **Kochskämper E.** and E. Challies. 2019. Learning in participatory environmental governance – its antecedents and effects. Findings from a case survey meta-analysis; Journal of Environmental Policy & Planning *21*(3), 213-227.

Article 5: **Kochskämper**, **E.**, T. M. Koontz and J. Newig. 2021. Systematic Learning in Water Governance: Insights from Five Local Adaptive Management Projects for Water Quality Innovation. Ecology & Society 26 (1), 22.

Article 6: Newig, J., **E. Kochskämper**, E. Challies and N.W. Jager. 2016. Exploring Governance Learning: How Policymakers Draw on Evidence, Experience and Intuition in Designing Participatory Flood Risk Planning. Environmental Science & Policy 55, 353-360.

The articles cluster according to research aims 1, 2, and 3 set forth in chapter 1 (see figure 3): Understand learning through participation (*Articles 1* to *5*), understand learning through adaptive management (*Article 5*), and understand learning about participatory governance modes (*Article 6*). The overarching method applied is the case study method or small-N research. Causal mechanisms are identified that produce the outcome of interest in a case, which can be defined as "a real-life, contemporary bounded system" (Creswell 2013: 97). The case study method accounts for conditions and their potential combinations through within-case analysis complemented with a cross-case comparison of mechanisms found relevant in single cases (Goertz & Mahoney 2012). By studying multiple cases, this collective instrumental case study design informs an improved understanding of the specific conceptual object of interest (see Stake 1995, 1998).

Qualitative research is described as "inherently multimethod" (Denzin & Lincoln 2011: 5), using a "palette of methods" (Stake 1995: xi-xii) and "analytical eclecticism" (Thomas 2011: 512). The resultant analytical flexibility bears the advantage for drawing intricate logical conclusions, but also carries a risk of slipping into a limiting intersubjectivity of interpretations. External validity is limited in qualitative research; findings only hold true strictly for the cases under examination. Moreover, particularly environmental problems call for mixed-method approaches in order to grasp their complexity (von Wehrden et al. 2017). Therefore I draw on a mixed-methods approach for research aim 1 by including *Article 4*, which examines learning in 307 cases of participatory, environmental decision making processes via multiple regression analyses, which were produced through a case-survey meta-analysis conducted in the EDGE project. Additionally, I sustain the results of research aims 1 and 2 with the supplementary *Article 7* that tested conceptual mechanisms on inter alia social learning in the 307 cases applying structured equation modelling:

Article 7: Jager N., Newig J., Challies E., **Kochskämper E.** 2020. Pathways to implementation: Evidence on how participation in environmental governance impacts on environmental outcomes; *Journal of Public Administration Research and Theory*, 30(3), 383-399.

Article 1, *4* and *7* relate not only to water but environmental governance in general; yet, the same underlying conceptual and methodological principles are employed in the remaining articles for defining and assessing participation in water governance. Therefore they are used as conceptual foundation or to corroborate findings in research aim 1 and 2.

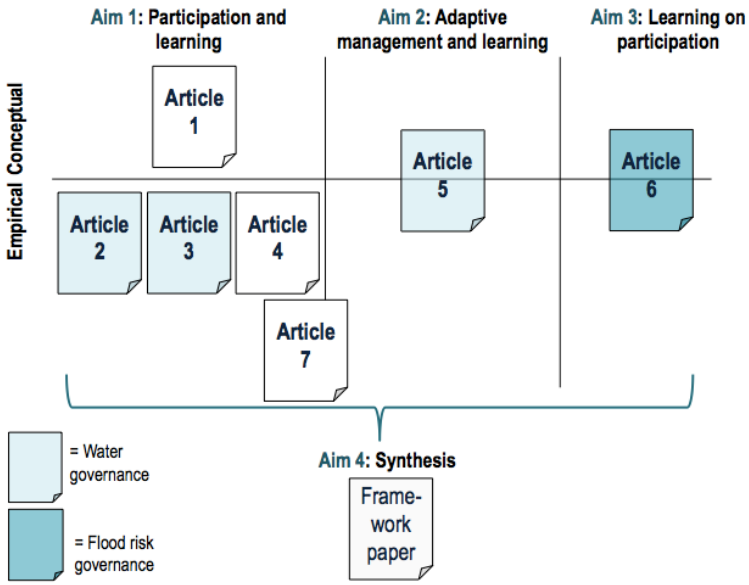

Figure 3: Structure of articles according to research aims, methodological contribution, and empirical research field. *Article 7 falls in-between categories because one finding also corresponds to Aim 2* (own depiction).

Furthermore, the qualitative research is substantiated by a transparent, systematic and justifiable exposure of concepts, case selection, as well as data generation and analysis: The concepts for each research aim are elaborated in *Articles 1*, *5*, and *6*, which were derived by inductive, qualitative literature reviews (see figure 3). *Article 1* presents causal mechanisms of participation possibly leading to effective environmental decision making and implementation, includ-

ing mechanisms that relate to learning. The conceptual part of *Article 5* explains the potential of adaptive management for learning and effectiveness. *Article 6* provides a conceptual framework of governance learning, i.e. learning by public officials with implementation competencies about participatory modes of governance.

Stringent case selection aimed to ensure that the study subjects, the cases, were in line with well-defined study objectives (see George & Bennett 2005, Thomas 2011 on this). For research aim 1 the main study subjects are eight cases of mandated participatory planning (MPP), which are examined with the objective to analyse how far participation induces learning by participants and process organizers that leads to effective outcomes for water governance. We sought countries with the greatest diversity in approaches to MPP introduced by the Water Framework Directive (WFD). From 13 EU member states[2], we selected Germany, Spain, and the United Kingdom (UK) for comparative analysis (see also Jager et al. 2016, 2018). Following a diverse-pair design (Gerring 2007), we identified processes in each country that could be located at different points within the three dimensions of participation presented in chapter 2.1., leading to identification of one 'more' and one 'less' participatory process in each of the three countries, and two cases lying in-between on the participatory spectrum in Germany and Spain; all located at regional or local levels[3] (see figure 4).

Empirical data were collected through face-to-face interviews (N=44). Semi-structured interview guidelines were derived from the conceptual framework following Lamnek (1989). Further, a coding-scheme of 138 codes was derived from the guidelines for the employed qualitative content analysis, following Miles and Huberman (1994). The interview and coding structure was based on a code book used in EDGE (Newig et al. 2013) including 259 variables for transforming qualitative case material on participatory environmental decision making into quantitative data in the meta-analysis that drew on the 307 cases. The interview guideline included questions on perceived individual and group learning through the participatory process on the WFD and sustainable water governance. Comprehensive case descriptions were compiled for *Article 2* and *3* on the basis of this structure. Academic and grey literature documenting the cases completed the data and served for triangulation of interview information.

Ecological improvement can usually not be attributed with certitude to specific management actions, and certain water issues simply take a long time to improve, regardless of actions in place (Koontz & Tomas 2006). To pay tribute to this complexity of environmental management, I developed a three-tier evaluation proxy for the outcome of interest (effectiveness in water governance), discussed with and reviewed by colleagues: (1) Based on the typology provided by the WFD itself, we assessed how many measures actually targeted main pressures in a sub-basin. (2) We gauged the implementability of measures, entailing the categories of generic versus specific measures, secured financing, and hard versus soft measures.

[2] The pool of EU Member States was limited by language proficiencies.

[3] Germany and Spain, where the federal states and autonomous communities have implementing responsibilities as Competent Authorities, and the UK where we treated Northern Ireland and Scotland as subunits to the EU member state level, displayed this diversity. The leeway in WFD implementation afforded to the Competent Authorities allowed for the opportunity to produce sub-plans to RBMPS and PoMs at lower levels than the river basin districts (EU 2009).

Through these two categories we were able to assess planning documents and the process outputs in 2009. (3) Eventually we compared the implementation status of measures and actual improvements in water bodies in the second plans of 2015 (see also Jager et al. 2018).

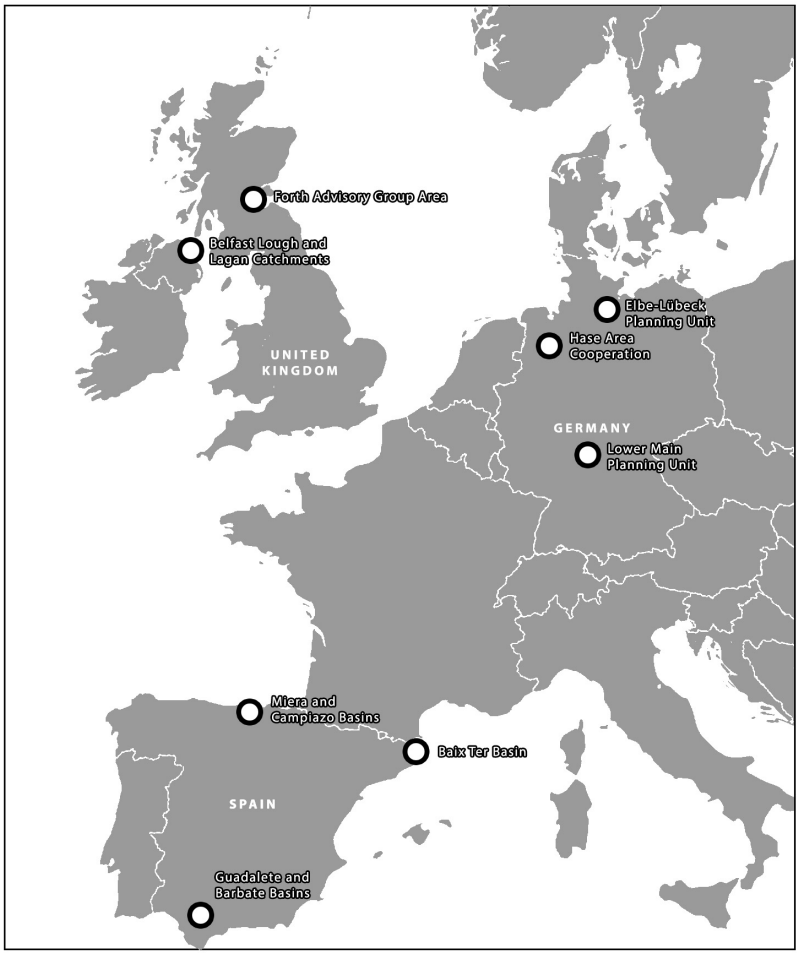

Figure 4: Case study locations in Germany, Spain and the UK (from Kochskämper et al. 2018).

The methodological procedure for research aim 2, understanding learning through adaptive management (AM), was similar yet was conducted empirically at a lower scale and in a more explorative fashion. The study object of *Article 5* is AM. The WFD opened up the opportunity for innovative small-scale projects under the Directive's legal umbrella, which allowed for an explorative case selection, tracing pilot projects on the ground. Selection criteria were that WFD pilot projects foresaw the procedural components of an AM cycle (see figure 1) in their approach. Additionally, several elements were held constant for all cases, approximating a most-similar case design (Gerring 2007): They shared the same pursuit (water quality enhancement) within a similar biophysical context and at a very local scale, leading to selection of five cases in Northern Germany. In order to assess *what* was learned *to what effect* the success of an adaptive management project was defined by improved environmental conditions and learning in relation to the reduction of ecological uncertainty, i.e. whether management actions and their (potential) adjustment resolve the issue of interest, and social uncertainty, i.e., the applicability of the approach in a social context without unanticipated response via opposition to chosen management actions or unforeseen disruptions during the process. I interviewed the main managers of the projects (N=7) using semi-structured interview guidelines

based on the conceptual basis presented in *Article 5*. Case material amounting to 1000 pages of mainly grey literature was collected and served for data triangulation. The data were once more analysed using qualitative content analysis.

Learning about participation as a governance mode by public officials is the study object for research aim 3, thus cases represent the German federal states representatives as Competent Authorities for FD implementation and potential learners on the employment of MPP. The implementation leeway afforded to Member States (outlined in chapter 3) creates a 'federal laboratory' (Oates 1999) setting, suitable for comparing participatory designs and learning modes. This research aim is less evaluative (see Thomas 2011) in comparison to aims 1 and 2, since it examines whether learning about participatory modes occurred (*what*), and draws causal links to the learning process (*how*), yet only draws initial conclusions on the effects of this learning. Public officials representing the federal states were interviewed (N=10), and once more the data were complemented with academic and grey literature, and evaluated via qualitative content analysis.

Özerol et al. (2018) found in a systematic review that comparing water governance through the case study method is a growing field. However, almost one-quarter of reviewed publications do not provide a clear rationale for case selection or establish a clear conceptual framework for comparisons. With the studies of this dissertation project, I aim to contribute to this study technique in making qualitative analyses and comparisons based on clearly defined theoretical and empirical foundations. Through this study design, this dissertation project aims to achieve a high internal validity of findings (see Goertz & Mahoney 2012), in order to contribute to an improved understanding of the conditions of learning and whether and how it leads to effective outcomes.

5 Findings

5.1 Aim 1: Understand learning through participation and its effect on water governance

As established in chapter 2.1 social learning is assumed to take place in participatory settings through mutual, reflexive learning that ideally includes deliberation (individual-centric perspective) or experiential learning (network-centric perspective). *Article 1* establishes 19 causal mechanisms[4] and key conditioning factors arranged into five overarching clusters linking participatory decision making processes to effective environmental outputs and implementation (see figure 4). Cluster I (environmental advocacy), cluster IV (acceptance) and mechanism one of cluster III (negotiation) relate to interest- and preference-based explanations for effectiveness. Clusters II (knowledge incorporation) and III (dialogue and deliberation), and the first mechanism in cluster V (informed addressees) relate to learning. The mechanisms of dialogue and deliberation most closely reflect the ideal-reflexive learning type, whereas clusters II and V follow a more additive logic concentrating on improved understanding through new information and knowledge. In *Article 4,* which I use to corroborate qualitative research results, learning was defined as deliberation, participant capacity building, and achievement of an informed output (environmental and implementation-relevant knowledge in figure 5).

[4] A "[…] mechanism provides a continuous and contiguous chain of causal or intentional links between the explanas and the explanandum" (Elster 1989, cited in Hedström & Ylikoski 2010: 51).

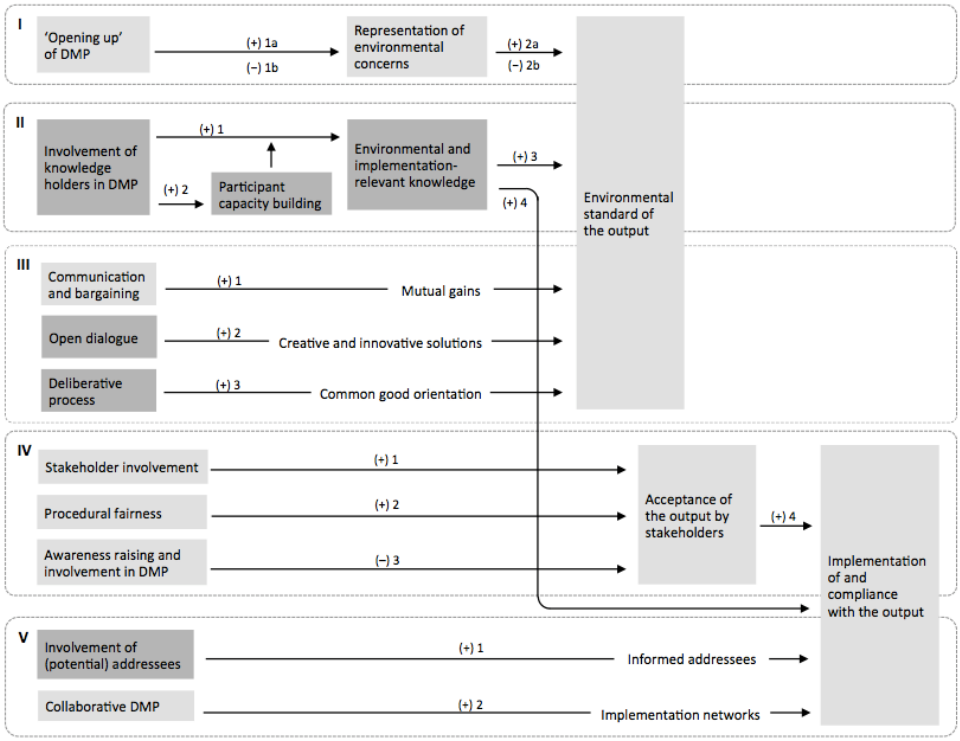

Figure 5: Overview of Mechanisms Linking Participation to Environmental and Social Outcomes. *Boxes in darker grey are related to learning* (adapted from Newig et al. 2018).

The empirical results discussed in this chapter are derived from eight cases showcasing mandated participatory planning (MPP) in Water Framework Directive (WFD) implementation. Starting with the first two analytical categories of *who* learned *what* the results show a clear picture: In the 'more' participatory cases (Elbe-Lübeck Planning Unit, Baix Ter Basin, Forth Area Advisory Group), as well as the Spanish 'in-between' case (Miera and Campiazo Basins), participants and process organizers reported having witnessed individual and group learning about the WFD and sustainable water management more generally. In all the 'less' participatory cases, and the 'in-between' case in Germany, participants or process organizers reported no learning. In the Spanish 'in-between' case, individual and group learning about sustainable water management through open dialogue was identified by one stakeholder, even as the most important process outcome.

Regarding *how* learning occurred, whereas the four cases in which learning was reported all followed their own trajectory, two-way information flow leading to fair and open dialogue in a well-organized and -facilitated process environment were reported as common factors in these participatory processes. In the German case eight local stakeholders discussed and decided on feasible measures via consensus building over several years with a so-called water board representing landowners in an interactive communication style. In the Scottish case 20 professionalized stakeholders exchanged knowledge on water-related projects already existing on the ground in bi-annual meetings over three years in a continuous mutual information flow. In the 'more' participatory case in Catalonia 150 participants met in different types of meetings over several months in which they could voice their opinions and share their insights. These were then collated and transparently prioritized. In the 'in-between' Spanish case, 644 actors participated in a similar palette of meetings as the former case over several

months, in which they could make their voices heard regarding their visions for water governance in the basins, with a final voting on respective measures.

The four cases also exhibited high degrees of power delegation to participants. Power delegation showed no significant effect on learning in the quantitative analyses of *Articles 4* and *7*, therefore it seems valid to assume a major influence of interactive communication for learning, as postulated by the individual-centric social learning perspective. Likewise, stakeholder diversity appeared not to matter in the cases studied, which is corroborated by the findings of *Articles 4* and *7*. Siddiki et al. (2017) found a negative effect of stakeholder diversity on knowledge sharing and related collaborative learning, but assumed a likely moderating role of trust. Trust developed towards process organizers, and associated respected leadership, was a factor highlighted by participants across all four cases and particularly in the Spanish 'in-between' case with 644 participants. Trustful relationships among stakeholders and government actors were also found to be significant for learning in *Article 4*.

However, trustful relationships also worked as a double-edged sword in the German case, since a certain degree of groupthink (Janis 1982) evolved in the small working group, and participants tended not to question the underlying assumption that measures targeting agricultural contamination had to be excluded from the process. The interactive communication can be described as a technical, rational dialogue, coming close to deliberation. Nevertheless, particularly the duration of the process, also a factor found significant for learning in *Article 4*, seemed to foster an iterative process of group learning.

Conflicting issues, which might have led participants to reflect on or question their own positions, were generally avoided: In the German case through the exclusion of certain topics, in the Spanish cases through the process design which sought to gather all opinions and insights, and in the Scottish case through the collection of knowledge about existing approaches on the ground. Local knowledge contributed to decision making, and was seen as relevant in all four cases; direct exchange with expert knowledge during the meetings took place in the German and Scottish cases, and ex-post in the Spanish processes. Apart from facilitation and structured methods of communication, knowledge exchange also had a significant effect on learning in *Article 4*.

The direct (participatory) outputs of the four cases indeed show enhanced environmental quality according to the evaluation proxy applied. The implementability and actual implementation of measures appeared to be fostered in the German and Scottish cases, which both included direct knowledge exchange. Individual and group learning were in all four cases primarily described as process outcomes, rather than a basis on which participants built proposals for new measures. Mutual learning through dialogical interaction did not lead to innovative solutions outside the usual toolbox such as e.g. trial-and-error approaches proposed by participants in the German and the Spanish 'in-between' cases. Acceptance of the output, combined with participants' satisfaction with a process that was perceived as fair, appeared to aid implementation in these cases, and output acceptance was the only factor found to be significant for implementation in *Article 7*. Yet, *Article 7* did not find evidence that learning fosters acceptance, as assumed in literature (see Huitema et al. 2010). It became clear that the

perception of a fair and trustful process was linked to actual two-way information flow in the four MPP cases, which was also a prerequisite for learning. Individual capacity building in relation to implementation appeared to have positive effects on implementing measures in the German case in which stakeholders had implementation responsibilities, as on-going involvement in implementing tangible, observable results created a sense of ownership.

In conclusion, it appears that MPP actually motivated 'simple' learning, in the sense of participants and process organizers acquiring new knowledge. An improved understanding of sustainable water governance was situated at an individual and group level in the cases that displayed learning. However, a change in beliefs and double-loop learning to drive innovation seemed not to occur. The process of learning was rather shaped through adding and exchanging knowledge, rather than through knowledge emerging via reflexive dialogue or deliberation. In addition, environmental advocacy through environmentally oriented stakeholders as a competing mechanism not related to learning offered a strong explanation for output effectiveness. These results are backed up by *Articles 4* and *7,* which found no evidence for stakeholder capacity building and deliberation leading to a higher environmental standard, innovation or new information in the outputs of the 307 cases. It is worthwhile to stress that the integration of stakeholders' knowledge, and its input into final planning documents, was contingent across the MPP cases on process organizers considering them for the output. The environmental orientation of the agency organizing the respective process seemed to present an important gearwheel for this mechanism.

5.2 Aim 2: Understand learning through adaptive management and its effect on water governance

In order to study learning through adaptive management (AM), *Article 5* elaborates the conceptual basis presented concisely in chapter 2.2. Apart from the different management phases already discussed in 2.2. (see figure 1), the article introduces two types of uncertainty that AM encounters, ecological and social uncertainty. The former thematizes unanticipated reactions of the ecological system towards the management employed, and the latter unanticipated responses from people in the social system via opposition to or disruptions of the chosen AM intervention. Uncertainty in general is not completely reducible (Walters 1986) and indeterminism an inherent part of social-ecological systems (Armitage et al. 2008). Social uncertainty characterizes therefore not a negative trait that has to be controlled; instead, the concept accentuates that learning about social factors might be crucial for AM to be not overly mechanistic or technical. Apart from environmental improvement, *Article 5* acknowledges therefore learning on ecological and social uncertainty as principle success factors in AM. When these two latter learning products meet, room for double-loop learning conducive to innovation emerges (Williams & Brown 2014).

Additionally, factors identified in literature as enabling AM are detected and linked to different management phases as well as the two types of uncertainty (see table 1). The potential enabling factors for the reduction of ecological uncertainty appear mainly related to cognitive learning, i.e. knowledge gain via an experimental management approach: during the phases of assessment and design decisions a local scale supports a precise differentiation of ecological variables (Chaffin & Gosnell 2015, Murray et al. 2015), and a rigorous design furthers precise

and relevant measurements and evaluations (Gunderson 2015, Meffe et al. 2002). Knowledge can be incorporated via eliciting expert knowledge or integrating different knowledge types. Networks are sought to proliferate knowledge gain (Koontz et al. 2015, Plummer et al. 2012) and aid implementation (Chaffin & Gosnell 2015). Comprehensive monitoring of implemented interventions is crucial for the experimental aspect of AM, which therefore should be employed long-term (Holling & Sundstrom 2015, Koontz & Thomas 2006). Participatory monitoring is increasingly perceived as facilitating complete and extensive data collection (Waylen & Blackstock 2017). Eventually, the element of adjustment of actions, if these do not lead to anticipated results, is as essential in AM that it should guide evaluations procedures.

Table 1: Factors influencing an AM project according to literature, aligned with types of uncertainty and management phases (from Kochskämper et al. 2021).

Phase of AM	**Ecological uncertainty**	**Social uncertainty**
Knowledge Base Synthesis *Design Decisions*	Local scale Rigorous design Knowledge incorporation	Enabling legislation Communication Reversibility Bridging organizations
Implementation	Networks	Trust
Monitoring	Long-term monitoring Participatory monitoring	Leadership Sufficient budget
Evaluation and Adjustment	Possibility for adjustment	Documented, communicated effects

Enabling factors identified for the reduction of social uncertainty predominantly seem to relate to relational learning between funding institutions, managers, stakeholders, and the wider public. A legal context not impeding and/or supporting AM as well as easily reversible interventions decrease likely opposition by public agencies and potentially affected stakeholders by setting the grounds for acceptance of the approach (Murray et al. 2015, Allen & Garmestani 2015). Communication between managers and stakeholders can increase acceptance, and build a shared understanding of management objectives (Chaffin & Gosnell 2015), which may materialize as trust later on (Hahn et al. 2006). Bridging organizations are perceived as important intermediaries between agencies, managers as well as affected stakeholders (ibid., Hahn et al. 2006, Plummer et al. 2012). Leadership (Gunderson 2015, Koontz et al. 2015, Murray et al. 2015, Plummer et al. 2012) and sufficient budget (Butler & Koontz 2005, Waylen & Blackstock 2017) seem key to guide AM through the critical and financially challenging phase of monitoring. Finally, the documentation and communication of project results preserve the knowledge gained, and advance its use and proliferation (O'Donnell & Galat 2008).

The narratives of five local cases that were not only initiated in a top-down manner, such as in the MPP cases, but also sometimes originated from bottom-up initiatives, are traced in *Article 5*. All cases pursued improved water quality of local river stretches by testing new, small-scale actions, while sitting under the legal umbrella of the WFD (see table 2). Four of them (cases 2 to 5) succeeded in completing at least one AM cycle. In case 1, farmers sabotaged the project by dredging out installed material during night. They already opposed the planned in-stream modifications during information rounds provided by the bridging organization in this case. Case 2, 3, and 4 were planned as what McFadgen and Huitema (2017) call technocratic

policy experiments, which are predominantly planned and issued by experts – here the managers. Case 5 resembled more what they call a boundary experiment that involves stakeholders from the outset. Nevertheless, case 2 and 3 worked closely with collaborating networks for implementation onsite. In case 2 with five water boards mainly consisting of farmers and landowners as the addressees of the experiments (possibly more sustainable management actions). After a project disruption, managers in case 3 established a new network together with trainees of the water and shipping administration for revising and repeating the implementation of interventions.

Table 2: Features of case studies (adapted from Kochskämper et al. 2021).

Design Factors	**Case 1:** In-stream modification	**Case 2:** Riparian vegetation	**Case 3:** In-stream modification	**Case 4:** Reintroduction Water Plants	**Case 5:** In-stream modification
Project Initiator	District agency	Environment agency	University	ENGO	ENGOs (3)
Project time	2013 to 2015	First 2009 to 2013; then to 2017	2008 to 2014	2010 to 2014; additional monitoring 2017	2009 to 2017
Legal context	EU Water Framework Directive (WFD)				

Turning to the first categories of *who* learned *what*, in cases 2, 3 and 4 learning on ecological uncertainty by project managers was indicated as managers learned about implementation techniques. In case 5 managers reported to already have sufficient knowledge on all procedures. Nonetheless, installed gravel and deadwood to improve dynamic meandering in the river flow caused repeatedly small erosions at the riverbanks, which were fixed ad-hoc. Additionally, informants critiqued the approach of in-stream modification in case 5 for not being systematically planned through and implemented. Hence, managers appeared not to reduce ecological uncertainty entirely.

In the cases in which the experimental management approach potentially affected stakeholders (cases 2, 3, 5) managers also appeared to learn about the process of how to deal with social uncertainty. This social learning occurred particularly with regards to gradually involving or seeking acceptance from these stakeholders. In case 3 it also occurred in maintaining the project throughout the critical phase of monitoring despite a sudden loss of the project's entire budget. Only in case 4 were the test sites deliberately chosen to not affect stakeholders. As such no learning on social uncertainty was necessary. Although the project was disrupted and not completed, managers in case 1 indicated social learning regarding early information provision and trust building. In cases 2 and 3, not only the managers but also the collaborating stakeholders learned: In case 2, the water boards all adopted the new management approach, and the trainees in Case 3 replicated the interventions at different waterways with actors other than the original management team. According to the ENGO representative in case 5 stakeholders and interested citizens in a loose network participating in the implementation of the material were not very interested to learn about the ecological effects of their interventions.

Regarding *how* actors learned, AM proposes clear procedural steps within a cyclical approach (see figure 1). The enabling factors listed before potentially foster this process of learning. The factors of local scale, enabling legislation, and reversibility of experimental actions were common to the five cases and presented contextual conditions. Regarding the reduction of ecological uncertainty, a notable difference between cases 2 to 4, in which this learning was reported or indicated, and case 5 with assumedly less learning, was a rigorous design of the project and long-term monitoring. This speaks to the origins of AM as a scientific approach that draws on structured experimentation and evaluative deduction (Fabricius & Cundill 2014, Foxon 2009, Holling 1978, Walters 1986). The incorporation of different knowledge types other than expert knowledge at the outset of projects seemed helpful in case 2 (via questionnaires and bilateral talks) and case 5 (via deliberative workshops with stakeholders and interested citizens), yet, did not seem to boost learning in the latter case. The collaborating network in case 2 brought about further insights, know-how, and, in case 3, creative and innovative solutions. Also in *Article 7* network formation co-varied strongly with learning outcomes. Vice versa, learning is seen as increasing the number and density of connections in actor networks (Newig et al. 2010). It seems that organizational learning actually played an important role for reducing ecological uncertainty - new, viable, and effective insights and findings were integrated into the projects' organization, and appeared not to depend on whether these emerged individually, collectively, or through different knowledge types.

Concerning the reduction of social uncertainty, in the cases with affected stakeholders (2, 3, and 5) trust-building and acceptance-seeking via communication was of major importance to get these on board vis-à-vis the testing of actions. A lack of built-up trust seemed also the main reason why farmers would simply not believe the river flow calculations presented by the bridging organization in case 1. The manager in case 3 reported substantial learning by all participants through the shift in the project's ownership. This ownership appeared to incentivize considerable leadership by the main manager in maintaining monitoring via own resources, which in turn aided (ecological) learning outcomes.

The category of learning *to what effect* follows the category of *how* learning took place. Interestingly, in all of the four projects that completed at least one AM cycle (2 to 5) a degree of environmental improvement was achieved. It seems that the iterative and sometimes ad-hoc adjustment of material installed in the river in case 5 led to the anticipated ecological outcomes, also without systematic learning on implementation techniques.

In conclusion, structured learning appeared to be linked to effective outcomes, although adjustments of interventions – the defining element of AM – as well led to environmental improvement without that this learning occurred. Organizational learning seemed to characterize the dominant form of learning by managers, and was moreover sufficient for innovative management practices and improved environmental outcomes. The individual-centric perspective on social learning stressing mutual, reflexive learning through interactive dialogue and ideally deliberation appears not to have played an important role. Participation appeared not to be as important for learning products as anticipated by scholars advocating for social learning in AM (Armitage et al. 2008, 2009, Cundill 2010, Pahl-Wostl et al. 2007, Plummer et al. 2012, Plummer 2009, Stringer 2006). The network-centric perspective on social learning via experi-

ence, observation, and experimentation leading to improved management practices seems to hold more explanatory substance to the environmental effects and dissemination of these in the cases with a collaborating network. In these cases, AM instigated double-loop learning that also materialized into collective action and knowledge dissemination.

5.3 Aim 3: Understand learning about participation as a governance mode

To investigate the occurrence of learning about participation as a governance mode, we established a conceptual framework of instrumental governance learning in *Article 6*. Referring to Bennett and Howlett's (1992) definition, we define this as learning by policy makers and other government actors about designing and running participatory planning processes in order to improve their effectiveness. Learning by policy makers may be a product of an intentional endeavour or evolve incidentally and intuitively. It can occur by soliciting different sources, such as policymakers' own jurisdictions and/or own policy fields or different ones by integrating experiences of others. It can further occur in different modes such as iteratively via incremental learning-by-doing and/or intentional lesson drawing, or in parallel such as through an experimental design with simultaneous trials, demonstrating an intentional approach (see table 2).

Table 2: Types of instrumental governance learning (from Newig et al. 2016).

Sources of learning / Modes of learning	Endogenous	Exogenous	
	Same jurisdiction and same policy field	**Other jurisdictions**	**Other policy fields**
Serial learning (sequential)	Learning from sequential instances of policymaking and implementation (e.g. successive policy/planning cycles, serial pilots, 'trial-and-error')	Learning from other jurisdictions' past experiences in the same policy field (e.g. lesson drawing, policy diffusion, policy transfer)	Learning from previous experiences in other policy fields with similar procedural requirements
Parallel learning (simultaneous)	Learning from concurrent policymaking and implementation processes (e.g. parallel pilots, policy experiments, randomised controlled trials)	Learning with other jurisdictions, via co-production of knowledge/evidence (e.g. coordinated planning and implementation)	Learning in parallel across different policy fields with similar procedural requirements

The introduction of new policy instruments, such as MPP, by the WFD and FD within a cyclical, iterative approach afforded considerable room for implementing public officials to learn about these governance modes. As *Article 6* argues, prior to the FD German federal states followed predominantly a security approach, a mainly top-down, technocratic governance mode aimed at maintaining and improving infrastructure for safe areas without including provisions for participation. Similarly to a shift in the hydraulic paradigm in water resources management, participation became an integral element in the paradigm of flood risk management, which puts emphasis on the relation between floods and human made infrastructure or behaviour (Newig et al. 2014). Besides, stakeholders are more severely and more directly affected by flood risk in the European context in comparison to water quality and quantity issues (ibid.). Planning processes involving stakeholders can therefore accommodate uncertainties and risks by integrating societal interests and values.

Starting once more with the categories of *who* learned *what*, all state officials reported governance learning in relation to participatory designs. To draw a clear causality between governance learning and a certain type of participatory design was not possible. Several federal states opted for limited participation, also considerably less than in the WFD planning context (see Newig et al. 2014); on the other hand three federal states plan to adopt the most inclusive participatory design used, the so-called flood partnerships. The level of flood risk within federal states gave no indication as to the chosen form of participation.

The learning process appeared not to occur intentionally, but rather through "successive limited comparisons" as Lindblom (1959: 81) described policy makers' drawing on their own experience. A majority of them reported consulting professional experts and researchers as the main exogenous source of knowledge, rather than learning through experiences from other jurisdictions or policy fields. The role of scientists, however, was seen by interviewees as limited due to scientific advice being perceived as too vague; thus advice by external consultants was more commonly pursued. Additional forms of intentional seeking of knowledge were participatory pilots, whereby these had little impact on the design of the employed participatory processes. One federal state official reported having learned through the MPP approach of another federal state, and, as already mentioned above, three federal states plan to adopt the inclusive design of flood partnerships. Two federal states demonstrated their interest in conducting a parallel experiment of different participatory formats. Nonetheless, these latter intentional and structured forms of learning were substantially less common than the unintentional, incremental way of 'muddling through' in the employment of participatory designs.

Apart from this intuitive way of learning, as opposed to a rational and intentional endeavour based on instrumental policy feedback (see King & Hansen 1999, Wood 2015), the apparently minimal influence of intentionally conducted participatory pilots demonstrates that sometimes actors did not learn, or more precisely, their learning did not automatically translate into policy outputs, as stressed by Rietig & Perkins (2017). We did not further investigate the reasons for this, for example organizational barriers, embedded interests, or institutionalized routines (ibid.). In general, participation as a governance mode was established in federal states in altered levels such as through the adoption of flood partnerships in some states or through forms of local knowledge gathering employed by the majority of states, which corresponds to Hall's first order policy change (1993). Nonetheless, whether this was mainly induced by learning or strategic, intuitive, or incremental forms of compliance with the requirements of the FD remains unclear.

5.4 Synthesis

Having explored all three research clusters separately, this chapter brings all insights together in a synergistic way to draw overarching lessons for the research field of learning in water governance.

Finding I: The inner workings of learning processes

The process of learning remains a black box in research on learning in environmental governance (Heikkila & Gerlak 2016). Yet, to craft spaces for effective learning we need in-depth

understanding of the inner workings of learning processes. The findings of the studies collected under this framework paper provide insights into the process of learning and enabling conditions for learning to evolve.

For social learning through participation the factors anticipated in literature (Connick & Innes 2003, Fazey et al. 2013, Heikkila & Gerlak 2013, Hurlbert & Gupta 2015, Siddiki et al. 2017) - procedural settings with open and fair dialogue, trust, respected leadership and facilitation - opened up space for learning, in the MPP and AM cases alike. A major factor for learning to evolve was trust. Trust built up, especially between process organizers and stakeholders, appeared as the essential, basic fuel required for accepting and processing new information, as demonstrated by the example of the failed AM case. Nonetheless, the German MPP case, in which learning occurred and at the same time one major pressing issue was left out, also shows the possible downsides of a trustful group atmosphere and trust in the leadership of the process chair.

Interactive communication appeared to constitute the overall frame for participant and group learning. As an ideal type of social learning, reflexive deliberation thus appears to be a relevant point of reference, however, in the cases examined in this research it remained an unattainable archetype. The observed knowledge exchange in the MPP cases had an interactive quality, yet more in the sense of combining local and technical knowledge and to a lesser extent moulding different perspectives and norms into joint learning products. In half of the MPP cases, in which learning was reported, dialogue was rather technical or hands-on on already existing projects, and in the other half it was more strongly related to visions on water governance in the sub-basin(s) in the long-run, particularly in one Spanish case in which learning was identified as one of the key outcomes. Nevertheless, dialogue in the Spanish cases was less interactive and reflexive than in the former two cases. Interactive communication proved to be especially important between process organizers and participants. This might also explain the reportedly high degree of learning in one Spanish case, since organizing agencies represented the societal paradigm of a 'new water culture', which was prominent at the time, in line with the WFD principles.

The indicated groupthink in the German case, the exclusion of conflicting topics throughout all cases, and the importance of the environmental orientation of the agency, hint towards another influential factor for the process of learning: The framing of learning experiences or how learners frame their problem (Dunlop & Radaelli 2013). The learning experience might work through issue framing regarding a pursued overarching goal in situations in which the specific content of learning is ambiguous or beyond the control of all actors (Daviter 2007, Grin & van de Graaf 1996). The content of learning was restricted in the MPP cases to WFD requirements and sustainable water governance more broadly. This included complex and ambiguous water issues without a clear delineation of the relevant learning topics for the finding of solutions. In comparison, the AM cases hardly left ambiguity or interpretation of the learning content, since experimentation prescribes and delineates the content of a learning endeavour (Dunlop & Radaelli 2013).

Framing is not only a rational choice, since human rationality is context-dependent (Clark & Wilson 1991). Actors discussing policy have different resources (time, expertise, access to knowledge) and incentives in different situations, leading to distinct interpretations of a 'rational' discussion (Wood 2015). Hay (2007) sees here the possibility of topics to get politicized or depoliticized as one form of framing: "Issues […] become the subject of deliberation, decision making and human agency where previously they were not" or they are "deliberated less and assumed to be inevitable (designated in the 'realm of necessity')" (ibid: 81). Wood (2015) posts that deliberative, social learning processes therefore primarily occur in contexts that are 'resource-rich', i.e. where actors have extensive financial, legal, and professional capacity to study a policy problem or policy intervention. In contrast, depoliticized debates in more restricted environments deal with broad-brush arguments and normative statements as opposed to the specific or technical details of policy, leaning towards ideological or partisan dichotomies (ibid.). The latter seems to be illustrated by the two more participatory MPP cases in Spain. The German MPP case can be considered resource-rich, the problem framing appeared nonetheless to limit reflexive learning through deliberation.

Professional facilitation and structured knowledge aggregation methods, both factors standing out in our studies, might be an important counterbalance to biased framings. Structured and systematic forms of learning played an important role not only in the MPP cases and the supporting quantitative studies, but also in the AM cases. Organizational learning by integrating new and viable insights into the organizational project structures and resultant management practices was indicated for managers when these drew on systematic methods for knowledge elicitation, project designs, and monitoring. Factors the AM literature identified as essential for the learning approach in AM had also largely a crucial function for learning by managers, however in a more fine-grained way related to the reduction of social and ecological uncertainty. This might be indicative for effective governance learning by policy makers, in putting emphasis on more intentional, systematic forms of learning, which only occurred rarely in our study.

Networks collaborating in implementation activities combined with structured procedures and methods seemed to motivate social learning from a network-centric perspective, and built up a sense of ownership in the AM cases. In the German MPP case, where tangible results were observed by the participants, a similar experience occurred. This finding puts a stronger emphasis on participation in implementation as a type of participatory activity that instigates social learning.

Finding II: The effects of learning: Going beyond environmental outputs

Effects of learning beneficial for the environment are rather more expected than empirically sustained (Armitage et al. 2018, Heikkila & Gerlak 2016). It is empirically not clear whether and which learning processes lead to actual environmental results.

In the MPP and AM studies and related quantitative analyses, learning did not automatically lead to enhanced environmental quality in outputs. The MPP cases showed that mutual group

learning and participant capacity building played a comparatively minor role in comparison to other mechanisms such as environmental advocacy. However, the integration of local knowledge, particularly when combined with expert knowledge had an impact on implementation. Similarly, in the AM cases the structured blending of expert knowledge with local knowledge brought in by stakeholders and implementing networks led to successful outcomes and learning. This might be an indication that organizational learning, i.e. the integration of new, viable, and effective insights and findings into planning irrespective of individual or collective discovery, has a stronger impact on outputs than social learning processes driven mainly by interactive, mutual, and collective creation of knowledge. The required resource-rich context mentioned above provides a possible explanation, since in-depth social learning processes that also bring about effective results might only evolve over time in an iterative process of problem discovery, definition, and deliberation (Emerson & Nabatchi 2015).

A further argument for the limited effect of learning is 'structural balance' which suggests that actors protect 'deep' normative assumptions and beliefs by avoiding or ignoring inconsistencies in debates as long as these are not untenably challenged (see Wood 2015). Cognitive learning may therefore not be sufficient for changing beliefs and according decisions and behaviour (Heikkila & Gerlak 2013, Wood 2006). An indication for this assumption is the single-loop learning without innovation found in MPP cases.

The AM approach led to innovation, which was not always the result of comprehensive learning, but the element of adjustment in the management approach. Expert learning based on a systematic project design by managers proved to be as instrumental for ecological solutions as processes including participation. At the same time, participants learning on experimental interventions spread their knowledge, which furthered more sustainable and innovative methods. The AM cases conveyed the delicacy of communicating experimental approaches to stakeholders in the context of problems with inherent uncertainty. Learning in general includes the reduction of uncertainty among actors (Heikkila & Gerlak 2013). The network-centric perspective on social learning via reflection through experience within systematic procedures therefore instigated not only innovation, but also seemed to provide a mechanism for collective action and knowledge dissemination. When knowledge dissemination includes the wider societal units or the broader public, it might in turn aid the acceptance of experimental approaches aimed at reducing uncertainties.

Collins & Ison (2009: 358) sustain this view theoretically by calling for "jumping off Arnstein's ladder" in re-conceptualizing social learning as a catalyser and multiplier for understanding the issue at hand by the broader public. Fischer and Maag (2019) show empirically that the comparative importance actors attribute to participatory forums depends less on the forum's contribution to cooperation, and more on the perceived contribution of the forum to learning and the distribution of the debated issue to the public and decision makers. Ansell and Gash (2018) found that learning constituted one crucial factor for encouraging the positive feedback effects that help collaborative platforms adapt and succeed. Learning may thus not be an explanatory variable for policy outcomes, but rather a conditioning or intervening variable, as Rietig and Perkins (2017) also found in their study on learning, e.g. related to collective action, motivation for participation, and situating the issue at hand at wider societal

levels. A direct effect on environmental outputs and outcomes as claimed by the majority of learning literature in environmental governance could, however, not be sustained in the different studies.

Finding III: Puzzling, powering and the perpetuation of learning

Putting learning into a broader conceptual context, particularly as an intervening variable or mechanism that competes with different factors leads to 'puzzling' and 'powering'. Learning as evidence-based deliberation of policy success or failure to bring about paradigm shifts can be denoted as 'puzzling' (Heclo 1974): Policy feedback or at best sustained experience as basis for rational, instrumental decisions (King & Hansen 1999, May 1992). In contrast, more rhetorical or 'non-evidence-based' discursive processes can be described as 'powering' related e.g. to interest-based struggles over resources (Hall 1993). Wood (2015) claims that social learning, which includes for him policy learning, is supplemented by external struggles for institutional resources. Institutional positions are secured via public opinion, the media, and civil society (Bennett & Howlett 1992). Puzzling and powering are therefore reinforcing elements (Van de Steen et al. 2016). "Policies are not merely maintained and replaced according to 'evidence' or power struggles over the control of state apparatuses, but through a constant legitimizing or delegitimizing of paradigm ideas through rhetorical argumentation" (Wood 2015: 8).

Powering might be particularly important to create perceived urgency to engage and tackle long-term policy issues, since putting societal problems on the policy agenda is not only a cognitive or informational matter (Van der Steen et al. 2016). In turn, puzzling, the analysis of a problem and recurring solutions, is presented in frames and narratives around which power arranges (ibid.). Van der Steen et al. (ibid.) perceive an alternative mechanism in perpetuation, which means securing agreements for the long term by e.g. institutionalisation, positioning decisions outside the day-to-day political debate, and raising the barrier for changing decisions in the midst of political struggles.

The cyclical, long term, and adaptive approach of the Water Framework and Floods Directive constructed supporting structures for the perpetuation of learning. European environmental policies proved to be a complex area for decision making and implementation, and the EU reacted with increased emphasis on proceduralisation and decentralisation as embodied by the directives (Challies et al. 2017). Sabel and Zeitlin (2008) argue that this opened up the space for experimental governance regarding complex problems, referring to deliberative problem solving that weighs different alternatives in policy making and makes this process and choices transparent to the wider public (ibid.). MPP as a policy instrument or governance mode can therefore be seen as an extension and multiplier of transparency, which also means that social learning that not only manifests at group level but also at wider societal levels can be perceived as a vital element in legitimizing policies.

Further, perpetuation can also impact on learning by policymakers. The results of aim three show that policymakers mainly drew on their own experience and intuition for governance learning. Lindblom, who claimed that policymakers mainly manoeuvre via this personal incrementalism (1959), stressed the descriptive nature of his assessment twenty years later

(1979), critiquing that taking bigger steps in policy and sound scientific analyses of policy alternatives should be aspired for learning and policy change to occur. According to Hall (1993) incrementalism endures until critical junctures are reached that induce paradigm change which is closely intertwined with underlying normative ideas and beliefs. Retrieving the assumption that changing deep, underlying norms and beliefs is a slow process, the procedural elements introduced in iterative policy cycles by the directives aided the transition from the former, technocratic, and centralistic water governance paradigm to a more holistic, participatory approach in water governance that draws on feedback and evaluation.

A more holistic water governance paradigm includes arrangements required to accommodate numerous social factors in an effort to motivate acceptance and social learning as puzzling to occur. In the AM cases managers learned about how to deal with social factors such as perceived uncertainties, which was vital for the acceptance of management interventions and the spreading of knowledge on successes. This highlights the important role of systematic governance learning including social uncertainties, also translated to higher levels and policy makers. Regarding effective process learning, WFD implementation, clearly drawing on AM principles, already showed early improvements in learning on assessment, monitoring, evaluation, and reporting by EU Member States (EU 2019). The acknowledgement of social factors might be additionally crucial for flood risk management that entails higher risks and uncertainties for stakeholders in the European context.

Learning seen as puzzling processes might not be as influential in shaping effective outputs in the short term as assumed and wished for in literature – in the MPP cases environmental advocacy which is rather linked to powering than puzzling had a stronger impact, and policy makers seldom engaged in experimental governance for puzzling. Puzzling might instead stipulate acceptance and legitimization for new powering efforts. Apart from these two mechanisms perpetuation of learning seems key, for which the EU directives laid down the necessary long-term, adaptive approach.

6 Conclusion

Water governance is undergoing a substantial shift from a technical, state-centred approach towards a holistic paradigm based on environmental considerations comprising the involvement of non-state actors; in water and flood risk management alike. How such governance arrangements induce learning and achieve effectiveness is still largely underexplored in research and practice. This doctoral dissertation has sought to contribute to a more comprehensive understanding of learning for effectiveness through participation and adaptive management, as well as learning about participatory planning as a governance mode.

The conceptual background for this endeavour focused therefore on clear conceptual depictions of conditions and causal mechanisms for learning within the three areas of research focus. These conceptual frameworks informed the qualitative analyses through the case study method employed, which was complemented with quantitative studies. The findings for research aim 1, understanding learning through participation and its effects on water governance, revealed that participatory planning led to learning through improved understandings at an individual and group level. Effective outputs, however, were rather shaped through envi-

ronmental advocacy and knowledge brought to the table by stakeholders and participants that was exchanged with the expertise of process organizers than through learning emerging through reflexive deliberation or dialogue. In the adaptive management cases (research aim 2) managers learned about how to deal with ecological and social uncertainty, and participants of implementing networks improved their knowledge as well as capacities, and spread the results. Nonetheless, environmental improvement was not necessarily linked to ecological learning due to the integral element of adjustment in AM. A systematic project design supported comprehensive learning, and once more trust stood out in the cases with affected stakeholders as important for a learning process to evolve. Regarding learning about participation as a governance mode (research aim 3) all interviewed public officials in German federal states reported some degree of governance learning, which emerged not systematically but primarily drawing on own experiences and intuition.

These findings were condensed into three overarching lessons for learning in water governance: (1) Interactive communication seems to form the overall frame for participant and group learning, especially between process organizers and participants. As an ideal type of social learning, reflexive deliberation remained however an unattainable archetype. Framing of learning experiences turned out to play an important and potentially distorting role, for which professional facilitation and structured knowledge aggregation methods might be an important counterbalance. Eventually, social learning occurred through participation in implementation stressing the network-centric perspective and learning through experience. (2) Learning processes impacting on effective outputs took rather the form of structured, organizational learning than reflexive social learning. Learning did not automatically enhance the environmental quality of outputs. It may thus not be an explanatory variable for policy outcomes, but a conditioning or intervening variable related to collective action, motivation for participation, and situating the issue at hand at wider societal levels. (3) The concepts of puzzling and powering might help understand learning as a source for effectiveness in the long-term when complemented with interest-based debates for creating sufficient political agency of policy issues. Learning seen as puzzling processes might instruct acceptance and legitimization for new powering efforts. The perpetuation of learning in systematic ways and structures appears to characterize an alternative to this reflexive and strategic interplay, for which the water-related EU directives provide the basis.

Policy makers and practitioners might benefit from these findings in the pursuit of learning for expected positive effects. Knowledge exchange enhanced planning outputs, which asked for two-way communication but, contrary to expectations in the literature, no intensive dialogue or deliberation. A systematic approach drawing heavily on expert knowledge reflected the main mechanism for learning on ecological uncertainty in the cases employing adaptive management. This systematization is not yet common in governance learning on participatory governance, but could be guiding in the effective steering of governance modes. Irrespective of the important role of systematic learning and expert knowledge, dialogical interaction can instigate social learning that furthers acceptance and legitimation of decisions and management approaches.

In terms of research, comparative water governance is "a relatively young field that has yet to consolidate" (Özerol et al. 2018). This doctoral dissertation aimed at providing a contribution through a methodology that makes qualitative steps of the case study method transparent, and also included quantitative studies to sustain findings of the comparative analyses. The findings, bound to the cases observed, could give indicative avenues for further hypothesis developing and testing in large-N studies. Moreover, the interplay of puzzling and powering for learning processes, and when and how perpetuation of learning occurs as a counterbalancing element represents a fruitful research area to further contextualize effective learning. Process and governance learning in relation to social factors could be further investigated for governance arrangements characterized by multiple actors, levels, and scales, and a high degree of problem uncertainty that can induce risk aversion by actors towards (perceived) possible future losses caused by management innovations. The latter seems particularly crucial in the field of water governance in the context of resilience and climate change adaptation. The finding of participatory implementation being a vital activity to promote social learning and collective action suggests an additional research topic in this context.

Learning may not be an automatically linear or systematic process with immediate results. However, the transformation and adaptation of water governance regimes, as envisioned in the Sustainable Development Goals and European water-related directives, go hand in hand with systematic learning on, from, and through examples show-casing successful water governance which ultimately shapes the societal understanding and policy paradigms on how to deal with the prevailing struggle to define and practice effective and sustainable solutions.

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Annex

Article 1:

The Environmental Performance of Participatory and Collaborative Governance: A Framework of Causal Mechanisms

Abstract

Many have advocated for collaborative governance and the participation of citizens and stakeholders on the basis that it can improve the environmental outcomes of public decision making, as compared to traditional, top-down decision making. Others, however, point to the potential negative effects of participation and collaboration on environmental outcomes. This article draws on several literatures to identify five clusters of causal mechanisms describing the relationship between participation and environmental outcomes. We distinguish (i) mechanisms that describe how participation impacts on the environmental standard of outputs, from (ii) mechanisms relating to the implementation of outputs. Three mechanism clusters focus on the role of representation of environmental concerns, participants' environmental knowledge, and dialogical interaction in decision making. Two further clusters elaborate on the role of acceptance, conflict resolution, and collaborative networks for the implementation of decisions. In addition to the mechanisms, linking independent with dependent variables, we identify the conditions under which participation may lead to better (or worse) environmental outcomes. This helps to resolve apparent contradictions in the literature. We conclude by outlining avenues for research that builds on this framework for analysis.

Keywords: Environmental governance, effectiveness, modes of governance, stakeholder involvement, deliberation, causal hypotheses, collective learning, public policy

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The Environmental Performance of Participatory and Collaborative Governance: A Framework of Causal Mechanisms

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Many have advocated for collaborative governance and the participation of citizens and stakeholders on the basis that it can improve the environmental outcomes of public decision making, as compared to traditional, top-down decision making. Others, however, point to the potential negative effects of participation and collaboration on environmental outcomes. This article draws on several literatures to identify five clusters of causal mechanisms describing the relationship between participation and environmental outcomes. We distinguish (i) mechanisms that describe how participation impacts on the environmental standard of outputs, from (ii) mechanisms relating to the implementation of outputs. Three mechanism clusters focus on the role of representation of environmental concerns, participants' environmental knowledge, and dialogical interaction in decision making. Two further clusters elaborate on the role of acceptance, conflict resolution, and collaborative networks for the implementation of decisions. In addition to the mechanisms, linking independent with dependent variables, we identify the conditions under which participation may lead to better (or worse) environmental outcomes. This helps to resolve apparent contradictions in the literature. We conclude by outlining avenues for research that builds on this framework for analysis.

KEY WORDS: environmental governance, effectiveness, modes of governance, stakeholder involvement, deliberation, causal hypotheses, collective learning, public policy

很多人支持合作治理和公民与利益相关方的参与，因为与传统的自上而下地决策相比较，它可以改善公共决策对环境的影响。然而，另一些人指出参与和合作会对环境造成负面影响。本文通过不同文献分支识别了关于描述参与和环境结果之间因果机制的五个类群。我们将（a）那些描述了参与如何影响环境产出标准的机制与（b）那些与产出执行的机制相区别。这三个机制群聚焦于环境问题代表，参与者的环境知识和决策过程中的对话互动。另外两个类群阐述了决策执行中接受，冲突处理和合作网络的角色。除了这些机制，我们将自变量与因变量相联系，识别了何种情况下参与会导致更好的（或更坏的）环境结果。这帮助我们解决文献中的明显冲突。我们以在此研究框架下可研究的问题作结。

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To advocate democracy is to advocate procedures, to advocate environmentalism is to advocate substantive outcomes: what guarantee can we have that the former procedures will yield the latter sorts of outcomes?

—Goodin (1992, p. 168)

1. Governance Modes as Interventions: Moving Beyond Competing Claims about Effectiveness of Participation and Collaboration

Scholars and public administrators are increasingly engaging with participatory and collaborative modes of governance in order to improve environmental outcomes of public decision making. The motives and rationales for public participation, which have traditionally centered around notions of emancipation and legitimacy, have been shifting toward an expectation of increased effectiveness of governance. Following this instrumental rationale (Newig, 2012), participation is advocated and used to open up decision making, integrating local knowledge, and the perspectives of a multitude of actors (Edelenbos, Van Buuren, & van Schie, 2011), and to promote acceptance and implementation of decisions (Bulkeley & Mol, 2003). Participation is thus assumed to lead "to a higher degree of sustainable and innovative outcomes" (Heinelt, 2002, p. 17). Many observers have argued that the success of collaborative and participatory governance will ultimately be judged by its ability to improve environmental conditions (e.g., Beierle & Cayford, 2002).

However, it is precisely the capacity to solve environmental problems that remains disputed (Dietz & Stern, 2008; Lange, Driessen, Sauer, Bornemann, & Burger, 2013; Young et al., 2013), because while collaborative governance continues to proliferate, there is still no consensus on its performance (Gerlak, Lubell, & Heikkila, 2013). Even where strong relations between collaborative processes and environmental outcomes are empirically established, it remains unclear why and how this is the case (Scott, 2015). Furthermore, competing claims as to the effectiveness of collaborative and participatory approaches pose a dilemma for "green democracy," introducing "tension between democratic means and environmental ends" (Wong, 2015, p. 138). Different fields of study have made a variety of arguments on the pros and cons of participation with respect to environmental outcomes. The existing literature is therefore fragmented, and leaves us with logical inconsistencies. Clearly, environmental benefits of participatory decision making are not automatic, but rather are contingent on an array of intervening factors (Irvin & Stansbury, 2004).

This article seeks to move a step forward by integrating existing claims from multiple research fields on the link between participation and outcomes into a coherent framework of causal mechanisms.

We are not the first to develop a conceptual framework on participatory or collaborative governance. Ansell and Gash (2008) have put forward a literature-based model explaining the general "success" of collaboration. Emerson and Nabatchi (2015), drawing on Emerson, Nabatchi, and Balogh (2011), present a yet more general framework including the drivers, dynamics, impacts, and adaptive responses of

"collaborative governance regimes." While building on these valuable contributions, our focus is more specific. Emerson and colleagues, in particular, study more institutionalized collaborative governance *regimes*. We theorize on public *decision making processes* (DMPs). These can be more or less participatory and collaborative. Our framework, therefore, explicitly incorporates and reflects on nonparticipatory and noncollaborative alternatives.

Decision makers are often able to choose the extent to which a DMP is going to be participatory or collaborative. Collaboration and participation, then, are a choice rather than a necessity. In this sense, we depart from Emerson and Nabatchi's (2015) notion of collaborative governance as processes "to carry out a public purpose *that could not otherwise be accomplished*" (p. 2, emphasis added). Rather, we conceive of governance modes as strategic *interventions* that can help achieve certain goals (Scott & Thomas, 2017). The key rationale of our framework is thus to provide reasoned assumptions on which modes of governance are likely to be effective (in environmental terms) under which circumstances.

The causal framework we present comprises five clusters of core mechanisms, which address the relationship between governance modes and (i) the environmental standard of outputs, and (ii) implementation of outputs. We disaggregate these mechanisms as far as possible, to isolate causal relations between important variables in the policy process, and tease out the often implicit assumptions on which each mechanism rests. We therefore not only specify and clarify hypothesized causal mechanisms between participation and environmental outcomes, but also identify the contextual conditions under which participation may lead to better (or worse) environmental outcomes.

Our focus lies on the instrumental value of collaboration and participation in environmental governance. We acknowledge that participatory and collaborative environmental decision making may have a range of nonenvironmental outcomes that would be important to consider in gauging the overall impact of a DMP (Rogers & Weber, 2010). In this article, however, we deliberately limit our focus to the implications of decision making for the environment. We do not advance any particular "pro" or "anti" participation argument, but rather seek to examine in detail what we suggest are the most important mechanisms. The mechanisms identified and examined below have been refined from ongoing meta-analytic research examining a large body of case study evidence on collaborative and participatory environmental decision making (Newig, Adzersen, Challies, Fritsch, & Jager, 2013), and draw on a range of works from *inter alia* political science, public administration, legal studies, social psychology, environmental studies, decision science, mediation, and conflict resolution.

Examining gaps and contradictions among these mechanisms, as well as key conditioning factors, we aim to identify important variables for empirical investigation, and to integrate competing claims as to the effectiveness of collaborative and participatory environmental governance. This is useful for two reasons: First, it should provide a point of reference for future theorizing and hypothesizing. Complementary or competing hypotheses, or refined causal mechanisms, can be compared against this framework, potentially improving the conceptual basis of participatory

governance. Second, it can and should guide and organize empirical enquiry by helping to focus on relevant empirical factors for assessing participation and its outcomes in single or comparative case studies, and by guiding the interpretation of findings. Such a framework should thus aid the generation and consolidation of robust evidence on the "instrumental" value of collaborative and participatory modes of environmental governance. In contrast to recent frameworks that describe collaboration in ideal-typical terms (e.g., Emerson & Nabatchi, 2015; Emerson et al., 2011), we seek to conceptualize different dimensions of participation, and identify the precise mechanisms that link these dimensions with outcomes.

The article proceeds as follows. Section 2 presents our conceptual framework for the analysis of participatory DMPs and clarifies key terms used in the article. Section 3 presents the core mechanisms on opening up decision making, incorporation of environmentally relevant knowledge, dialogue, veto players, conflict resolution, acceptance, and capacity building for implementation and compliance, based on a thorough review of the literature. Both positive and negative mechanisms linking participation and effectiveness are elaborated. Section 4 concludes the article with reflections on the key insights gained, the potential and limitations of our framework, and future research directions.

2. Conceptual Framework and Definition of Key Terms

We consider the participation of nonstate actors in public decision making and how they interact and collaborate to reach collectively binding decisions on environmental issues. This captures a wide variety of governance modes and "degrees" of participation and collaboration in planning, licensing, rule-making, impact assessment, and other forms of public policymaking. The core concept is that of a DMP. A DMP may be initiated in a "top-down" or a "bottom-up" fashion, and may comprise a single process or several related (sub-)processes (e.g., public hearings, task forces, round tables, citizen advisory committees, etc.) that are, to a greater or lesser extent, participatory or collaborative.

"Participatory governance" and "collaborative governance" are two concepts widely addressed in the academic literature, which have much in common. An abbreviated version of Emerson and Nabatchi's (2015) definition of collaborative governance as "processes and structures of public policy decision making and management that engage people across the boundaries of public agencies, levels of government and/or the public, private for-profit, and civic spheres to carry out a public purpose [. . .]" resonates with our understanding of participatory governance. Yet both concepts have their individual features. "Participatory governance"—the more widely used term in Europe[1]—stresses the involvement of actors who are not normally charged with decision making. This may include formats such as public hearings or other forms of consultation that are of a non-"collaborative" nature in the stricter sense. "Collaborative governance"—more common in the North American context—emphasizes the process of working together. Both concepts, from their own perspective, entail the respective other:

From the perspective of participatory governance, collaboration is one form of interaction (out of many); from the perspective of collaborative governance, participation is one element (out of many).

Here, we consider participation as the overarching variable in DMPs. We are principally concerned with DMPs as chains of events geared toward specific outcomes, and less so with enduring collaborative regimes that typically entail iterative dynamics. Within participatory processes, collaboration features as an important category, and almost all of the studied mechanisms refer to collaborative settings. Participation is understood here as a three-dimensional concept, and can be more or less "intensive" in each of these governance dimensions (Fung, 2006; Newig & Kvarda, 2012):

1. *Breadth of involvement*: The range of stakeholders[2] and other actors included in the process (e.g., involvement of few selected experts, representatives of organized groups, or citizens vs. the general public).

2. *Communication and collaboration*: The manner, direction, and intensity of information flows (e.g., one-way information provision vs. collaborative development of preferences).

3. *Power delegation to participants*: The extent to which participants are afforded influence over the decisions to be taken.

Taking this into account, we define participatory governance as *processes and structures of public decision making that engage actors from the private sector, civil society, and/or the public at large, with varying degrees of communication, collaboration, and delegation of decision power to participants.*

The implication of the three-dimensional conceptualization is that these dimensions are in principle independent of each other, meaning that any given DMP can score "high" in one dimension but "low" in another. For example, there are governance modes with high levels of power delegation such as public referenda, in which collaboration is virtually absent.

The mechanisms comprising the framework relate to one or more of these dimensions treated as independent variables, which are assumed to produce social and/or environmental outcomes.[3] For analytical purposes, a DMP concludes with the production of a substantive output such as a collectively binding decision or plan. The process may also generate a variety of social outcomes, depending on the nature and degree of participation and collaboration. These may include: individual and collective learning, awareness raising, acceptance of the process and output, conflict resolution and trust-building, and strengthening social capital and networks among stakeholders (Newig et al., 2013). A participatory DMP may also generate negative outcomes by, for example, eroding trust among participants and stakeholders, alienating the public, or triggering new conflicts. Ultimately, the interaction of environmental outputs and social outcomes shape the quality and extent of implementation and compliance.

The mechanisms presented in the following section are summarized in Figure 1. Following Elster (1989), we assume that "[a] mechanism provides a continuous and

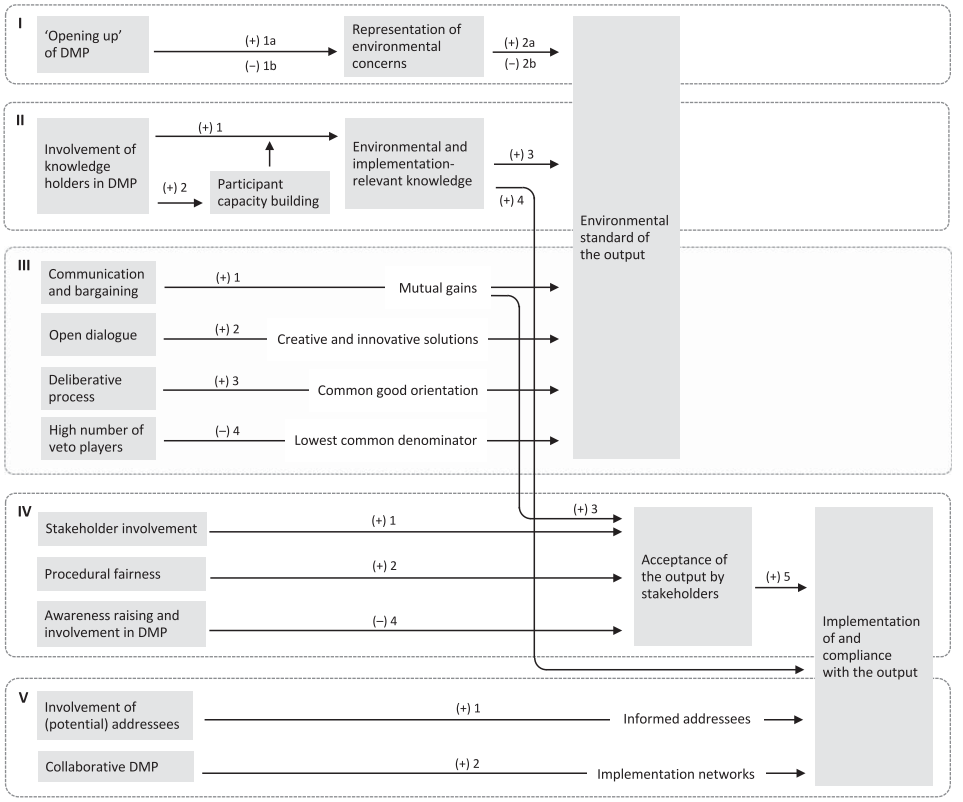

Figure 1. Overview of Mechanisms Linking Participation to Environmental and Social Outcomes. *Note*: The mechanisms are organized in clusters (Roman numerals) and individual mechanisms (Arabic numerals within clusters). Plus signs (+) denote reinforcing relationships, minus signs (–) denote weakening relationships. For example, the top left arrow combines mechanisms M I.1a (positive influence of "opening up" on representation of environmental concerns) and M I.1b (negative influence).

contiguous chain of causal or intentional links between the explanans and the explanandum" (cited in Hedström & Ylikoski, 2010, p. 51).

Mechanisms relate, first, to the link between independent and dependent variables. To aid the more precise identification of causal mechanisms, we disaggregate what often appear in the literature as complex, multistep mechanisms—or merely hypotheses linking different variables—into basic steps in a causal chain. We thus identify 19 mechanisms relating participation to outputs, and outcomes. We present these in five clusters, reflecting five fundamental ways in which participation and collaboration are assumed to affect environmental outcomes. We recognize, second, that causal relations depend not only on these mechanisms, but also on their interaction with the surrounding context. Specification of the context within which a given mechanism works is an important, yet often ignored, step in assessing its explanatory power (Falleti & Lynch, 2009), and we therefore seek to account for contextual *conditioning factors* (*sensu* Berry, Golder, & Milton, 2012) at each stage of the process, both internal and external to DMPs—that is, broadly within and beyond the control of process organizers (see Figure 2 for a schematic overview). Of the plethora of

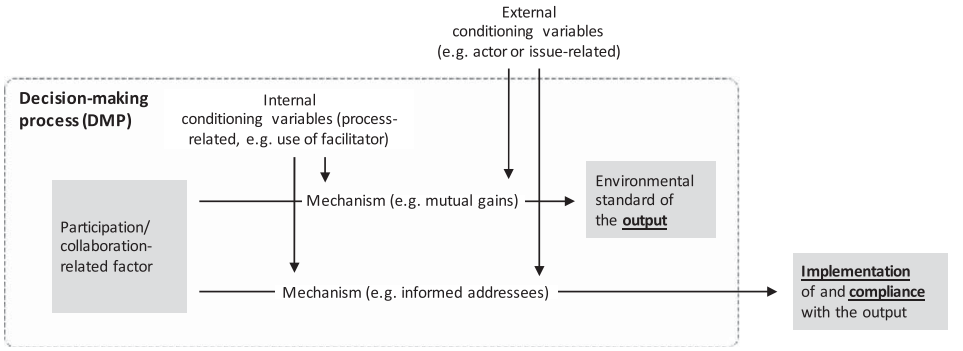

Figure 2. Schematic Depiction of Causal Mechanisms Linking Modes of Governance (Participation/ Collaboration-Related Factors = Independent Variables) to Outputs and Their Implementation (= Dependent Variables).
Note: These mechanisms operate under constraining and enabling contexts termed conditioning variables, collectively discussed in more detail in Section 3. The dashed line separates the DMP from its context.

contextual variables potentially impacting environmental outcomes, we focus here on those factors likely to influence the identified mechanisms.

3. Mechanisms Linking Participation and Collaboration to Environmental Outcomes

In this main section, we outline in detail each of the mechanisms we identified, and discuss the conditioning variables that affect them.

3.1. Cluster I: Opening Up of Decision Making to Environmental Concerns

It has been widely argued that the inclusion of environmental concerns—for example, as represented by environmental NGOs and environmental administration—in participatory governance structures leads to more environmentally beneficial decisions (Dryzek, 2005; Smith, 2003). First, we consider—in two submechanisms—whether and how the opening-up of decision making to nonstate actors increases representation of environmental concerns.

1. *Opening up and the representation of environmental concerns.* Opening up decision making to actors not normally included may have substantial impacts on the representation of actors and interests, including environmental concerns:

> *M I.1a: Opening up a DMP to nonstate actors allows previously excluded groups, including environmental groups, to participate, thus increasing representation of environmental concerns in a DMP.*
>
> *M I.1b: Opening up a DMP to nonstate actors decreases representation of environmental concerns.*

Conventional public environmental DMPs "often fail to incorporate the whole range of environmental values" (Smith, 2003, p. 129). Opening up a DMP can create

opportunities for greater representation of a broader range of stakeholders from many—often underrepresented or marginalized—sectors of society (Fung, 2006). Hence, such representation may significantly alter the distribution of actors and interests involved. Arguably, environmental groups and other actors motivated by environmental concerns will have a strong incentive to participate in a DMP affecting environmental matters, and thus be rather strongly represented (Larson & Lach, 2008). Paradoxically, opening-up decision making in this way could also weaken the position of environmental concerns, as potentially opposing concerns might dominate.

Whether or not a participatory process substantially increases the representation of environmental concerns (M I.1a vs. M I.1b) depends on both the potential participants, and how the process is designed.

- *Stakeholders' environmental orientation*: Depending on the issue and the scope of the DMP, stakeholders may be more or less strongly oriented toward the environment (Fung, 2006; Larson & Lach, 2008; Newig & Fritsch, 2009). This may depend *inter alia* on the spatial scale of decision making. Decisions at the local level tend to be biased toward economic development at the expense of environmental values (Irvin & Stansbury, 2004; Koontz, 1999; Layzer, 2002).

- *Willingness to participate*: Stakeholders' willingness to participate varies (Newig, 2007). Actors weigh up expected costs and benefits of participation, considering the likelihood of their influencing the decision (Turner & Weninger, 2005). This is particularly true for environmental groups that have to gain or maintain credibility (Holzinger, 2000; Whelan & Lyons, 2005). Further, actors tend not to participate when they perceive their concerns to be already sufficiently represented (Diduck & Sinclair, 2002), or when they anticipate manipulation by more powerful participants (Purdy, 2012).

- *Stakeholder capacity*: Well-resourced actors are more able and more likely to participate (Diduck & Sinclair, 2002; Fung, 2006; Fung & Wright, 2001). Environmental groups tend to have comparatively few resources at their disposal (Ansell & Gash, 2008; Layzer, 2002), often working on a voluntary or nonprofit basis. Where meetings and other participation events are held during work hours, and where attendance necessitates travel, the costs, especially to small, nonprofessionalized, and local environmental groups, are relatively high. Access to resources and capacity to meaningfully participate is often related to geographical scale: Stakeholder representatives at regional or national levels are usually selected on competency-based criteria, and have access to more professional resources than their counterparts at local levels of governance (Rockloff & Moore, 2006).

- *Open versus inclusive process*: The aforementioned stakeholder-related factors cannot be considered in isolation from the participatory process design. It makes a difference whether a DMP is "open" (to everyone), relying essentially on self-recruitment of participants, or whether it is "inclusive" in that the organizers deliberately follow strategies to invite and introduce certain stakeholders to the

process, aiming for a balanced and representative group (Fung, 2006). Targeted stakeholder selection helps to offset underrepresentation of environmental concerns, as can the use of positive incentives, the reimbursement of attendance costs, and the choice of appropriate process timeframes and meeting locations (Johnston, Hicks, Nan, & Auer, 2011).

To sum up, a participatory process is more likely to lead to stronger representation of environmental concerns when stakeholders show a strong environmental orientation and a strong tendency to participate (M I.1a). Completely open processes are prone to suffer from imbalances of participants, making underrepresentation of environmental concerns more likely (M I.1b). Processes employing specific measures to target and support otherwise under-resourced stakeholder groups potentially contribute to strong representation of environmental concerns.

2. *Representation of environmental concerns and environmental quality of decisions.* A second pair of mechanisms addresses the extent to which the inclusion of environmental concerns impacts positively or negatively on the environmental quality of decisions:

> *M I.2a: Increased representation of environmental concerns in a DMP fosters environmental advocacy, impacting positively on the environmental quality of the output.*
>
> *M I.2b: Increased representation of environmental concerns in a DMP weakens the position of environmental groups vis-à-vis more powerful actors, impacting negatively on the environmental quality of the output.*

M I.2a assumes that environmental actors, by participating in a DMP, have better chances to advocate for their concerns than if they were not involved. The particular values, arguments, and knowledge (see cluster II) brought to the table by proponents of environmental interests can enhance the environmental quality of outputs (Brody, 2003). This may happen by convincing other actors and coalitions engaged in the process.

M I.2b, by contrast, argues first that in participatory processes, environmental groups may be co-opted by more powerful actors. The cordial relationships often developed among parties in collaborative processes may lead to greater concessions on the part of environmental groups ("pacification" or "seduction") (Amy, 1987). The obligation for participants to engage "reasonably" can stifle expressions of objection and frustration, which may be seen as counterproductive and nonconstructive. In this way, participation can serve to suppress and dilute the concerns and convictions that environmental groups bring to the table. Second, environmental groups may be deprived of other, more effective ways to pursue environmental concerns (Berry, 1981). By taking part in a DMP—or choosing to "play the consensus game" (Whelan & Lyons, 2005)—groups may lose recourse to means of challenging power from outside of participatory settings, such as lawsuits, protest, or direct action. This may result in an overall loss of influence for environmental groups (Ansell & Gash, 2008; Bulkeley & Mol, 2003; Fung & Wright, 2001). Indeed, under some circumstances effective influence may only be possible in confrontation with authorities (Whelan & Lyons, 2005).

What determines whether representation of environmental concerns in a DMP improves or weakens the environmental quality of a decision, and whether actors pursuing environmental goals are able to effectively influence decisions in collaborative settings?

- *Process characteristics*: Professional facilitation or mediation, along with clear rules and procedures, can help overcome power imbalances and avoid co-optation of (environmental) groups (Amy, 1987; Cooke, 2001).
- *Trust among participants*: Co-optation is more likely to occur in trustful settings. Conversely, where distrust prevails, participants may be viewed by their adversaries as more powerful than they actually are (see Leach & Sabatier, 2005, on "devil-shift").
- *Participant characteristics*: Participants may be more or less prone to co-optation and devil-shift. This likely depends on actors' political, legal, and technical resources (Ley & Weber, 2015). Stakeholders will decide strategically whether to participate and focus their skills and resources in a given process, or to pursue their interests in alternative venues with greater perceived benefits (Lubell, 2013; Sabatier & Jenkins-Smith, 1999). Some actors, however, do not have full knowledge of the alternatives open to them (Holzinger, 2000), let alone of those open to other actors, which can lead actors to stay in the process at the risk of being co-opted. Further, environmental stakeholders may possess fewer resources for "outside process" campaigns such as litigation or organizing public protests (Whelan & Lyons, 2005).

3.2. Cluster II: Incorporation of Environmentally Relevant Knowledge

A second strand of thinking builds on the assumption that participation strengthens the knowledge base of decisions through incorporating different kinds of (e.g., local and/or lay) knowledge that are relevant to understanding and addressing the environmental problem at hand, thereby enhancing environmental policy outputs and their implementability (Beierle & Cayford, 2002; Fazey et al., 2013; Fischer, 2000; Fung, 2006; Ostrom, 1990; Ulibarri, 2015).

1. *Relevance of lay and local knowledge for decision making*

   M II.1: Involving actors directly occupied with the environmental issues at hand in decision making, leads to a higher degree of environmentally relevant knowledge and knowledge relevant for implementation being made available to the DMP.

As Smith (2003, p. 62) notes: "Too often, decision makers [. . .] are far removed from the impact of their decisions, and the experiences, knowledge and perspectives of those whose practices are more attuned to the change in ecosystems are not articulated." Involving stakeholders in decision making may improve the information base in different ways, depending on the nature of both the uncertainties at

issue, and the relevance of the knowledge held by stakeholders for addressing the problem at hand.

Stakeholders—or "knowledge holders" (Schmitter, 2002)—may hold local knowledge that is more accurate than knowledge normally available to decision makers. Scientific models may simply be wrong or inadequate if they fail to take account of local conditions (Fischer, 2000; Wynne, 1992). Further, local actors may have specific knowledge that can complement existing models (i.e., specialist knowledge, Wynne, 1992).

Through participatory processes, authorities may also gain insights into the social context within which measures will be implemented. For example, officials may learn whether and how stakeholders communicate and interact, what local norms and customs prevail, what competing stakes exist, and what the social "costs" of implementation might be. In this way, authorities may better anticipate the extent of local acceptance of proposed measures (van Asselt & Rotmans, 2002), and thereby learn about the likelihood of implementation and compliance (Newig, Pahl-Wostl, & Sigel, 2005).

Conditioning factors for M II.1 include:

- *Knowledge deficit (decision maker)*: As stated above, a certain lack of knowledge on the part of decision makers is an obvious precondition (Hurlbert & Gupta, 2015). This, however, may not be easily recognized in practice. Decision makers may not perceive a knowledge deficit, whereas in reality stakeholders could actually contribute relevant and valuable knowledge to inform decision making.

- *Knowledgeable stakeholders*: To contribute meaningfully, stakeholders must be sufficiently knowledgeable (Geissel, 2009). Therefore, if knowledge input is important to the process, then those stakeholders who are likely to provide this knowledge should be invited to participate. This may require tailoring the spatial scale of a DMP to that of the issue at stake. Involving a diversity of participants is expected to increase the potential of meaningful contributions (Emerson et al., 2011). Below (2) we discuss how in a longer participatory process, participants can be educated and empowered to be able to contribute more meaningfully.

- *Structured knowledge integration*: The process ought to facilitate knowledge exchange and input by participants. Structured methods to achieve this include individual interviews, participatory modeling (Renn, 2006; Rowe & Frewer, 2005), transactive memory systems (Heikkila & Gerlak, 2013), and methods that translate between "lay" and "expert" types of knowledge (Edelenbos et al., 2011).

2. *Education and empowerment of participants for more meaningful participation.* Meaningful public input does not occur automatically, but often presupposes capacity building among participants. This can happen during a participatory process, where information exchange informs and empowers participants, increasing their ability to provide constructive, environmentally relevant input.

> *M II.2: Participation improves participants' understanding of the issues at hand, increasing the likelihood of their providing constructive, environmentally relevant input*.

As Beierle and Cayford (2002, p. 15) assert, "[i]ncreasing public understanding of environmental problems builds capacity for solving those problems [... and] to formulate alternatives." Laird (1993) argues that participation can empower participants by improving their understanding and capacity to analyze an issue. Thus, in a collaborative setting, "participants must generate enhanced or new capacities for joint action that did not previously exist" (Emerson & Nabatchi, 2015).

For capacity building among participants, communication must allow for two-way information flow. The extent to which participation and collaboration improve participants' knowledge and capacity depends on several factors:

- *Knowledge deficit (participants)*: A precondition for this mechanism is that participants are not already sufficiently knowledgeable, which is typically the case in "technically intensive" issues (Laird, 1993). While this may seem obvious, it means that there will be relatively straightforward issues where participant capacity building is simply unnecessary.
- *Engaged participants*: Participants must be interested in the subject, willing to listen, and prepared to engage with the perspective of the administration. This may be lacking in highly conflictual situations where levels of trust are low (Heikkila & Gerlak, 2013). Conversely, participants should critically engage with expert knowledge and advice in "their efforts to form their own view on the issue under consideration" (Laird, 1993, p. 354).
- *Understandable and unbiased information*: Information provided by the organizers must be comprehensive and understandable for interested lay stakeholders. Where information is skewed or biased, or certain views or community sectors are over-represented, uptake of information by participants is likely to be impaired (Coenen, 2008).

3. *Knowledge and environmental outputs*. Assuming that participation does make relevant knowledge available to environmental DMPs, and that interaction in participatory settings can foster this by informing and empowering stakeholders, it is further argued that:

> *M II.3: A higher degree of environmentally relevant knowledge made available to a DMP leads to higher environmental standards of the output*.

However, the fact that knowledge is contributed does not imply it will automatically inform a decision. First, knowledge may be framed and interpreted differently by various actors, as has been highlighted repeatedly (for a recent overview, see Heikkila & Gerlak, 2013). To inform decision making, knowledge needs to be framed and seen as useful to this end. Second, public decision making is a political process shaped by interests and power, as discussed in cluster I above. Political will to draw on knowledge made available during a DMP—both by decision makers and by interested stakeholders—is thus a precondition, notably with regard to the formal decision-making stage following a participatory format (Flynn, 2008).

4. *Knowledge and implementation*. In addition to improving outputs, stakeholder knowledge harnessed or generated in participatory processes may also improve implementation.

> *M II.4: Environmentally relevant and implementation-relevant knowledge included in a decision makes implementation of the decision more likely*.

The key idea is that an output that builds on the practical knowledge and experience of stakeholders, and thereby targets solutions that are accepted by implementing actors, is more likely to be implemented than one that lacks this kind of grounding in (local) knowledge (Ulibarri, 2015). Whether or not implementation *actually* happens depends on multiple factors, which are addressed in more detail in M IV.5 below (e.g., acceptance by implementers and decision makers).

3.3. Cluster III: Group Interaction, Learning, and Mutual Benefits

Participation as reflected in mechanism clusters I and II above can be thought of as "additively" valuable in that decision making profits from inputs (e.g., environmental concerns, or environmentally relevant knowledge). However, participation can also be "multiplicatively" valuable in that the *interaction* of participants yields solutions that "would not have occurred to the participants individually" (Smith, 2003, p. 62). We identify mechanisms capturing the effects of different kinds of dialogic processes (negotiation, open dialogue, deliberation, and consensus seeking), the types of solutions they can produce (mutual gains, innovation, and common good orientation) and their environmental implications, both positive and negative.

1. *Negotiation and mutual gains for environmentally beneficial outputs*. The first mechanism in this cluster asserts that negotiation—underpinned by communication and bargaining—allows for the identification of positive-sum solutions. Compared to a non-negotiated outcome, a positive-sum ("win-win") solution represents an improved allocation of the resources at stake in a DMP, so that all or many affected interests benefit, including the environment (Brody, 2003).

> *M III.1: A DMP characterized by a higher degree of communication and bargaining is more likely to lead to the identification of mutual gains than a DMP with little or no communication and bargaining*.

This refers to a form of dialogue that—in contrast to more restricted participation modes such as petitions or public hearings—is communication intensive (Beierle & Cayford, 2002; Susskind, Levy, & Thomas-Larmer, 2000). Intensive face-to-face dialogue (Ansell & Gash, 2008; Delli Carpini, Cook, & Jacobs, 2004) creates conditions under which negotiating parties discover in an active manner each other's perspectives, capabilities, needs, and preferences (Emerson & Nabatchi, 2015). Consequently, participants will be more likely to arrive at a solution that increases mutual gains (Ansell & Gash, 2008). Compared to deliberative processes,

discussed below, negotiation is less ambitious, and parties need not develop a common value basis or shared purpose, but rather pursue their own self-interest.

The basic premise for negotiation to happen is that participants' exit options are not preferable to negotiation (cf. the discussion in I.2). Whether or not a participatory process involving negotiation will produce mutual gains depends on procedural fairness, potentially through professional facilitation (Susskind, McKearnan, & Thomas-Larmer, 1999). Identifying mutual gains likely increases chances that the environment will also benefit, but this also depends on the representation of environmental concerns in the DMP (cluster I).

2. *Open dialogue, innovation and learning for environmentally beneficial outputs*. Beyond securing mutual gains, dialogue may foster innovation beneficial to the environment.

> *M III.2: A participatory DMP characterized by open dialogue more likely leads to the development of creative and innovative solutions to environmental problems than one without open dialogue*.

Interaction and dialogue among diverse participants potentially produces innovative results through the exchange of different perspectives, information, and knowledge conducive to mutual learning (Fazey et al., 2013; Heikkila & Gerlak, 2013). Learning by individuals and/or groups of participants may imply improved understanding of other participants' perspectives and the problem at hand, and/or transformation of views and values via critical reflection (Connick & Innes, 2003; Emerson & Nabatchi, 2015). Innovation and win-win solutions often go hand-in-hand, and through learning and developing new ways of thinking, long-term impasses can be overcome (cf. examples in Connick & Innes, 2003). Exchanging perspectives and knowledge of different types appears to be particularly beneficial in situations of radical uncertainty, where problems are characterized by indeterminacy, complexity, or incommensurability (Ansell, 2016; Pellizzoni, 2003).

As the mechanisms underlying innovation are centered on knowledge and learning, the same conditioning factors as discussed for M II.1 to M II.3 apply. Apart from process design that allows for open and fair dialogue, high levels of trust and a shared sense of purpose among participants provide favorable conditions for positive outcomes (Connick & Innes, 2003; Heikkila & Gerlak, 2013; Oh & Bush, 2014). Facilitation is held to be conducive to effective knowledge exchange, and to compensate for strategic behavior (Fazey et al., 2013).

3. *Deliberation and environmentally beneficial outputs*. Possibly the most promising—but also the most demanding—mechanism of dialogical processes is deliberation. While many scholars understand deliberation as encompassing interaction forms such as open dialogue and negotiation (e.g., Smith, 2003), we use it here in a more narrow, Habermasian sense in order to more clearly distinguish the different mechanisms.

M III.3: A deliberative participatory process setting is more likely to produce an orientation of participants' views toward the common good, and therefore more likely to produce outputs more favorable to the environment, than a nondeliberative DMP.

A deliberative setting is characterized by "candid and reasoned communication and information exchange that is structured and oriented toward problem solving" (Emerson & Nabatchi, 2015), as opposed to mere bargaining or negotiation (Elster, 2000). It is undistorted by power play, transparent, and fair, based on clear rules that enable unimpeded dialogue (e.g., through professional facilitation), and characterized by a trustful atmosphere (Ansell & Gash, 2008; Emerson & Nabatchi, 2015; Innes & Booher, 1999; Smith, 2003). The dialogue is conducive to following the most "reasonable" argument in the Habermasian sense (Fung & Wright, 2001; Webler & Tuler, 2000).

These process factors are expected to lead to a common good orientation of the discourse, characterized by "preferences and justifications which are 'public-spirited' in nature [because] preferences held on purely self-interested grounds become difficult to defend in a deliberative context" (Smith, 2003, p. 63). A deliberative setting is expected to "transform initial policy preferences (which may be based on private interest [. . .], prejudice and so on) into ethical judgements on the matter in hand" (Miller, 1992, p. 62) and toward an output that secures benefits for all parties and the environment (Aldred & Jacobs, 2000). This distinguishes deliberation from the other mechanisms described in this cluster.

The quality of deliberation and its outcomes depends on the provision of a safe and protected space for participants, where they can speak freely and exchange in a meaningful way (Birnbaum, 2016; Emerson & Nabatchi, 2015). This includes strategies for accommodating pronounced power imbalances (Choi & Robertson, 2014; Selin & Chavez, 1995).

Whether or not the environment profits from deliberation may depend on the extent to which an environmental issue actually is a "common good" issue (as opposed to affecting a particular group of individuals).

4. *Veto players and consensus at the lowest common denominator*. On the downside of participatory group interaction, there is a danger that participation hampers agreement in decision making. Particularly (but not exclusively) in processes striving for consensus, the participation of a large number of actors who can potentially veto a decision may be detrimental to achieving public-good-oriented solutions.

M III.4: The more veto players involved in a DMP, the more likely the output will have lower environmental standards.

A veto player is "an individual or collective actor whose agreement is required for a policy decision" (Tsebelis, 1995, p. 293). In the context of environmental governance, it has been claimed that with an increasing number of veto players, dramatic changes of the *status quo* are less likely, with solutions instead being based on the

lowest common denominator, with negative consequences for the environmental standard of outputs (Brandt & Svendsen, 2013; Brody, 2003; Layzer, 2008; Tsebelis, 1995). Whether or not this occurs likely depends on:

- *Mode of decision making*: Where consensus is not necessary, fewer veto positions exist.
- *Degree of conflict*: The further the positions of participants differ, the less scope for negotiation, and the more likely that solutions will emerge at the lowest common denominator (Tsebelis, 1995). Consequently, planners aiming to arrive at implementable solutions try to enlarge negotiation space from the outset.
- *Participants' willingness and ability to cooperate*: This applies both to the attitude of participants in general, and to the leeway that representatives of organizational actors have to negotiate in a DMP (Tsebelis, 1995).

3.4. Cluster IV: Acceptance and Conflict Resolution for Implementation

A fourth main function of participation and collaboration is to foster the *acceptance* of decisions, with a view to better compliance and implementation (Birnbaum, 2016; Bulkeley & Mol, 2003). We distinguish between *implementation* as "actions by public and private individuals (or groups) that are directed at the achievement of objectives set forth in prior policy decisions," including "one-time efforts to transform decisions into operational terms, as well as continuing efforts to achieve the large and small changes mandated by policy decisions" (van Meter & van Horn, 1975, p. 447); and *compliance* as "the specific obedience or lack thereof to a law or directive" (van Meter & van Horn, 1975, p. 454).[4]

Arguably, acceptance is crucial for effective governance, because outputs with a high environmental standard on paper but little acceptance by addressees and implementers are likely to remain symbolic and ineffective, if implementation cannot be centrally monitored and enforced (Ulibarri, 2015). Different types of environmental decisions, however, rely on different implementation activities and/or compliance by specific actor groups.

1. *Accommodation of interests*. The most straightforward mechanism in this cluster assumes that in an inclusive, participatory process, acceptance may develop due to a sense of "decision ownership," if the output reflects participants' concerns (Brody, 2003; Chess & Purcell, 1999; Newig, 2012):

> *M IV.1: A higher degree of participation leads to the accommodation of more diverse interests in the output, which increases acceptance by stakeholders.*

This requires meaningful contributions from participants, and the willingness of authorities to consider participants' interests in a final decision (Edelenbos et al., 2011). Representatives must be perceived as legitimate spokespersons by affected stakeholders (Brody, 2003; Newig, 2012). Likewise, the exclusion of

important groups with means to oppose the implementation of a decision (e.g., through legal challenges) bears the danger of nonacceptance (Layzer, 2002).

2. *Procedural fairness*. "No matter how good an agreement is by some standards, if it was reached by a process that was not regarded as fair, open, inclusive, accountable, or otherwise legitimate, it is unlikely to receive support" (Innes & Booher, 1999, p. 415). Expressed positively, we suggest that:

> *M IV.2: A DMP that is perceived as fair and legitimate is likely to be accepted by participants, their respective constituencies, and other stakeholders*.

If stakeholders believe that a process was run fairly, and they trust in the purpose of the process, they are more likely to accept the final decision and other outcomes of the process (Susskind & Cruikshank, 1987; Webler & Tuler, 2000). A strong sense of procedural justice among stakeholders can even increase acceptance of decisions that do not reflect the substantive interests of all stakeholders (Lind & Tyler, 1988; Wondolleck & Yaffee, 2000).

Characteristics of a fair and just process include:

- Early and meaningful involvement for those directly participating—that is, fair representation (Newig, 2007; Webler & Tuler, 2006) and no foregone conclusions (Diduck & Sinclair, 2002; Newig, 2012).
- A certain level of trust on the part of stakeholders in the intentions of the process organizers and institutions (Webler & Tuler, 2000) and, on the part of the organizers, unbiased enforcement of rules and standards (Birnbaum, 2016).
- Within-process communication that permits participants to express their views: "Citizens value opportunities to speak, whether or not this voice is linked to influence over the decisions made by the political body" (Lind & Tyler, 1988, p. 170).
- Mediation, if needed, should be impartial (Webler & Tuler, 2000).
- For stakeholders outside of the immediate process, perceptions of fairness may rely on transparency (Reed, 2008) and accountability (Webler & Tuler, 2000, 2006).

Note that these process characteristics bear resemblance to those required for deliberation and open dialogue. Yet while deliberation requires a collaborative setting, a fair and legitimate process likely to produce acceptance is less demanding in terms of the quality of participant exchange.

3. *Negotiation, mutual gains, and conflict resolution for acceptance*. A third route to acceptance is via outputs that make more stakeholders better-off. Processes that produce such positive-sum solutions (as discussed in mechanism III.1) may involve the successful resolution of conflicts.

> *M IV.3: Mutual gains and conflict resolution resulting from negotiation increase stakeholders' acceptance of the output*.

While a solution assuring mutual gains may be more acceptable to negotiating parties (Susskind et al., 1999), the extent to which it is more widely accepted—for example, by stakeholders and the public at large—depends on negotiating parties' representativeness of their wider constituencies (Elster, 2000).

In the case of value conflicts, especially where actors hold strongly opposing values, conflict resolution can be difficult. However, skilled facilitators or mediators may be able to bring initially adversarial parties together, establishing and maintaining ground-rules for negotiation (Leach & Pelkey, 2001), and ensuring fairness. The extent to which a given consensus or resolution is accepted in the longer run, and by stakeholders and addressees beyond the immediate participants, is likely to depend on those factors at work in conjunction with the generation of acceptance more generally (see M IV.1).

4. *Waking sleeping dogs.*

> *M IV.4: Raising stakeholders' awareness of issues, and their involvement in decision making, leads them to consider possible negative effects of decisions and thus increases opposition to environmentally beneficial measures.*

In addition to resolving conflicts, participation can also (i) introduce conflict over who counts as a legitimate participant; and (ii) fuel conflict by heightening stakeholder sensitivities to adverse aspects or implications of a decision (Coglianese, 1997; Rose-Ackerman, 1994). Participants "may also find that the more time they invest in a rulemaking proceeding, the less willing they are to overlook imperfections of the rule" (Coglianese, 1997, pp. 1326–27).

In light of these effects, the promise of participation can lead to unrealistic expectations among stakeholders as to what a participatory process can accomplish (Coglianese, 1997). Whether participation actually increases conflict or opposition to a decision depends in part on the interests at stake. The more stakeholders have a (potentially) high stake in the issue, and the more pronounced the conflicts among stakeholders, the more likely this mechanism is to operate. Careful stakeholder analysis may help avoid conflict via the first submechanism by ensuring that no potential veto players are left out of the process. The second submechanism is likely to be more important where environmental issues remain relatively obscure and have not been widely publicly debated.

5. *Acceptance for implementation and compliance.* Ultimately, acceptance of environmental decisions, generated through participatory and collaborative processes, is expected to foster implementation and compliance, thus strengthening environmental performance (Stave, 2002):

> *M IV.5: The greater the degree of acceptance by stakeholders, the higher the likelihood of implementation and compliance.*

This may happen through (i) reduction of opposition to outputs, and (ii) generation of support for outputs. The former argument, commonly found in the consensus building and conflict resolution literatures, holds that acceptance

generated in a participatory process (e.g., via negotiation, positive-sum effects, procedural justice) reduces opposition to the output (e.g., through litigation) and potential noncompliance, thereby facilitating implementation (Bulkeley & Mol, 2003; Innes & Booher, 1999; Susskind & Cruikshank, 1987).

The latter argument links acceptance to stakeholders' increased willingness to (co-)implement and voluntarily comply with outputs. In this sense, acceptance actively and positively motivates stakeholders (Coenen, 2008; Layzer, 2002). This assumes that stakeholders are addressees or potential co-deliverers of a given decision, or perform some other function in implementation.

As Beierle and Cayford (2002) warn, the link between participation and implementation should not be taken for granted. A number of factors can have a significant influence:

- Even where a participatory process produces agreement on goals and objectives, disagreement can arise over implementation, which can be delayed or stalled;
- If a DMP has excluded important actors—for example, politicians and bureaucrats, private sector actors—implementation may be hampered by those groups (see also M III.4);
- As there may be a considerable time lag between decision making and implementation, circumstances may change such that implementation as initially envisaged becomes infeasible or undesirable.

3.5. Cluster V: Capacity Building for Implementation and Compliance

Participatory governance can provide decision makers and participants with information and build individual and collective capacities that aid implementation and compliance.

1. *Informing policy addressees.*

   M V.1: Participation of policy addressees in decision making improves implementation and compliance.

Involving those state and nonstate actors who will be responsible for implementing and/or complying with an output informs them and increases their capacity to act, adapt, and behave in ways conducive to implementation and compliance (Brody, 2003; Innes & Booher, 2004; Newig, 2007). Through involvement in the DMP, policy addressees become more informed on the issue at hand (Koontz & Thomas, 2006; Pellizzoni, 2003) and become alerted to opportunities for voluntary action (Campbell, Koontz, & Bonnell, 2011).

Arguably, various process characteristics will influence the uptake of information by participants; these have been described in the context of M II.2 above.

Of further relevance are the conditioning factors mentioned in M IV.5 that affect whether or not actors are likely to engage in or facilitate implementation.

2. *Networks for implementation.*

M V.2: Participation fosters the formation or strengthening of networks among participants, which leads to improved implementation and compliance.

Intensive communication and repeated interaction in participatory DMPs likely result in more frequent, and perhaps also more selective, relationships with other actors. Once these relationships become more stable (typically outlasting the original DMP), we may speak of governance networks (Poocharoen & Ting, 2015). Either new networks are formed, or pre-existing networks may be strengthened, thus facilitating joint action. It is assumed that participants come to recognize that others have important knowledge and capacities, or common interests (Layzer, 2008; Oh & Bush, 2014), which helps to build shared motivation for joint action (Emerson & Nabatchi, 2015; Innes & Booher, 2004; Sayles & Baggio, 2017).

Networks of stakeholders potentially mobilize collectively held knowledge and capacities in ways that are appropriate to and supportive of implementation (Weible & Sabatier, 2005). First, the sense of common purpose and shared motivation (Emerson & Nabatchi, 2015) that underpins network development increases the potential of collective action (Poocharoen & Ting, 2015). Second, networks can aid mutual monitoring and social control, thus fostering the detection of noncompliance (Leach & Pelkey, 2001; Ostrom, 1990).

The formation and efficacy of such relationships and networks depend on a range of factors. Actors' becoming part of a network in the first place depends on the incentive structures a process provides, as well as actors' motivation and goals (Lubell, 2013). For organizers, this means that attention must be paid to the costs of participating, taking into account existing ties among actors, while stakeholders need to recognize their mutual compatibility and the benefits of resources exchange (Booher & Innes, 2002; Rhodes, 2008). How far networks aid implementation and compliance may depend on the structure of the network. For example, dense networks are expected to be more conducive to collective action, because they better facilitate resource and information exchange (Emerson & Nabatchi, 2015; Poocharoen & Ting, 2015).

4. Discussion and Conclusion

Table 1 summarizes all 19 mechanisms and specifies the conditioning variables associated with the dependent and independent variables. Independent variables are defined as the central features of a (participatory) process. These embody variations of the governance dimensions developed in section 2 (breadth of involvement, communication and collaboration, power delegation). Conditioning variables, which impact on the relation between dependent and independent variables, may be associated with the external context in which DMPs take place, or with factors internal to a DMP, relating to the design and functioning of processes themselves. From the

viewpoint of a process organizer, *external factors* can in principle be taken as given, determining the scope of possible process design options. For example, if process organizers are aware of knowledge deficits on the part of stakeholders (external factors), they are in a position to choose an appropriate process design (M II.2) in order to deal with this challenge. *Internal factors* represent the particular process specifications of a mechanism (e.g., facilitation or early involvement). Internal conditioning variables bear resemblance to independent variables, as both are under the control of the process organizer. However, independent variables refer to the general mode of governance (more or less participatory and/or collaborative in three dimensions), whereas internal conditioning variables specify the process-related conditions under which a particular mode of governance is likely to be effective with regard to a particular mechanism.

Many conditioning factors are repeatedly mentioned (e.g., process facilitation, trust-building, not excluding important groups, stakeholders' environmental orientation). While this highlights the relative importance of these factors, it does not mean that these are universally important "success factors" for participatory processes.

Generally, it must be emphasized that despite the analytical stance we have taken here, these mechanisms will not occur in isolation in a given decision-making setting, but are often closely interrelated. In particular, mechanisms that rely on the same independent and conditioning variables are likely to occur in conjunction. For example, deliberation may enhance the environmental quality of a political decision (M III.3), while at the same time its structural features of discursive fairness are beneficial for gaining acceptance among stakeholders and the public (M IV.2) and, ultimately, fostering implementation and compliance. From a process-organizer perspective, this implies opportunities but also challenges. For example, intensive face-to-face interaction may both enable social learning (cluster III), and foster networks for implementation (cluster V). Conversely, involving stakeholders in decision making may entail many "positive" effects for environmental outputs (cluster I in particular), but also "wake sleeping dogs" (M IV.5).

While this article has focused on the instrumental value of participation for the environment, we find that many of the independent and conditioning variables relate to aspects of democratic legitimacy, such as access to decision making, balanced representation, and procedural fairness. This supports the argument that democratic legitimacy and effectiveness are in many ways closely related in participatory public environmental decision making.

We have illustrated how unpacking and disaggregating competing claims allows for a more precise identification of the opposing mechanisms that underpin these claims as well as the relevant conditioning factors that separate them. Together, these steps can help take us beyond generalizations about the effectiveness (or lack thereof) of participatory governance, while also illuminating specific contextual factors that help explain contradictory claims.

We see at least three areas for further research, which at the same time demarcate both the potential and the limitations of this study.

Table 1. Overview of Mechanisms Including Contextual (Conditioning) Variables

Mechanism	Independent Variables (Feature of Participation)	Dependent Variables (Results)	Conditioning Variables	
			Internal to the DMP	External to the DMP
Cluster I—Opening up of decision making to environmental concerns				
1a. Access for environmental concerns 1b. Dominance of nonenvironmental concerns	Opening up decision making for groups typically outside the policy process	Strong (a) versus weak (b) representation of environmental concerns	Targeted recruitment, balanced representation of stakeholders	Environmental orientation of stakeholders, willingness, and capacity to participate
2a. Advocacy of environmental concerns 2b. Co-optation of environmental groups	Representation of environmental concerns in collaborative (2b) DMP	Strong (a) versus weak (b) environmental output	Facilitation or mediation; trust-building	Environmental groups' susceptibility to co-optation
Cluster II—Incorporation of environmentally relevant knowledge				
1. Harnessing lay/local environmental knowledge for decision making	Involving a variety of issue-related stakeholders in a DMP	Additional knowledge relevant to the DMP and implementation	Structured knowledge integration	Knowledge deficit among decision makers; knowledgeable stakeholders
2. Education and empowerment of participants for meaningful participation	Stakeholder involvement in DMP	Empowered and knowledgeable participants	Clear, understandable information; trust-building	Engaged stakeholders but with knowledge deficits; trust in authorities
3. Sound information basis for environmentally appropriate decision making	Environmental knowledge available to DMP	Strong environmental output	Framing of knowledge as useful	Political will and commitment; stakeholder interests
4. Knowledge fosters the implementability of decisions	DMP includes environmental and implementation-relevant knowledge	Implementation of decision	Lasting conflict resolution; no important groups excluded	Participants charged with implementation; participant capacities
Cluster III—Group interaction, learning, and mutual benefits				
1. Negotiation and bargaining for mutual gains	Communication intensive DMP	Strong environmental output	Facilitation, representation of environmental concerns	Capacities and relative exit options of participants
2. Group innovation and learning	DMP with open dialogue; group interaction	Innovative solutions benefiting strong environmental output	Facilitation, shared sense of purpose, trust-building	Complex problem setting; competent and open-minded participants
3. Deliberation and common good orientation of participants	Deliberative setting	Strong environmental output	Protected space: trust-building, fair, and transparent process	Competent participants; low conflict and power imbalance

Table 1. *cont.*

Mechanism	Independent Variables (Feature of Participation)	Dependent Variables (Results)	Conditioning Variables	
			Internal to the DMP	External to the DMP
4. Consensus at lowest common denominator	Number of veto players involved in DMP	Weak environmental output	Decision mode	Degree of conflict; narrow negotiation space
Cluster IV—Acceptance and conflict resolution for implementation				
1. Accommodation of participant interests	Stakeholder involvement, power delegation	Acceptance of output by stakeholders	Access of important groups	Participants are legitimate representatives
2. Acceptance through procedural fairness	Fair, inclusive, accountable, or otherwise legitimate DMP	Acceptance of output by participants and other stakeholders	Early involvement, transparency, facilitation	Trust in authorities
3. Negotiation, mutual gains, and conflict resolution for acceptance	DMP that produces mutual gains and resolves conflicts	Acceptance of output by stakeholders	Facilitation and mediation; no important groups excluded	Participants are legitimate representatives
4. "Waking sleeping dogs": Stakeholders become aware of a decision's negative aspects	Stakeholder awareness raising and involvement in decision making	Increased controversy and opposition to environmental outputs	Excluding important stakeholders; raising unrealistic expectations	Diverse stakeholders with high and conflicting stakes; issue salience
5. Acceptance for implementation and compliance	Acceptance of output by stakeholders	Implementation of and compliance with output	Lasting conflict resolution; no important groups excluded	Participants charged with implementation; participant capacities
Cluster V—Capacity building and implementation and compliance				
1. Potential addressees are informed of upcoming obligations	Early participation of policy addressees	Implementation of and compliance with output	Clear, understandable, unbiased information	Addressee interests and capacities, technical feasibility
2. Social capital and network-building for implementation	Collaborative DMP	Implementation of and compliance with output in collaborative networks	Intensive repeated interaction; trust-building, sense of ownership	Participants' incentives, capacities, and role in implementation; shared motivation; redundancy of network relations

First, our treatment of (participatory) process features has deliberately remained rather abstract, owing to the goal of precisely describing causal mechanisms that are valid across a broad range of actual situations. Future research could link the identified mechanisms and internal conditioning factors to particular participatory formats and instruments, such as citizen juries, watershed collaborations, deliberative opinion polls, and so forth.

Second, while this study has focused on environmental decision making, several of the mechanisms described here are likely to have more general relevance and apply to other sectors, such as public health, spatial planning, or budgeting.

Third, we see great potential for this framework to structure and guide empirical research on the effectiveness of participatory governance. The mechanisms and variables put forth here could serve as a basis for the formation of testable hypotheses. One promising avenue by which to test such hypotheses is to conduct meta-analytical research to consolidate findings from the case record. Case-survey meta-analysis (Beierle & Cayford, 2002; Newig & Fritsch, 2009) provides a formal and structured means to draw upon the rich qualitative data contained in numerous (single) case studies. In an ongoing research program, we draw on this method to code a number of variables relating to context, process, and outcomes for a large-N sample of cases of participatory decision making (Newig et al., 2013). This will produce a semiquantitative dataset suitable for formal statistical analysis in order to shed light on the effect of key variables in various contexts. As a complementary method, there is considerable scope to employ causal process tracing (Mahoney, 2012) in order to assess the extent to which different mechanisms and clusters of mechanisms are relevant to particular cases, and to examine specific causal mechanisms. Both approaches, especially if employed in combination with other primary research methods such as comparative case studies, and field experimentation, have the potential to substantially improve our conceptual models and our knowledge on what works under what conditions in environmental governance.

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Notes

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1. Out of 423 articles listed in Scopus containing "participatory governance" in title, abstract, or keywords, 46 percent were associated with European countries, 23 percent with North America, 9 percent with Asia. By contrast, out of 479 articles on "collaborative governance," 40 percent were associated with North America, 29 percent with Europe, 10 percent with Asia (search date December 1, 2016).
2. We define stakeholders as actors potentially affected by the environmental problem and the consequences of possible solutions. These may be individual citizens or representatives of governmental, private sector, or civil society groups or organizations.
3. In line with much of the literature (e.g., Ansell & Gash, 2008), we define "outcomes" broadly as the ensemble of outputs and actions that follow from these, and subsequent implementation.
4. It is a truism that implementation and compliance do not necessarily advance the common good. Likewise, participatory and collaborative decision making may produce benefits "beyond compliance" (Rogers & Weber, 2010). For the sake of clarity and parsimony, we assume implementation of and compliance with policy outputs to be generally favorable in environmental terms.

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Article 2:

Participation for effective environmental governance? Evidence from Water Framework Directive implementation in Germany, Spain and the United Kingdom

Abstract

Effectiveness of participation in environmental governance is a proliferating assertion in literature that is also reflected in European legislation, such as the European Water Framework Directive (WFD). The Directive mandates participatory river basin management planning across the EU aiming at the delivery of better policy outputs and enhanced implementation. Yet, the impact of this planning mode in WFD implementation remains unclear, though the first planning phase was completed in 2009 and the first implementation cycle by the end of 2015. Notwithstanding the expanding body of literature on WFD implementation, a rather scattered single case study approach seems to predominate. This paper reports on implementation of the WFD in three case studies from Germany, Spain and the United Kingdom, reflecting three substantially different approaches to participatory river basin management planning, on the basis of a comparative case study design. We ask if and how participation improved the environmental standard of outputs and the quality of implementation. We found an increasing quality of outputs with increasing intensity of local participation. Further, social outcomes such as learning occurred within dialogical settings, whereas empowerment and network building emerged also in the case characterized mainly by one-way information. Finally, one important finding deviant from the literature is that stakeholder acceptance seems to be more related to processes than to outputs.

Keywords: Stakeholder involvement, Water governance, Mandated participatory planning, Learning, Public policy, Implementation.

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Research article

Participation for effective environmental governance? Evidence from Water Framework Directive implementation in Germany, Spain and the United Kingdom

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ABSTRACT

Effectiveness of participation in environmental governance is a proliferating assertion in literature that is also reflected in European legislation, such as the European Water Framework Directive (WFD). The Directive mandates participatory river basin management planning across the EU aiming at the delivery of better policy outputs and enhanced implementation. Yet, the impact of this planning mode in WFD implementation remains unclear, though the first planning phase was completed in 2009 and the first implementation cycle by the end of 2015. Notwithstanding the expanding body of literature on WFD implementation, a rather scattered single case study approach seems to predominate. This paper reports on implementation of the WFD in three case studies from Germany, Spain and the United Kingdom, reflecting three substantially different approaches to participatory river basin management planning, on the basis of a comparative case study design. We ask if and how participation improved the environmental standard of outputs and the quality of implementation. We found an increasing quality of outputs with increasing intensity of local participation. Further, social outcomes such as learning occurred within dialogical settings, whereas empowerment and network building emerged also in the case characterized mainly by one-way information. Finally, one important finding deviant from the literature is that stakeholder acceptance seems to be more related to processes than to outputs.

1. Introduction

Claims abound that collaboration and participation[1] in environmental governance can improve environmental outcomes (Koontz and Thomas, 2006). Yet after decades of research and practice in participatory environmental governance, there is still a lack of understanding of just how and under what conditions this should occur (Gerlak et al., 2013; Newig and Fritsch, 2009; Young et al., 2013). This paper seeks to contribute to the growing body of evidence on the effectiveness of participatory governance. We study the implementation of the European Water Framework Directive (WFD),[2] which mandates that European member states produce planning documents that detail how 'good water status' will be reached. Citizen and stakeholder participation is required in the preparation and updating of these plans in six-year cycles. This 'mandated participatory planning' approach (Newig and Koontz, 2014) and common timeframe for WFD implementation across the EU provides an excellent test bed for comparative investigation of the effectiveness of participatory environmental governance (De Stefano, 2010; Jager et al., 2016). Comparing different participatory processes across Europe with respect to their effectiveness in delivering environmentally beneficial outcomes, we shed light on the relation between (participatory) policy processes and outcomes.

We report on three local participatory planning processes from Germany, Spain and the United Kingdom, asking whether and, if so, how participation improved the environmental standard of outputs and the quality of implementation. In particular, we trace how processes incorporated and integrated knowledge, how they

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[1] Throughout the paper, we use the terms 'participation' and 'participatory governance' due to their better compatibility with the European approach, but we acknowledge that there is considerable overlap with the concepts of 'collaboration' and 'collaborative governance', which are more common in the North American context.

[2] 'Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000, establishing a framework for Community action in the field of water policy'.

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0301-4797/

fostered deliberation and acceptance, and whether and how this improved substantive environmental outputs and/or social outcomes such as collective learning, trust and network building.

The paper proceeds as follows: Section 2 presents our conceptual framework in the form of four principal causal mechanisms derived from the literature linking participatory governance and environmental outcomes. Section 3 introduces the WFD as an example of mandated participatory planning, outlines our methodology, and describes the case study sites and respective planning processes. In section 4, we systematically compare outputs and outcomes in the cases, and analyze whether any of the mechanisms described in section 2 account for these results. Section 5 reflects on the insights gained from this study for the broader field of environmental governance.

2. Conceptual framework: participation and effectiveness in environmental governance

Following Fung (2006), Newig and Kvarda (2012) and others, we understand participation as a multi-dimensional concept. Participation can hence be more or less 'intensive' in each of the following dimensions:

1. *Involvement of stakeholders:* The range of parties included in the process (e.g. selected experts vs. a broad range of stakeholders and the public).
2. *Communication and collaboration:* The manner, direction and intensity of information flows (e.g. one-way information provision vs. collaborative development of preferences).
3. *Power delegation to participants:* The extent to which participants may influence the decisions to be taken.

Drawing on the available literature and recent syntheses (Drazkiewicz et al., 2015; Gerlak et al., 2013; Fritsch and Newig, 2012; Newig et al., 2013; Newig et al.,submitted; Reed, 2008), we present in the following key mechanisms specifying potential (positive and negative) effects of participation on the environmental quality of governance outcomes.

2.1. Mechanism 1: opening up of decision-making to environmental concerns

It has been argued that inclusion of environmental concerns in participatory decision-making processes (DMP) leads to more environmentally beneficial decisions (Brody, 2003; Dryzek, 2005; Smith, 2003). The key argument is that environmental groups or other actors pursuing environmental concerns will have a strong incentive to participate in a DMP on environmental matters, and thus be rather strongly represented (Binder and Neumayer, 2005; Larson and Lach, 2008). Beyond increased representation in numbers, the particular values and arguments brought forth by environmental groups can re-direct established approaches, shift actors' policy positions, and enhance the environmental quality of outputs (Brody, 2003; Smith, 2003).

On the other hand, in participatory settings environmental groups may be co-opted by more powerful interests, and/or be deprived of effective means of pursuing environmental goals outside of such settings (Berry, 1981; Whelan and Lyons, 2005). Cordial relationships developed among parties in collaborative processes may lead to the 'pacification' or 'seduction' of (environmental) groups (Amy, 1987), while the expectation that participants act 'reasonably' can be used to suppress actors' expression of objection and frustration, then seen as irrational or non-constructive. Professional third-party facilitation or mediation, along with clear rules and procedures, can help avoid co-optation of (environmental) groups (Amy, 1987; Cooke, 2001). Further, actors may opt out of a collaborative process if they can more effectively pursue their concerns elsewhere (Susskind and McMahon, 1985).

2.2. Mechanism 2: incorporation of additional environmental knowledge

Participation has been credited with furnishing factual information that would otherwise not be available to decision makers – especially in relation to localized issues. The involvement of informed stakeholders may provide detailed or specialized local knowledge (Brody, 2003; Pellizzoni, 2003). This knowledge may be more *accurate* or *specific* than knowledge normally available to decision-makers, e.g. complementing or scrutinizing existing scientific models (Wynne, 1992). Therefore, participants' knowledge can contribute to improving both the environmental standard and the implementability of decisions.

In other cases, different knowledge types (e.g. local and expert knowledge) can complement each other through critical exchange, fostering improved understanding of other participants' perspectives and the problem at hand and/or a transformation of views and values via critical reflection (Armitage et al., 2008; Connick and Innes, 2003).

Apart from a process design that allows for open and fair dialogue, facilitation of group processes and sufficient time are held to be conducive to effective knowledge exchange (Raymond et al., 2010). However, a certain political will to draw on knowledge made available in a DMP – both by decision-makers and by interested stakeholders – is a crucial precondition for the incorporation of additional environmental knowledge (Flynn, 2008).

2.3. Mechanism 3: dialogical interaction

Decision-making processes characterized by dialogue and intensive two-way interaction among participants are hypothesized to produce more environmentally beneficial outputs and outcomes. Depending on the type of dialogical interaction (negotiation or deliberation), different types of benefits (mutual gains, and common good orientation) are anticipated.

For conflictual issues, participatory processes involving intensive interaction are expected to create spaces for negotiation and bargaining (Elster, 2000). By developing understanding of each other's capabilities, needs, demands and preferences, participants are more likely to arrive at solutions that maximize mutual gains, including benefits for the environment (Ansell and Gash, 2008; Brody, 2003; Delli Carpini et al., 2004).

Intensive dialogue can also foster deliberation among participants, and enable rational arguing (as opposed to bargaining or negotiation). In this context, deliberation approaches an ideal communicative situation wherein rational discussion and the 'weight of the better argument' prevail (Elster, 2000). A (re)orientation of participants' views towards the common good implies moving beyond personal interests in pursuit of solutions to the problem at hand (rather than personal gains) and outputs that benefit the community and the environment (Webler and Tuler, 2000).

2.4. Mechanism 4: acceptance, implementation and compliance

Participatory environmental decision-making is argued to foster acceptance of a decision among policy addressees and stakeholders via representation of a wide variety of interests. Acceptance may derive from stakeholders' satisfaction with the decision itself, or with the nature of the process, and is assumed to be positively related with implementation and compliance (Bulkeley and Mol,

2003; Macnaghten and Jacobs, 1997). First, it is assumed that inclusion of actors, and consideration of their positions and preferences, will enhance their acceptance and aid implementation and compliance, simply because the decision reflects their interests (Papadopoulos and Warin, 2007). Second, a procedure that is perceived as fair and legitimate can increase stakeholders' acceptance of a decision, even if that decision runs counter to their interests (Lind and Tyler, 1988). However, legitimacy of participatory processes is linked to a variety of factors, including transparency, open and egalitarian modes of communication, early participation at all stages of policy-making, and effective moderation and facilitation (Susskind et al., 1983; Webler, 1995). Actual influence in the decision-making is stressed as a necessary condition (Webler and Tuler, 2000).

3. Local participation in Water Framework Directive implementation in Germany, Spain, and the United Kingdom

3.1. The Water Framework Directive as an instance of mandated participatory planning

The WFD arguably is the single most important piece of recent European legislation in the water field (Hering et al., 2010). It aims to achieve 'good water status' in all European water bodies by 2015 and at the latest 2027. 'Good water status' refers to both water quantity and quality, measured in ecological and chemical terms, in ground, surface and coastal waters, following a holistic environmental approach. In pursuit of this ambitious substantive goal, the WFD can be said to have redrawn the map of Europe for water policy, as it mandates the establishment of planning structures at the river basin, rather than on country, level. Competent river-basin authorities were required to designate water bodies (natural, heavily modified, artificial); assess the status of water bodies; and produce plans to achieve and maintain 'good status' (see WFD, Annex V). River basin management planning is to be conducted in a participatory fashion, with the 'active involvement' of all interested parties in the production and updating of river basin management plans (RBMPs) and programs of measures (PoMs). These plans and programs are supposed to be the main vehicles of policy implementation.

In calling for the active involvement of stakeholders in the planning process, the European Commission is appealing to a distinctly instrumentalist rationale for participation, as reflected in the WFD guidance document on participation (European Commission, 2003: 6): "Public participation is not an end in itself but a tool to achieve the environmental objectives of the Directive". Thus, public participation is seen as a central element of WFD planning, and a key success factor for the Directive's implementation (see WFD, Preamble 14). There is, however, no prescription on how participatory planning should be designed in terms of who should be involved, at what stage and how, and as such the Directive leaves member states with considerable leeway in this regard (Newig et al., 2014).

With the initial planning phase completed in 2009, however, the extent to which this mandated participatory planning approach (Newig and Koontz, 2014) has been effective remains unclear. The empirical evidence that might validate claims either way is certainly still lacking in the European context. Notwithstanding the expanding body of literature on WFD implementation, a single case study approach seems to predominate (Boeuf and Fritsch, 2016), and only a relatively small number of comparative analyses are available (e.g. Liefferink et al., 2011). Only very rarely are social and substantive outcomes explored in the context of participatory implementation (e.g. Hophmayer-Tokich and Krozer, 2008).

3.2. Case selection and methodology

The WFD, like other EU environmental directives, constitutes a particularly apt setting for comparative research, given the aforementioned set of common requirements and timeframe. This common context helps to isolate the causal mechanisms by which participation affects governance outcomes, which are otherwise difficult to study in a comparative manner.

Taking advantage of the fixed WFD frame, we selected the Planning Unit South Elbe-Lübeck Canal (506 km^2) in the German state of Schleswig-Holstein; the Miera and Campiazo Basins in Cantabria, Spain (620 km^2); and the Belfast Lough and Lagan Catchments in Northern Ireland (1005 km^2)[3] as our case study sites (see Fig. 1). These exhibit, on the one hand, similar institutional contexts as in the three member states implementing competent authorities were located at a sub-national level. On the other hand, we selected these three cases from the diversity of participatory process forms within the three different member states in order to account for varying approaches regarding the three dimensions of participation introduced in section 2:

- *Involvement of non-state actors:* Whereas in Elbe-Lübeck small groups of less than 10 carefully selected stakeholders participated, Belfast Lough and Lagan had larger groups of 20–40 participants based on open invitation, while Miera and Campiazo sought much broader societal representation, combining targeted and open invitation, attracting a total of 644 participants.
- *Communication mode:* Consistent with the small groups in Elbe-Lübeck, two-way communication was most intensive here. Although the Cantabrian approach had to handle a huge number of participants, there was also two-way information exchange, whereas in Belfast Lough and Lagan, despite the moderately sized groups, the process was mostly restricted to information provision and subsequent consultation.
- *Power delegation to participants:* Elbe-Lübeck was the only case in which stakeholders had a clear influence on decisions, to a degree close to local self-governance. In both Miera and Campiazo and Belfast Lough and Lagan, participants' influence on planning was much more limited.

To ensure attribution of participatory processes and outcomes and the comparability between cases, our analysis focuses on those processes that were (1) most decisive in influencing RBMPs and POMs, and (2) located on a rather local, sub-basin level.

Following a review of the WFD literature – including peer reviewed studies, official EU and member state reports, and grey literature from various planning authorities – we conducted semi-structured interviews with stakeholders at the level of competent authorities in late-2014 (3 interviews) and the level of sub-basin planning processes, in the first half of 2015 (12 interviews). For the latter we identified process organizers and at least two stakeholders representing opposing interests in relation to the most pressing water quality problem in each case study area.

We performed a content analysis on the transcribed interviews and documentary case material, structured according to context, process, substantive output, social outcomes and environmental outcomes and impacts. Environmental outputs were mainly assessed through RBMPs and PoMs, tracing the measures proposed in each of the selected processes. Hence, yardstick for the assessment of environmental quality was the goals of 'good water status's

[3] Henceforth respectively: Elbe-Lübeck; Miera and Campiazo; Belfast Lough and Lagan.

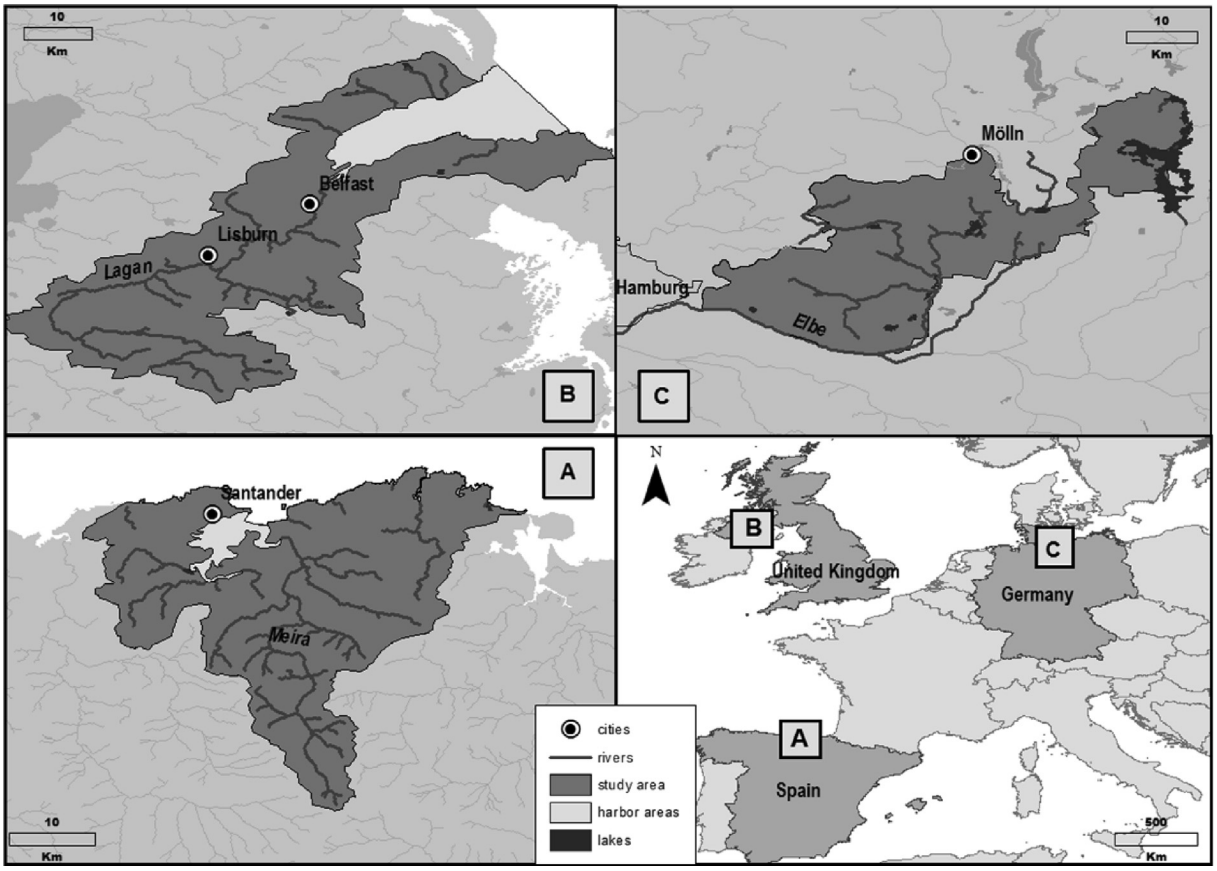

Fig. 1. Case study sites.

set by the WFD itself. Where no clear link between participation and environmental standards of RBMPs and PoMs could be established, we analyzed additional output documents. Environmental output quality was assessed on four dimensions: targeting of main water management issues in the sub-basin, specificity of measures, identification of implementing addressees, and feasibility of measures.

3.3. Germany – Schleswig-Holstein: Elbe-Lübeck planning unit

Participation in Schleswig-Holstein was mainly organized at the sub-basin level, where 34 planning units, each with one working group, were established. So-called Water Boards, associations that traditionally represent the interests of land-owners, chair these working groups and have responsibility for implementation under public contract. Due to their experience and contacts, the Water Boards were expected to be crucial for generating acceptance among stakeholders (Bruns, 2010), particularly as implementation of land-owner related measures relied on voluntary action. Further, it was assumed that inclusion of relevant stakeholders at an early stage in the planning process, would also aid implementation. Thus, the working groups, comprising organized stakeholders selected by the Ministry of Environment, initiated planning relatively early (in 2002), and held meetings generally on a monthly basis (see Fig. 2 for an overview of the planning process).

The Elbe-Lübeck working group comprises eight stakeholders: Water Board (2), Association of Towns and Municipalities (1), Farmers' Federation (1), ENGOs (environmental non-governmental organizations) (2), Fishery Association (1), Local Water Authority (1), as well as a guest representative of the Water and Shipping Agency. Additionally, a representative of the state Ministry of Environment attends the meetings, but does not have voting rights. In addition to the agricultural representative, two participants – including the chair – have an agricultural background.

The main water management issues in the planning unit are lack of connectivity due to river flow alterations and infrastructure, and diffuse pollution – almost exclusively from agriculture. No water bodies were classified as having good status. Despite this difficult starting point, participants and organizers described the atmosphere within the working group as calm, constructive and cooperative throughout the process. The Ministry and Water Board provided information and expert advice. The process chair – a Water Board representative – was highly regarded by all participants, being seen as well suited for the task, highly committed and motivated. Participants were actively involved in discussion, which was described as almost conflict-free and without intense negotiations. Participant input was perceived as constructive and useful for achieving WFD targets. Most of the measures were proposed by the Water Board, and participants had the possibility to adjust them. As implementation depended on voluntary action combined with state funding, an important benchmark for discussion was the implementability of measures.

Once decisions were taken, they were submitted to a federal state database. Within the final RBMP (MELUR, 2009) and PoM (FGG Elbe, 2009) only general measure types were listed, rather than specific ones. Measures were also not recorded elsewhere, except in the meeting minutes, which give a detailed account. The process chair always communicated the final output and its implementation status to the working group.

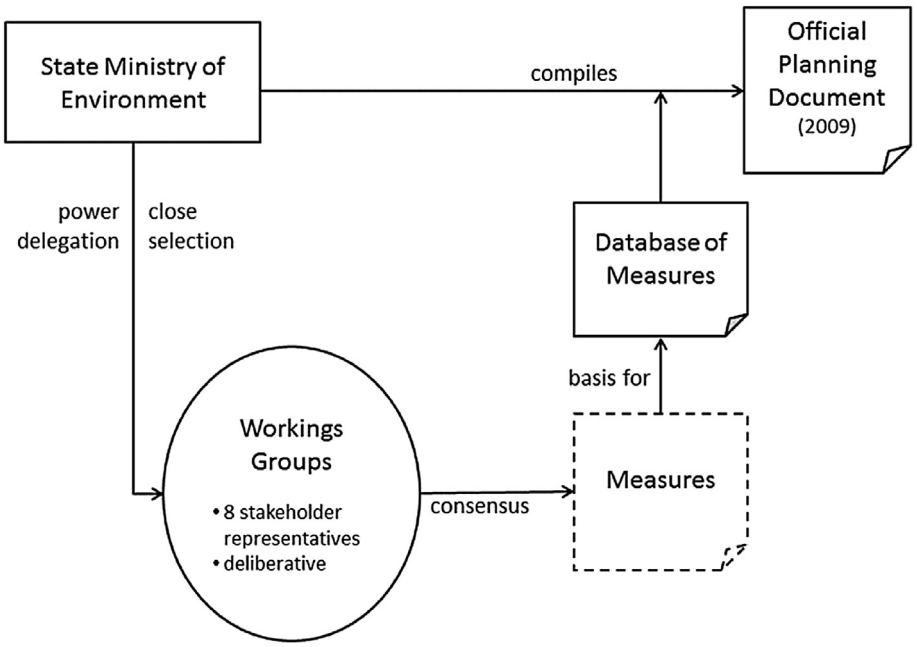

Fig. 2. Overview of the river basin management planning process in Elbe-Lübeck. Dashed lines indicate informal document.

3.4. Spain – Cantabria: miera and Campiazo Basins

Participatory planning in Cantabria has surpassed the basic requirements of the WFD. The majority of basins in Cantabria lie within the interregional river basin district of the Cantábrico Occidental, which is administered by its respective river basin authority (RBA). For such basins, which span multiple autonomous regions, RBAs are the implementing competent authorities. Despite this, the Government of Cantabria decided to initiate its own participatory process, as the RBA-led process was perceived as insufficiently local, and the RBA itself was not highly regarded among Cantabrian stakeholders. To this end, the Office for Hydrologic Participation in Cantabria (OHPC) was created within the Cantabrian Environmental Agency, representing the 'new water culture' (*nueva cultura del agua)*– a new and important paradigm in the Spanish context at the time, which demanded a more holistic and integrated view on water resource management (ISSTI, 2008).

Following an analysis of other European processes of participatory water governance, the OHPC initiated an extensive stakeholder identification process (see Fig. 3 for an overview of the planning process). While at the beginning of the planning cycle, sectoral meetings (i.e. involving only one stakeholder group defined as economic, social and administrative) were held in each sub-basin, the OHPC later ran additional multi-stakeholder forums, as well as water forums open to the wider public, in order to reach as many stakeholders as possible.

The Miera and Campiazo process, starting in 2008, comprised an official opening event, four sectoral meetings, six water forums, and three multi-stakeholder forums, which were held in different catchments. The aim of maximizing representation and activation of stakeholders was even supported by advertisements placed in churches and bars. This led finally to the participation of 644 individuals and entities (OHPC, 2010).

In preparation for the meetings, the OHPC together with the University of Cantabria, compiled all relevant information on water bodies and pressures in the sub-basins into an analysis document, which was supplied to participants beforehand. In the upper basins, diffuse pollution is an issue due to agriculture, but even more pressing problems are point- and diffuse-source pollution by urban development and industry – in particular around the capital city of Santander and its port in the north – as well as river connectivity in the middle and lower sections of the basins. 67% of waters do not reach good status (OHPC, 2008).

The process aimed to identify social perception of relevant water issues by eliciting information and proposals from stakeholders. Accordingly, meetings were generally characterized by only little two-way discussion and consensus building, as the OHPC initially intended, and focused rather on the collection of opinions and proposals. Meetings sometimes developed "an atmosphere of individual wish-fulfillment, lacking collective goals or coordination" (ISSTI, 2008: 11). On the other hand, this meant ample possibility for participants to bring in their opinions. In large water forums, for instance, the OHPC divided participants into sub-groups so everyone could have a say.

The main clash between stakeholders played out in the multi-stakeholder forums, particularly in the final one that aimed to reach a decision. Categories of problems – as results of the foregoing meetings – were presented, discussed, and finally voted on in terms of their urgency using a 'traffic light' system. Each participant had one vote, and 'consensus' was reached when more than 50% agreed. When the voting procedure was criticized by a representative of a large interest group, it was made clear that these were not final or concrete decisions or measures, but more of an 'idea map' for further planning.

Following the prioritization of measures by stakeholders, experts from the University of Cantabria selected measures based on feasibility (ISSTI, 2008). The output comprises a document compiling 213 generic measures, which was published in 2010 (OHPC, 2010) and presented in 2011 at meetings in each catchment. The list was handed over to the RBA on time, which published the RBMP in late-2013. The 213 measures, however, are confined to an appendix on stakeholder participation (CHCantábrico, 2013) and no explication of their integration into the actual PoM is given.

3.5. United Kingdom – Northern Ireland: Belfast Lough and Lagan Catchments

WFD implementation in Northern Ireland followed a largely uniform approach consisting of the centralized development of

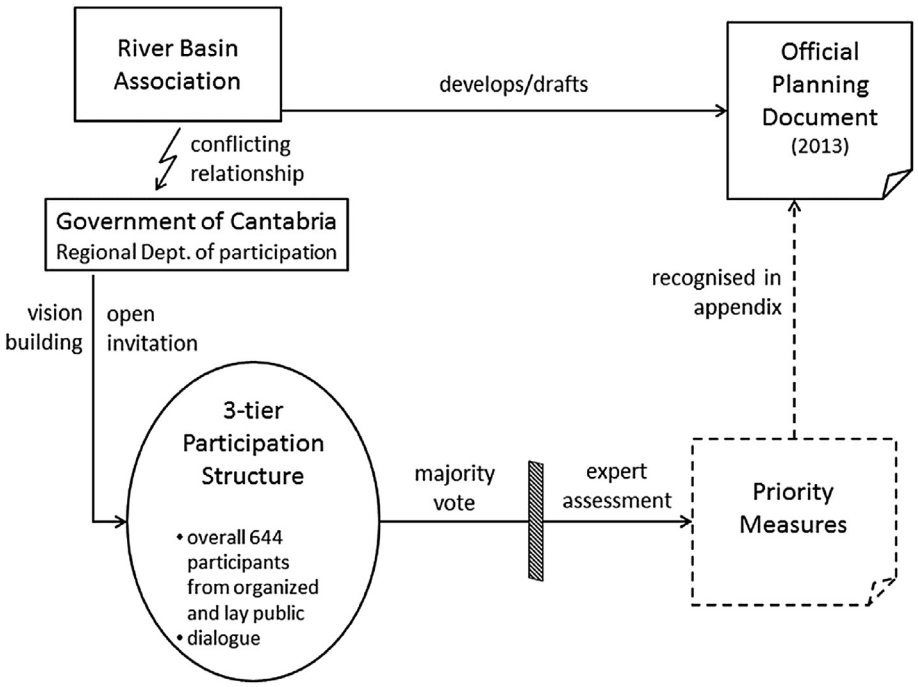

Fig. 3. Overview of the river basin management planning process in Miera and Campiazo. Dashed lines indicate no formal document or no formal connection.

RBMPs and PoMs, organized by the Northern Ireland Environment Agency (NIEA) within the Department of the Environment, which is the implementing competent authority. Active stakeholder involvement below a national-level forum occurs mainly at the sub-basin scale via Catchment Stakeholder Groups, which were set up in 2007 and have met biannually since then, such as in Belfast Lough and Lagan (see Fig. 4 for an overview of the planning process).

The main pressures in Belfast Lough and Lagan result from agriculture via diffuse and point-source pollution in the upper catchment. In the lower reaches, point-source pollution (including industrial, sewage, and urban wastewater spills) is the main pressure, while barriers to connectivity are also an issue. 97% of all water bodies do not reach good status (NIEA, 2010, 2012).

The biannual meetings of Belfast Lough and Lagan were hosted at different venues within the catchments, and several officials from NIEA had chaired the group. The evening meetings were open to the general public and all interested stakeholders, but in practice attendance by citizens and community groups was rather limited, and clearly incident-driven. Meetings were usually attended by between 20 and 40 stakeholders, although officials from NIEA and other government departments sometimes accounted for more

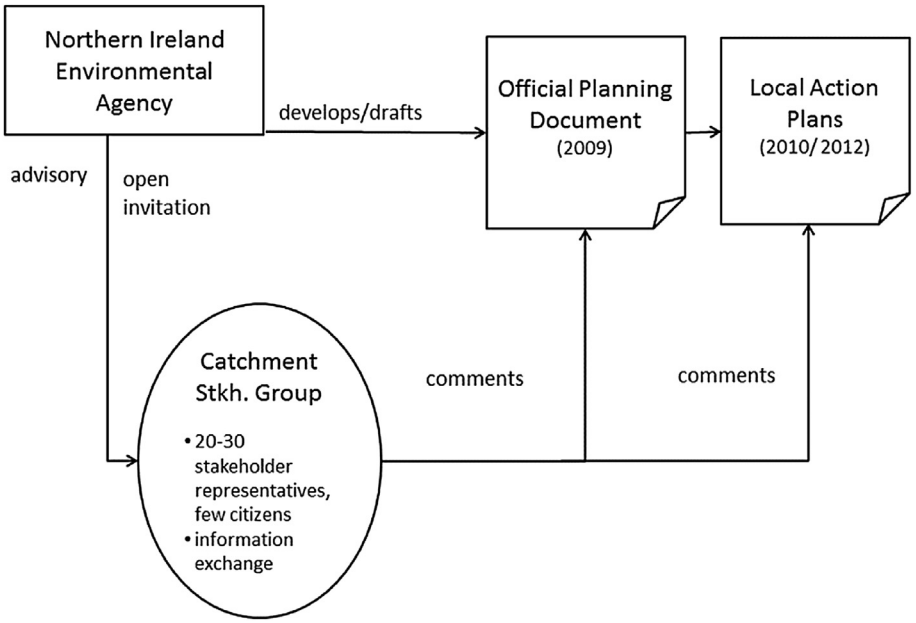

Fig. 4. Overview of the river basin management planning process in Belfast Lough and Lagan.

than half of all attendees. Other participants included representatives from local angling clubs, environmental conservation and natural heritage groups, electricity generators, and the government-owned water company. Surprisingly, farmers and agricultural interests were generally not represented in the process, and nor did ENGOs participate to any great extent. According to farmer representatives, meetings were held at an inconvenient time of day, and the tone of the meetings was perceived as hostile towards farmers, who were seen by many other stakeholders as the source of water quality problems. The main reason stated, however, was that the meetings were not deemed particularly important or relevant given the already established channels of communication and cooperation between farmers union and groups and the government on water issues. Similarly, ENGOs preferred engagement via the national stakeholder forum and the related consultation process, which opened the door for bilateral meetings with decision-makers.

The typical format of meetings was for the authorities to deliver or invite one or two presentations on water management issues, monitoring efforts, or proposed measures or initiatives, and for these to be followed by questions from the floor and discussion. Some more structured forms of information elicitation were also employed, such as workshops, questionnaires or written comments. In the absence of agricultural and environmental groups, angling groups, which represented the largest non-state actor group, took on the role of advocating for water quality and environmental protection more generally. Yet, some stakeholders described having become disillusioned with the process given the often-limited scope for questions and discussion as meeting agendas were filled with Agency presentations.

In spite of this, participants had opportunity to comment on most WFD documents relating to the sub-basin, including the draft RBMP in 2009. The main critiques of the draft plan were that it lacked detail and ambition (NIEA, 2009a). Key recommendations included promoting local projects and integrating local knowledge (e.g. via monitoring by angling clubs), to increase co-ordination with agriculture and ENGOs, and to promote efficient water use (NIEA, 2009a). Four sections of the plan had been updated subsequently and one new measure on promotion of water efficiency included. How far-reaching this new measure is, is not clear, as the RBMP itself lists generic measures to be applied to the whole basin (NIEA, 2009b). In late-2009, Local Management Areas were defined, for which Local Management Area Action Plans were produced to drive implementation at the local level. At the spring 2010 meetings, Local Management Area Action Plan workshops were held, to gather participants' input into local Action Plans and their feedback on the format of the meetings. The comments of participants on the draft Action Plans are not publicly accessible.

4. Cross-case analysis

4.1. Environmental planning outputs and outcomes

We distinguish planning outputs (agreements/plans) from outcomes (action on the ground in terms of implementation and compliance) and impacts (actual changes in the environment). The WFD envisages RBMPs and PoMs as the central vehicles for implementation. While these were in fact produced in all case study regions (albeit with considerable delay in Spain), our analysis suggests that these official plans are of limited value for understanding actual implementation of measures, because they are too general and abstract to drive action on the ground. Instead, each of the planning processes studied produced more specific, localized outputs (list of measures; local Action Plans). Below we analyze these outputs according to the following criteria: (1) Targeting of main water management issues; (2) specificity of measures; (3) identification of implementing addressees; and (4) feasibility of measures.

(1) In Elbe-Lübeck, the developed measures comprehensively target river connectivity – a significant water management issue in the area. Nonetheless, measures failed to really address diffuse pollution, a major pressure in the planning unit. Given the reliance on voluntary action for implementation, addressing diffuse pollution implied in most cases the state buying land from farmers for buffer strips. A rapid rise in land prices since 2007, due to the federal promotion of corn for biogas, was therefore frequently identified as the main barrier to implementation. In addition, addressing diffuse pollution was not a priority for stakeholders, including nature conservation representatives. In Miera and Campiazo, on the other hand, most measures address main problems by targeting contamination caused by industry and urban development, followed by river connectivity, and port related measures. While the local Action Plans for Belfast Lough and Lagan (NIEA, 2010, 2012) do describe the measures planned for each water body and most measures do target the main pressures of the catchment, the measures are 'soft', entailing further investigation and assessment, environmental education, awareness raising, and support of local stakeholder groups. Whereas these measures may have important impacts, it seems they should be complemented with specific 'hard' measures (e.g. removing barriers for improved connectivity).
(2) Regarding specificity of measures, only the minutes of Elbe-Lübeck list concrete measures. The listed measures in Miera and Campiazo rather reflect broad aspirations and the measures in the local Action Plans read more like general recommendations.
(3) Implementing addressees were specified in Elbe-Lübeck (usually the Water Board), and also the Belfast Lough and Lagan local Action Plans address particular stakeholders, identify implementing agencies and implementation timeframes. The rather generic list of measures of Miera and Campiazo does not identify implementation addressees, which would have exceeded the competence of the non-binding, complementary proposal.
(4) Measures produced in Elbe-Lübeck were clearly feasible, as selected measures were almost fully subsidized by state government. Although the local university had conducted a general feasibility check for the Miera and Campiazo list, this did not assess actual short-term implementability. As all measures comprised soft actions under the Belfast Lough and Lagan local Action Plans, they were likely to be feasible provided sufficient resources are made available.

In Elbe-Lübeck, implementation, which began in 2010, has been completed for most measures, and has had a considerable impact: The number of natural water bodies increased from three to five (MELUR, 2014) and the rivers are repopulated with trout. Improvements in water status, however, are yet to materialize.

Implementation in the Local Management Areas of Belfast Lough and Lagan, as described in the draft updated RBMP (NIEA, 2014), was successful for some of the awareness-raising measures, such as leaflets and river walks, and for monitoring, carried out mainly in partnerships; e.g. together with anglers. Nonetheless, the 2009 targets have not been met, and the number of water bodies achieving good status has not increased in either Local management Area.

In the Miera and Campiazo case, there appears to be no real

connection between the RBMP and the list of measures. By assessing an overall improved status, even the inventory of water bodies is different to that developed by the University of Cantabria and OHPC. Apart from the sometimes difficult coordination between the RBA, the Cantabrian government, and municipalities, two major external factors came to hinder implementation. First, due to the economic crisis of 2008/2009, many high-cost measures became infeasible to implement. Second, a change of the Cantabrian government in 2011 halted the entire process. The OHPC was disestablished and no further participatory processes were organized in Cantabria for the 2009–2015 cycle.

4.2. Social outcomes

All processes produced important social outcomes. Both cases, which included two-way information generated different learning processes. In Elbe-Lübeck, individual learning occurred through improved knowledge on the WFD and sustainable water management more generally. According to the Ministry, the whole group passed through an iterative learning process from measure to measure. In Miera and Campiazo even rather knowledgeable participants stated that they learned from the process. According to the OHPC and stakeholder representatives interviewed, the whole group learned about sustainable water management. One representative even cited the exchange of opinions and related learning processes as the most important outcome of the whole process.

Trust was only reported to have developed in Elbe-Lübeck; according to participants meetings are still characterized by an atmosphere of trust and mutual understanding. In Miera and Campiazo development of common understanding and trust were not very strong, given a lack of actual dialogue. In Belfast Lough and Lagan, meetings did not afford much opportunity for learning, developing trust or mutual understanding among stakeholders.

Nevertheless, various groups, which (unlike unionized farmers and ENGOs) did not necessarily enjoy routine access to relevant government departments, valued the increased accessibility of important governmental and private sector actors. The process has perhaps been most helpful for local stakeholders where it has supported already existing and new projects on the ground. Support accessed via new networks and relationships built were reported as having been instrumental in setting up and sustaining various local environmental projects. Network-building and improved collaboration, however, have been most pronounced among the various government officials and departments responsible for the water environment.

Improved contacts or network building was not the case in Miera and Campiazo. Although contacts between participants of Elbe-Lübeck intensified over time, neither specific networks nor common implementation projects emerged at local level. A multiplier effect, in disseminating information and creating acceptance of measures among the wider public, intended by the process organizers, seems to have occurred only to a minimal extent. Stakeholders did not perceive their role to involve reporting back to their organizations and appear not to have used their contacts to agriculture in order to promote respective measures.

4.3. Mechanisms linking process and outcome

4.3.1. Mechanism 1: opening up of decision-making to environmental concerns

In all cases, we find the involvement of environmental concerns in river basin management planning. This was most notable in Elbe-Lübeck – with 2 out of 8 participants from ENGOs – and in Miera and Campiazo, where environmental interests were proactively sought to participate, in line with the 'new water culture'. In Belfast Lough and Lagan, ENGOs participated sporadically, as they had more effective means for engagement outside the process; a robust affirmation of the influence of alternative and more effective venues to influence outputs, as mentioned in section 2 (see Table 1). In the absence of ENGOs angling groups acted as environmental advocates to a certain extent.

In section 2, we identified the mechanism of advocacy as enabling the translation of the participation of environmental groups into effective outputs. This seems to hold for all cases: In Elbe-Lübeck ENGO representatives were active in ensuring that the issue of river connectivity was comprehensively addressed. In Miera and Campiazo, environmentally oriented stakeholders actively contributed to the rather comprehensive list of well targeted measures. In Belfast Lough and Lagan, it is clear from interviews and meeting minutes that angling groups were very active and highly vigilant on water quality and river ecosystem health.

The opposite mechanism was defined as co-optation, which seems to have occurred to some degree in Elbe-Lübeck; the pressing issue of diffuse agricultural pollution was not addressed at all. Overrepresentation of agriculture within the group seems not to have been the main reason for this, as all participants highlighted the calm and constructive atmosphere of meetings. It appears that the need for clearly implementable solutions put the focus on less demanding issues; encouraged by the progress made with measures addressing river connectivity – such as the replenished fish stocks. ENGOs that were not participating directly in the working groups did critically question the disregard for agricultural pollution (NABU, 2010).

Apart from this opposing mechanism, additional factors seem to have hindered advocacy in influencing the output, which we did not cover in section 2. Arguably, the less deliberative atmosphere in Miera and Campiazo, compared to Elbe-Lübeck, made environmental groups less prone to co-optation. Yet, opposing stakeholders agreed on the priority list of measures only upon assurance that it was non-binding and rather symbolic, thereby incorporating environmental concerns, but into a 'wish-list'-like output. In Belfast Lough and Lagan, advocacy could not impact greatly on the output, simply due to how the process was designed. Despite various suggestions and criticisms from stakeholders, it appears that promotion of efficient water use and support for local monitoring (e.g. by angling groups) are the only points to have been taken up.

4.3.2. Mechanism 2: incorporation of additional environmental knowledge

Our second mechanism focuses on the incorporation of additional environmental knowledge, brought in by stakeholders, into the process output. Additional environmentally relevant knowledge seems to have evolved in all cases. While different forms of knowledge played a role (Table 2), we observed no conflict between these. In Elbe-Lübeck, all participants were quite familiar with issues around particular water bodies and could contribute useful local knowledge to shape concrete and implementable measures. In Miera and Campiazo, local knowledge was brought in by several stakeholders, including ENGOs, and OHPC was frequently surprised by the relevant knowledge brought in by rural people. Although in Belfast Lough and Lagan the information flow was primarily from the authorities to participants, stakeholders (especially anglers) succeeded in contributing local knowledge via feedback and input on draft plans.

However, the second part of the mechanism – incorporation into the output – seems to have been influenced again by the combination with additional factors. In Elbe-Lübeck, the Water Board, which was leading the participatory process, holds not only context-specific knowledge, but also expert knowledge so that every measure was prepared with, discussed with or revised by, the

Table 1
Mechanism 'Opening up of decision-making to environmental concerns', disaggregated into a threefold sequence.

Sequence of (theory driven) causalities	Elbe-Lübeck	Miera & Campiazo	Belfast Lough & Lagan
1. 'Opening' up of DMP	Representation of ENGOs	Representation of ENGOs and additional actors ('new water culture')	Representation of angling groups
2. Representation of environmental concerns	Advocacy of environmental concerns Co-optation of environmental actors	Advocacy of environmental concerns Non-bindingness of measures suggested	Advocacy of environmental concerns Lacking power delegation
3. Higher environmental standards of the output	Addressing significant water issue Ignoring the important issue of agricultural nitrate	Addressing significant water issues General 'wish-list' character	Only two proposals clearly included into planning Addressing significant water issues (only soft measures)

Table 2
Mechanism 'Incorporation of additional environmental knowledge', disaggregated into a twofold sequence.

Sequence of (theory driven) causalities	Elbe-Lübeck	Miera & Campiazo	Belfast Lough & Lagan
1. Harnessing additional knowledge	Lay-local knowledge Expert knowledge	Lay-local knowledge No expert knowledge	Lay-local knowledge Expert knowledge Expert knowledge
2. Additional/more specific knowledge relevant to the DMP and implementation	Feasible, concrete measures	Generally feasible, no concrete measures	No concrete measures, feasible (soft) measures

association's engineer. In Miera and Campiazo, there was no direct exchange between expert and lay-local knowledge, which was sharply criticized by some stakeholders. The general feasibility check was conducted after meetings. In Belfast Lough and Lagan, it seems that the administration only drew on input to a minimal extent, demonstrating perhaps limited political will and resources to include additional knowledge.

4.3.3. Mechanism 3: dialogical interaction

Interestingly, none of the cases represented a deliberative process. In Belfast Lough and Lagan this was perhaps not foreseen in the first place, although the original terms of reference (NIEA, 2008) did imply rather more exchange and interaction among stakeholders, but overall the process appears not to have lived up to these terms.

In Elbe-Lübeck, dialogue and negotiation, rather than deliberation, were the main modes of interaction, and arguably contributed to high quality outputs (see Table 3). Nonetheless, the development of a shared understanding of interests and preferences did not occur. The main potentially conflicting issue, which would have directly affected stakeholder property and/or property rights and as such shaped their preferences and interests, was left out.

In Miera and Campiazo there was little negotiation, let alone deliberation, due to the process design. The aggregation of all proposed measures precluded a discussion reflecting on or negotiating individual preferences. Hence, individual interests served as the main points of orientation rather than any shared understanding or common good orientation. This was in part due to the group sizes, which were simply too large for intensive discussion, highlighting a trade-off between broad representation of stakeholders and the possibility for effective deliberation.

4.3.4. Mechanism 4: acceptance, implementation, and compliance

The inclusion of stakeholder interests into a decision and subsequent acceptance and implementation was one mechanism identified in section 2 (see Table 4). This seemed to be important in Elbe-Lübeck, as the self-drafted measures were in fact accepted by stakeholders and subsequently implemented by them (mainly the Water Board). An additional factor, not covered in our theoretical scheme, which was repeatedly raised, was the possibility to see tangible results. All participants seemed to be highly satisfied with their decisions if they could witness the actual results. Connectivity problems – unlike diffuse agricultural pollution – lend themselves to this, as measures usually imply a removal or construction of new, more sustainable infrastructure.

In Belfast Lough and Lagan, some stakeholders were frustrated at the apparent lack of responsiveness of NIEA to their concerns, and a perceived lack of influence on the planning process. They expressed dissatisfaction with the RBMPs and Action Plans on the grounds that measures were vague and ambiguous, and perceived as unlikely to be implemented given a shortage of resources. Aside from this, however, dissatisfaction was mainly expressed regarding the process. Stakeholders felt that the meetings were often stacked with government staff, and that the agenda often allowed too much time for

Table 3
Mechanism 'Dialogical interaction', disaggregated into a twofold sequence.

Sequence of (theory driven) causalities	Elbe-Lübeck	Miera & Campiazo	Belfast Lough & Lagan
1. Deliberation and common-good orientation	No deliberation No common-good orientation	No deliberation No common-good orientation	No deliberation No common-good orientation
2. Strong environmental output	–	–	–
1. Negotiation for mutual gains	Dialogue/negotiation No shared understanding of preferences and interests/mutual gains	Broad participant selection Medium dialogue/negotiation No shared understanding of preferences and interests/mutual gains	Mainly one-way flow of information No dialogue/negotiation
2. Strong environmental output (and social outcomes)	Avoidance of/No solution for conflicting issue Learning, trust	Avoidance of/No solution for conflicting issues (generic list of actions) Learning	Avoidance of/No solution for conflicting issues (soft measures drafted by state agency)

Table 4
Mechanism 'Acceptance, implementation and compliance', disaggregated into a threefold sequence.

Sequence of (theory driven) causalities	Elbe-Lübeck	Miera & Campiazo	Belfast Lough & Lagan
1. Acceptance through procedural fairness	Perceived fair and legitimate process	Perceived fair and legitimate process	No perceived fair and legitimate process
2. Accommodation of participant interests	Reflection of interests in the output Tangible results	No reflection of interests in the output	No reflection of interests in the output
3. Enhanced implementation and compliance with output	Acceptance Implementation Empowerment	Acceptance No implementation Empowerment	No acceptance Implementation gap Empowerment, networks

official presentations and insufficient time for questions and meaningful discussion. Despite relatively high reported levels of dissatisfaction, several local groups have proceeded to cooperate with NIEA as co-deliverers in an attempt to deliver on a few of the measures.

A perceived fair and legitimate process contributing to acceptance – the second mechanism stated in section 2, also played a major role in Miera and Campiazo: There was no actual integration of stakeholder interests into the final output (RBMP) or implementation. Surprisingly, acceptance and stakeholder satisfaction appear here to be mainly related to the participatory process. Participants valued very highly the opportunity to participate in forums and express their opinions. The process was perceived as very fair and legitimate, in particular due to the equal opportunities to have a say, open mode of communication, neutral mechanism for reaching consensus, and neutral moderation. Although everyone knew that the priority list was not actually part of the plan, and had not been implemented, they were highly satisfied with the process and even stated that they would participate again.

Also in Elbe-Lübeck the process was perceived as very fair and legitimate. Stakeholders praised particularly the consensus vote, even if this meant less favored options on a few occasions. Early and on-going participation was also highlighted as important.

5. Conclusion

In this study we identified and elaborated on three different experiences in participatory water governance under the European WFD. The considerable leeway afforded to member states in establishing participatory processes led in the German case to a model of small groups of organized stakeholders with intensive communication and high power delegation. In the Spanish case, far-reaching participation by stakeholders and the wider public involved two-way information flow, but finally no power delegation to participants. In the Northern Ireland case, medium-sized groups of stakeholders participated in meetings characterized largely by one-way information flows and limited power delegation. In all cases the required RBMPs and PoMs were produced, but these documents do not appear to have played the decisive role envisaged by the Commission. Many actually remain quite descriptive and vague about measures to be taken.

In all of our three cases, however, additional outputs (list of measures, local Action Plans) were produced to guide subsequent implementation, but these often bypassed the official EU planning process. Regarding mandated participatory planning, we found an increasing quality of these additional outputs with increasing intensity of local participation. However, the model of local collaborative governance in the German case shows the dangers of co-optation of environmental groups, which weakened environmental outputs. Full implementation also only occurred under this model. Social outcomes such as learning occurred within the more dialogical settings of the German and Spanish cases. All cases seem to have led to empowerment to some degree, whereas network building emerged mainly in the Northern Ireland case characterized mostly by one-way information.

We identified four mechanisms potentially contributing to the environmental quality of outputs and implementation within the three case studies: Representation and advocacy for environmental concerns; provision of additional environmental knowledge; deliberation and negotiation; and acceptance through perceived fairness of process and reflection of stakeholder interests in the output. We found these mechanisms seemingly conducive to output and outcome quality, however, mainly in combination with additional factors. Let alone the counteracting co-optation mechanism in the German case; actual advocacy of environmental interests was difficult to achieve with a non-binding output in the Spanish case and lacking power delegation in the Northern Ireland case. Likewise, not only additional knowledge brought into the process but also a balanced exchange of knowledge types, between e.g. lay-local and expert knowledge seems to have been crucial for a more specific output. The former is surely difficult to achieve when there is a lack of political will to draw on this knowledge, as in the Northern Ireland case. In addition, balancing of interests through negotiation or deliberation that might have led to common understanding of preferences or a common good orientation was not required, as conflicting issues that would have substantially affected stakes had been left out: In the Spanish case due to the broad participant selection and process type allowing every stakeholder to voice concerns; in the German case by excluding one pressing issue from discussions; and in the Northern Ireland case by only drafting soft measures.

Finally, incorporation of stakeholder interests into the output enhanced acceptance, particularly, in combination with tangible results as in the German case (frequently difficult to provide in environmental planning). Surprisingly, the Spanish case offered strong evidence counter to the claim in literature that actual influence in decision-making is necessary for a perceived fair and legitimate process. The Spanish and Northern Ireland cases suggest that stakeholder acceptance seems to be rather more related to processes than to outputs. There might certainly be additional potential factors, deriving from different participatory national cultures, which earlier studies have shown to have an influence on WFD implementation (Enserink et al., 2007; Tippet et al., 2005). Nonetheless, the factors identified in our conceptual framework seem to hold over different contexts, as the above-mentioned acceptance mechanism indicates.

Given the variety of (often conflicting) findings in the continually expanding cross-disciplinary literature on participation in environmental politics and governance, we suggest that comparative case studies, like the one presented here, stand to yield novel insights into the conditions under which mechanisms linking participation and environmental outcomes are effective.

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Appendix A. Supplementary data

Supplementary data related to this article can be found at http://dx.doi.org/10.1016/j.jenvman.2016.08.007.

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Supplementary Material to
"Participation for effective environmental governance? Evidence from Water Framework Directive implementation in Germany, Spain and the United Kingdom"

Interview guide for process participants

1. *Participant characteristics*

To start with – what interests did you represent in the process, and how did you come to participate in the process? Had you in the past participated in a process like this (or other, different types of participatory processes)? What was your initial opinion of the process (at the beginning)? Were you aware in advance of how the process would work? Were you able to contribute to the design of the process itself?

Follow-up questions:

- Did you already have knowledge of the content and aims of the WFD, or familiarity with water resources management? In what form?
- What, in your view, is the main water management issue in the area, the main problem, or what should be the main goal?
- What was your perspective on the role of the authorities and the other stakeholder groups involved?
- Were there conflicting goals, competing interests? Were there any past/pre-existing conflicts?
- Were you already in contact with the other stakeholder groups or participants?

2. *Process as it played out*

How did the process play out? In general: How did the meetings work? Frequency/length, information provision or discussion/dialogue, means of information exchange? Was there any possibility to alter the process on the basis of feedback from the participants, or organiser?

In terms of the dynamics: What was the tone and type of discussion like? Was it possible to contribute your ideas and views effectively, were there conflicts (or resolution of conflicts)? What was the behaviour of participants like towards each other (at the start and over the course of the process)?

Follow-up questions:

- Was it clear from the start what the goal of the process was? And what your role in it was?
- What interests were represented: Who were the main actors/interests (in terms of the size of organisations, the resources or expertise at their disposal)? Did these have more of a chance to be heard and to participate in the process?
- Were there any uncertainties, from your perspective, at the outset of the process? (in the sense of uncertainties regarding the purpose and goals of the WFD, or how certain goals could be achieve? Or uncertainties regarding the goals and motivations of other participants, such that it was difficult to gauge their objectives? Dis this change at all during the process?
- Did other participants bring information or knowledge to the process that was new to you? Did you learn something through understanding the positions of other participants? Was information introduced to the process by the process organisers/authorities communicated in such a way that it was understandable and accessible to others? Did you learn about the issue as a result of information introduced by the organisers/authorities?
- After the process, were you able to understand/sympathise with the perspectives of other participants? Would you assume that others were better able to understand your own position? Did your opinion change over the course of the process? Do you think others' opinions were

changed via the process?
- How did group decision-making work? Was there any consensus-based decision-making?

3. *Results of the participatory process*

What exactly was the (main) result of the participatory process? Written documents, list of measures, HMWB designation, implementation strategy, etc.? To what extent did these feed into the official management plan or programme of measures? Were these outputs of the process rather general or rather concrete recommendations and measures? How do you assess the decisions made via the process? How did they help achieve the goals of the WFD? Can you provide examples? How do you assess the decisions made?

Follow-up questions:
- Were the decisions of the group accepted by all, or were there divergent opinions at the end of the process?
- Would you see any of the results/decisions/measures as particularly innovative?
- Were there any adaptive solutions – i.e. either experimental measures/approaches such as piloting measures for future application to other contexts; or flexible measures, such as projects or measures deliberately designed to be changed as necessary. Was the need for adaptive approached discussed at all? Are you in favour of such measures? Why/Why not?

Over the course of the process, did you learn about the WFD and/or sustainable water management? If so how/what? How do you assess the process of learning that happened in the group (if there was one)? Do you have better connections to other stakeholder groups due to your involvement in the process? Are there any common or cooperative efforts underway as a result (to do with WFD implementation, or other actions)?

4. *Final considerations and continued participation*

How would you assess the process overall (positive and negative points)?

Would you take part in such a process again? Are you taking part in the course of the second WFD planning cycle? In the case that you are taking part in the current WFD planning process, how would you describe it in comparison to the process in the first planning cycle? Is interaction among the participants different/the same, more positive/negative? Are new actors participating? How is cooperation with these new actors playing out?

Do you think that overall this kind of participation in the implementation of the WFD / sustainable water management is beneficial? Or could it also be achieved through other forms of planning and decision-making or involving other actors?

Interview guide for process organizers

Part A: Selection of WFD implementation strategy

1. Assessment of the Directive

- What is your impression of the Water Framework Directive (WFD)? Did it actually change planning structures in the water sector in [basin/ sub-basin]? Did it lead to a new approach to the protection and management of waterways and water bodies?
- What were the most important challenges to achieving the goals of the WFD in [basin/ sub-basin]? (e.g. river continuity, Pollution (diffuse or point-source), water abstraction etc.)
- The WFD required management plans by 2009, and now again for 2015. What meaning was attached to the plans from the first planning cycle? (Reform of water management? Opportunity for innovation, or just more bureaucracy to contend with? Difficult to switch to the 'new' system?)
- What role did/do the development of plans and programmes of measures play? – Important step towards the implementation of measures, or rather mere reporting to Brussels?

2. Multi-level participation process

- In [basin/ sub-basin] participation in WFD implementation took place across several administrative levels in the form of [*type of process*]. What were the goals of this approach to participatory implementation? Why on these particular levels, in this way, with this timing, with the stakeholders selected, etc.?
- Can you describe how this form of participation arose or was selected? Who contributed to/decided on this? How much leeway did you have to design and run the participation processes? What arguments played a role? Were alternative approaches considered (e.g. 'more' or 'less' participatory)?
- Which processes, or parts of the process, were seen as most important for the planning of measures (or other tasks in the management planning process)? Did the role of these processes change over the course of the planning process? If so, did other process types become important and/or take over this role?

3. Process design of the main participatory process for the planning of measures

- Regarding this/these most important participatory process/es: What were the initial ideas as to how these should be designed – in terms of the level, actors, information flows, scope for discussion and decision-making?
- What was the object of participation? (Stocktaking, designation of artificial and heavily modified water bodies, identification of exemptions, selection of measures, etc.) In what ways were participating actors able to make suggestions, and how were these to be integrated into the planning process?

Part B: The participatory process

- Compared to how it was planned for the process to run, how would you describe the process as it actually played out? (Reasoned discussion, conflict, uncertainties, information deficits, misunderstandings etc.?) Were there differences among the various processes?
- What is your assessment of the conditions underlying the processes as they played out? (Common understanding and knowledge of participants, underlying conflicts and levels of trust/mistrust,

mutual understanding between actors and administrative authorities, etc.)

- In your opinion, and with respect to all of these processes, were all of the actors with an important contribution to make to WFD planning and implementation involved? Was the participation of any actors explicitly supported or promoted through the design of the process?

- Were the processes adapted or changed from their original design over the course of planning? How? Why?
- Of all of the processes that were conducted, could you identify one or more that was/were especially productive in terms of achieving its aims, or that you consider an especially good example for participation?
- Overall, how would you judge the process of WFD participation in [basin/ sub-basin] – in relation to both participation at different administrative levels and, if applicable, differences at a particular level?

Part C: Results of the participatory process

1. Results for planning of measures

- Overall, would you say that participation, as it played out in your basin/ sub-basin, was helpful in order to achieve the goals of the Directive? If so, what was the main success factor in this? If not, why not?
- Were the actors able to propose measures? In what form? How were suggested measures, designation of artificial and heavily modified water bodies, and identification of exemptions dealt with in the planning process?
- What is your assessment of the suggestions and proposals introduced by participants? Were these appropriate and realistic proposals? Were proposed measures innovative, flexible or adaptive? Were there notable differences between the participatory processes in terms of the proposed/suggested measures elicited?
- How would you describe the quality of the measures and other proposals generated through the processes just discussed? Were there notable differences?
- How were/are the final management plans regarded by the various actors who participated in their development?
- Did the participatory processes have other outcomes aside from the development of the plan? (E.g. trust-building or network-building among participants, collective learning and improved understanding of issues, new approaches to water quality on the part of participating actors). If so, did these outcomes affect the (better) implementation of the Directive (e.g. through actors' local initiatives etc.)?

2. The way forward

- Will you repeat this approach to participation for the new WFD planning cycle? The same actors, or new/additional groups?
- What lessons have been drawn from the participatory planning process in the first planning cycle? What effect do/will these have on the second planning cycle?
- For the second (and indeed the first) planning cycle, did you draw on models or experiences from other countries or jurisdictions? Was there any cooperation with other countries/jurisdictions? Did any other agencies or bodies influence the design of the participatory processes?
- Currently the Floods Directive is also being implemented. Is there any overlap between FD implementation and the second planning cycle of the WFD? Will experiences from the first WFD planning cycle also inform participation in the FD?
- Can you recommend any further contacts that might help us further in this research on participation in [basin/ sub-basin]? (For instance – in regards to the examples we have discussed, is there an important contact person?)
- Could you recommend any particularly interesting individual processes that we might follow up

on? (E.g. the positive example you mentioned earlier).

Article 3:

Impact of participation on sustainable water management planning: Comparative analysis of eight cases

Abstract

Does participatory governance benefit the environment? The European Water Framework Directive (WFD), which came into force in 2000 with the aim of revolutionising European water governance, mandates participatory river basin management planning across the European Union. The belief of European policymakers and the European Commission is that participation will deliver better policy outputs and implementation. This book examines a range of approaches to participatory river basin management planning, and considers whether and how participation impacted on the environmental standard of planning documents, quality of implementation and social outcomes.

It draws on evidence from WFD implementation in eight case studies from Germany, Spain and the United Kingdom on the basis of a matched comparative case study design. The Directive sets common timeframes and procedural requirements, which provides a perfect test-bed and unique opportunity to study the effects of participation on implementation and outcomes in comparative perspective.

Part III

Comparative analysis and conclusions


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7 Impact of participation on sustainable water management planning

Comparative analysis of eight cases

Elisa Kochskämper, Nicolas W. Jager, Jens Newig, Edward Challies

In the preceding chapters, we analysed in detail eight cases of participatory water management planning in Germany, Spain and the United Kingdom (UK) in the context of European Water Framework Directive (WFD) implementation. We conducted these case studies to better understand the causal mechanisms at work linking participation with environmental outcomes of decision-making processes (DMPs). To this end, we presented in Chapter 2 a framework of potentially relevant causal mechanisms. In this chapter we undertake an integrative and comparative analysis of all eight cases in light of our conceptual mechanisms.

All cases demonstrated rather different pathways by which participation shapes environmental outcomes. However, it is possible to identify general tendencies in the different countries' styles of participation: In Germany, participation was organised according to a multi-level structure, with local or regional forums or working groups being the main entry point for stakeholder input. In Spain participation was, in contrast, spread horizontally over the respective territory, with emphasis on parallel sectoral and multi-stakeholder forums. In the UK, participation was embedded within a multi-level administrative structure, with stakeholders and local groups acting as co-deliverers of actions on the ground. For all three countries arguably, WFD implementation meant adaptation of, or addition to, established patterns of water governance rather than a discontinuity with established practice, which is generally in line with the growing literature on WFD implementation (Albrecht 2013; Theesfeld & Schleyer 2013; Moren-Abat & Rodríguez-Roldán 2012; Fritsch & Benson 2013; Jager et al. 2016). Germany integrated stakeholder participation into the existing multi-tier water administrative structure. Spain extended the scope of its pre-existing water councils to bring in additional, new actors into new decision-making forums. The UK continued with, but adapted and broadened, a relatively centrally driven and coordinated consultative network model.

As regards the actual characteristics of participation, cases[1] varied considerably: Baix Ter (ES), Elbe-Lübeck (DE) and Forth (UK) were characterised

by intensive communication (two-way/reciprocal information flows) and relatively high levels of power delegation – that is, influence afforded participants over the final decisions and plans. Guadalete and Barbate (ES), Lower Main (DE) and Belfast Lough and Lagan (UK) represented cases with 'less intensive' participation in comparison. Two further cases – Hase (DE) and Miera and Campiazo (ES) – differed in that they exhibited relatively intensive communication and information exchange, but only a low degree of power delegation, which limited participants' influence over the final measures and plans (see Table 7.1 for more detail).

Individual citizens and citizens' groups were almost entirely absent from the processes studied here, with participatory spaces open to the wider public only in Baix Ter, Miera and Campiazo and Belfast Lough and Lagan (see Figure 7.1). Regarding actors' stakes and interests, we mapped

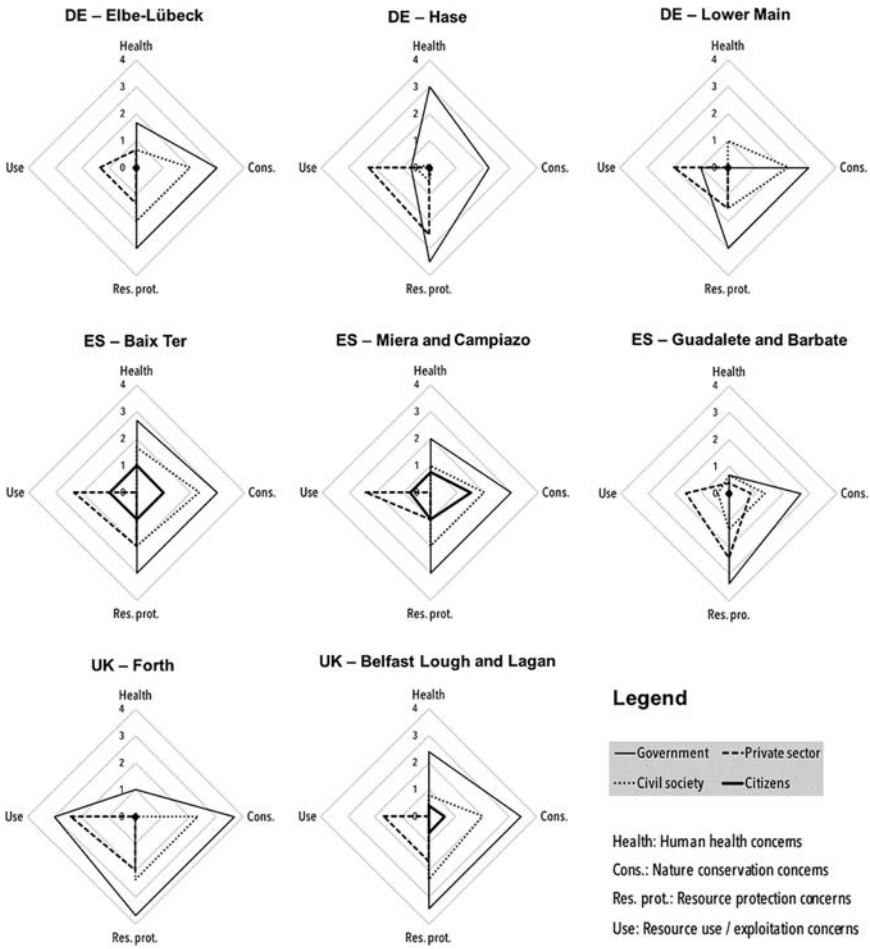

Figure 7.1 Profile of mean stakeholders represented in participatory processes

Table 7.1 Features of participatory processes

	DE – Elbe-Lübeck	*DE – Hase*	*DE – Lower Main*	*UK – Forth*	*UK – Belfast Lough and Lagan*	*ES – Baix Ter*	*ES – Miera and Campiazo*	*ES – Guadalete and Barbate*
Size	506 km^2	3,039 km^2	8,378 km^2	4,680 km^2	1,005 km^2	200 km^2	620 km^2	5,969 km^2
River Basin District	Elbe RBD	Ems RBD	Rhine RBD	Scotland RBD	North Eastern RBD	Internal basins of Catalonia	Cantábrico Occidental RBD	Guadalete and Barbate RBD
Per cent water bodies with good or better status (2009)	0%	1%	18%	22%	3%	36%	33%	41%
Main pressures	Connectivity, agricultural pollution	Agricultural pollution, connectivity	Agricultural pollution, connectivity	Morphological pressures, urban pressures, agricultural pollution	Agricultural pollution, urban pressures	Urban pressures, agricultural pollution and abstraction	Urban and industrial pressures, agricultural pollution, connectivity	Agricultural pollution and abstraction, connectivity
Competent Authority (CA)	Ministry of Energy, Agriculture, the Environment and Rural Areas of Schleswig-Holstein	Ministry of the Environment, Energy, and Climate Protection of Lower Saxony	Ministry of the Environment and Consumer Protection of Bavaria	Scottish Environment Protection Agency	Department of the Environment of Northern Ireland	Catalan Water Agency	Cantábrico Occidental River Basin Authority	Andalusian Water Agency

(Continued)

Table 7.1 (Continued)

	DE – Elbe-Lübeck	*DE – Hase*	*DE – Lower Main*	*UK – Forth*	*UK – Belfast Lough and Lagan*	*ES – Baix Ter*	*ES – Miera and Campiazo*	*ES – Guadalete and Barbate*
Main participatory process (PP)	Working Group	Area Co-operation	Regional Water Forum	Area Advisory Group	Catchment Stakeholder Group	Series of information events, sectoral meetings, working groups, multi-stakeholder forum	Series of sectoral meetings, water forums, multi-stakeholder forums	Three sectoral meetings, one multi-stakeholder workshop, one mediation meeting
Access to PP	Selection by CA	Selection by CA	Selected by CA, application	Selection by CA	Invitation by CA and open to the public	Invitation by CA and open to the public	Invitation by CA and open to the public	Selection by CA
Participants	8–10 representatives from water boards, municipalities, agriculture, ENGO, angling, local water authority, water and shipping agency, ministry	23 representatives from state agencies, counties, municipalities, water boards, agriculture, forestry, angling, water services, industry	65–90 participants from state agencies, municipalities, agriculture, ENGO, angling, hydro power, water services, forestry, industry, tourism	15–25 key stakeholders from local authorities, forestry, agriculture, water and wastewater, industry, ENGO, fisheries	20–30 participants from state agencies, angling, ENGO, natural heritage, hydro power, recreation, water services	150 participants from agriculture, forestry, industry, energy, commerce, ENGO, research, civil society, citizens, administration	644 participants from municipalities, administration, citizens, private and industry actors, recreation, farmers, civil society associations, research and ENGOs	50 stakeholders from civil society, public administration, private sector (multi-stakeholder workshop and mediation meeting)

Process time span and meeting frequency	2002–2009 Monthly	2005–2009 2–5 meetings per year	2005–2009 Annually	2006–2009 Bi-annually	2007–2009 Bi-annually	2007 15 meetings in three-month project phase	2008 14 meetings in three-months project phase	2010 Two (different) meetings
Communication Mode	Dialogue	Dialogue in early phase, later information exchange	Information provision, limited discussion	Continuous mutual information flow	Information provision with subsequent discussion	Continuous mutual information flow, final discussion	Information provision, consultation	Information provision, consultation in sub-groups
Output of the PP	Measure lists contained in meeting minutes	List of measures	Oral and written comments	Input into RBMP and Area Management Plan	Oral and written comments	List of measures	List of priority measures	Responses of a questionnaire to participants
Influence on action on the ground	Identification and decision of measures	Communicative, co-funding for measures (10%) required	None	Co-development of and feedback on measures	Commenting on measures through oral and written feedback	Limited, lack of funding	None	None

participants onto a set of analytical categories defined by four societal sectors – government, private sector, civil society and citizens – and four different 'orientations' towards the environment: conservation of the natural environment (pro-conservation), protection or sustainable use of natural resources of instrumental value for humans (pro-natural resource protection), protection of human health linked to environmental issues (pro-human health), and the acceptance or tolerance of unsustainable resource use or ecological degradation (pro-exploitation) (Newig et al. 2013). As Figure 7.1 highlights, we can observe clear patterns of actor representation and environmental orientation. In all cases, government actors were the most highly represented group with a strong tendency towards conservation, but also towards the (sustainable) management of water resources (pro-resource protection), and to a lesser degree towards human health interests. Private sector and civil society actors have similar patterns of medium degrees of representation in our cases, however with opposite orientations: While civil society actors (usually environmental non-governmental organisations, ENGOs) exclusively have 'pro-environmental' interests (pro-conservation, pro-natural resource protection, pro-human health), private actors, mostly from agriculture or industry, generally have an interest in some form of resource use (pro-exploitation, pro-natural resource protection). Further, the figures reflect that the few citizens involved in our cases showed no dominant environmental orientation.

We are interested in ascertaining whether and how process design choices and actual participatory processes shaped outputs and outcomes in the cases studied. To this end, we rely on a conceptual process model, wherein a participatory process leads first to a *participatory output* (e.g. a list of measures or plan recommendations), and second to a *political output* (e.g. a final plan) issued by a competent authority, which reflects to a greater or lesser extent the participatory output.

The remainder of this chapter presents our analysis in four sections: First, we examine outputs and, second, discuss conceptual mechanisms that potentially explain environmental output quality (mechanism clusters I–III, see chapter 2). Third, we assess actual implementation of plans in the studied sub-basins. Fourth, we return to explanatory mechanisms that address effective implementation (mechanism clusters IV and V).

From participatory processes to river basin management plans

Participatory processes, like those studied here, are always interwoven with a wider political context. When linking the various modes of participation in our cases to the different outputs, as depicted in Figure 7.2, it becomes apparent that a clear causal chain between process and outputs cannot always be firmly established. In fact, we may be able to discern a pattern, distinguishing cases that were soundly embedded within the broader water

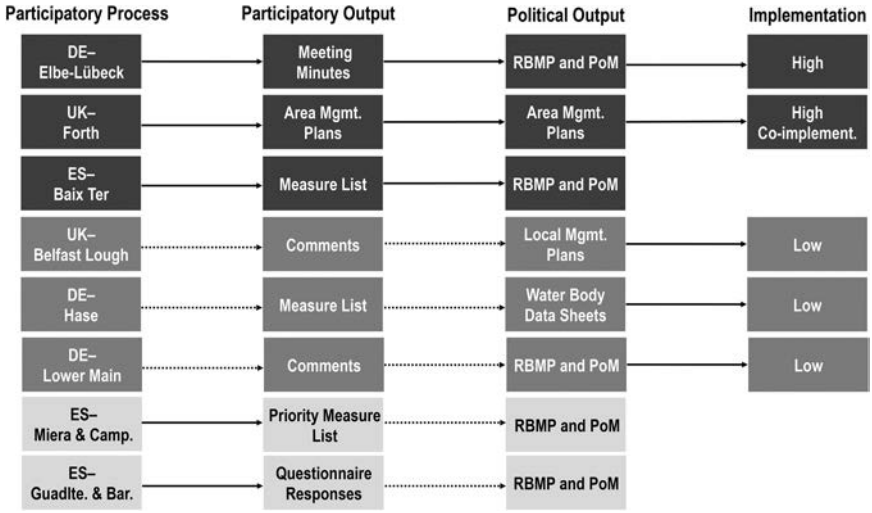

Figure 7.2 Participatory process output, political output and implementation

governance regime and which produced planning outputs with clear political relevance, from those where we find a disconnect in the chain between participatory process and the political decision or plan.

In Figure 7.2, we group cases according to the degree to which participation actually informed political outputs (plans) and implementation. The first group comprises the three 'more' participatory cases, Baix Ter, Elbe-Lübeck and Forth. In all of these cases, the participatory output clearly informed the political output, as proposed measures were included into RBMPs and PoMs, or into additional documents important for further planning. For the second group of cases, it was either unclear how the participatory output – the measures list produced in Hase and minuted comments in Belfast Lough and Lagan – informed governmental planning, or no participatory output was documented at all, such as in Lower Main. For further analysis of the latter three cases, we use the political output, while seeking to trace the likelihood and degree to which participant input during the participatory processes contributed to the respective political output. For cases of the third group – Guadalete and Barbate and Miera and Campiazo – it was possible to trace the participatory output; yet this was clearly disconnected from the political output.

To assess the quality of outputs, we considered (1) the extent to which measures targeted the main water management issues in the sub-basin(s), and (2) the 'implementability' of the measures, which we assessed as a combination of specificity and (where it was possible to determine) feasibility of measures, as well as the allocation of measures to specific institutions or

Table 7.2 Environmental quality of outputs from the case study processes

Case	*Output type*	*Water management issues*	*Implementability*
Elbe-Lübeck (DE)	Participatory/political output	Partly targeted	High
Forth (UK)	Participatory/political output	Targeted	Rather high
Baix Ter (ES)	Participatory/political output	Targeted	Rather high
Belfast Lough and Lagan (UK)	Political output	Targeted	Medium to rather high
Hase (DE)	Political output	Targeted	Low
Lower Main (DE)	Political output	Targeted	Low
Miera and Campiazo (ES)	Participatory output	Targeted	Medium
	Political output	Not targeted	Medium
Guadalete and Barbate (ES)	Participatory output	Targeted	Rather low
	Political output	Not targeted	Medium

actors responsible for implementation (see chapter 3). The results of this categorisation are displayed in Table 7.2.

In Baix Ter and Forth, the final plans targeted all the main water management issues, although diffuse pollution from agriculture was slightly underrepresented. The mostly generic measures were assigned to specific implementing actors; and time horizons for implementation (Forth) and anticipated impact (Baix Ter) were specified for each measure. In Elbe-Lübeck the agreed measures were specific and feasible, and implementing addressees were clearly identified. Although hydromorphological alterations, one of the main water management issues, were addressed, nitrate pollution, the second most urgent topic, was left out in Elbe-Lübeck.

In Belfast Lough and Lagan, participants' comments on the political outputs (i.e. draft Local Management Area Action Plans) are not publicly available, but there does seem to have been some degree of integration of participant input (see chapter 6). The plans target the main water management issues, identify actors responsible for implementation, and assign measures to specific water bodies. However, the plans comprise almost entirely soft measures, such as further investigation, assessment and awareness-raising campaigns. While such measures can potentially have a considerable effect, it is unlikely that they can tackle all relevant water management issues. Furthermore, it is possibly relatively difficult to determine when or whether mainly generic measures have been completed.

In Lower Main and Hase it is unclear whether and how comments made by participants, or the list of measures developed, really fed into the political

output. In both cases, political outputs targeted the most pressing water management problems, but they also had peculiarities that reduced the potential for implementation: In Lower Main, all actions targeting agriculture were made voluntary. In the context of a major long-running conflict between environmental groups and agriculture, environmental groups saw this as very one-sided in favour of agricultural stakes. In Hase the environmental agency developed data sheets in addition to the rather broad RBMPs, which clearly display measures in catalogue style. Stakeholders could select from this list under the same co-financing scheme that was already heavily criticised during the participatory process (see chapter 4). Due to the necessity for local stakeholders to select and co-finance measures, feasibility appears rather uncertain.

In the two Spanish cases Guadalete and Barbate and Miera and Campiazo, the participatory results in the form of questionnaire responses and a priority measure list targeted the main water management issues. Implementability was rather difficult to gauge, however, as in Guadalete and Barbate, the questionnaire format only allowed for respondents to prioritise measures within broad pre-given categories. In Miera and Campiazo, the University of Cantabria revised the highly generic measure list developed in the participatory process with regard to feasibility of measures, but rather with a view to long-run as opposed to short-run implementability.

In both cases, the political output did not draw on the participatory output. In Guadalete and Barbate the political output even contradicted the prioritisations in participants' questionnaire responses. In Miera and Campiazo the final RBMP, produced by the River Basin Organisation, showed a different inventory of water bodies, assessing better overall water status than the University of Cantabria had assessed in preparation for the process (CHCantábrico 2013). Additionally, the plan did not address industrial pollution to the same degree (ibid.). The global economic crisis of 2008–2009 severely affected Spain during the first WFD planning cycle, which may have constrained financing of measures. In Miera and Campiazo, however, the main reason for the disconnect between participatory and political outputs seems to lie in political struggles between the Cantabrian government and the River Basin Organisation, which is linked to the national government. The Cantabrian government changed in 2011, and the new administration did not appear to attach much importance to WFD participatory processes, as the Hydrologic Office for Participation was rapidly dismantled.

From the above discussion, we identified three cases (Baix Ter, Elbe-Lübeck, Forth) as the ones that produced outputs of a rather high environmental standard according to our assessment criteria. At the same time, these represent the cases with higher levels of participation. In the 'less' participatory cases (Belfast Lough and Lagan, Guadalete and Barbate, Lower Main) the main water problems were not targeted (Guadalete and Barbate) or implementability was rather low. In Hase, and Miera and Campiazo, two cases that included participatory venues conducive to discursive interaction,

the final outputs seemed not to draw on participant input. Final outputs were found not to genuinely tackle the main significant water management issues, and their implementability was low or uncertain. These results suggest that participation actually improved the environmental standards of decisions for WFD implementation. Below, we explore whether and how participation impacted on the environmental standards of planning outputs across our case studies, drawing on the causal mechanisms identified in chapter 2. In doing so, we seek to determine whether participation provides sufficient explanation for the environmental standards of planning outputs, and whether it actually functioned in an instrumental sense to enhance environmental effectiveness.

Causal mechanisms linking participatory processes and outputs

The first three mechanism clusters described in chapter 2 comprise various mechanisms that potentially explain how participatory decision-making impacts on the environmental quality of outputs. After exploring which mechanisms might have shaped the environmental standard of final planning documents in our eight cases, we summarise our findings.

Opening up decision-making to environmental concerns

Opening up participatory planning processes to a wider range of stakeholders may increase, or decrease the representation of environmental concerns (Smith 2003), depending on the relative capacities of stakeholders to participate, and the nature of the process (Johnston et al. 2011; Larson & Lach 2008).

M I.1a: *Opening up a DMP to non-state actors allows previously excluded groups, including environmental groups, to participate, thus increasing representation of environmental concerns in a DMP.*
M I.1b: *Opening up a DMP to non-state actors decreases representation of environmental concerns.*

In all cases, national implementation of WFD provisions required that decision-making or planning processes be opened up to societal groups, including those advocating for environmental issues. Nevertheless, process attendance by stakeholders representing environmental concerns varied. In some cases, process design choices such as the particular mode of invitation provide strong explanatory factors. Stakeholders' incentives to participate and the resources available to them were also important factors explaining their participation.

In those participatory processes with entirely open access, supported by concerted public outreach – i.e. Baix Ter, Miera and Campiazo – we

observed strong representation of environmental concerns: ENGOs that were participating for the first time in water management decisions actively attended the processes. In both cases scientists and academics, agency staff and civil society organisations that endorsed the so-called 'new water culture' paradigm (calling for sustainable water management) also attended. Extensive targeted invitation of stakeholders, in addition to the open call for participants, aimed to secure balanced representation of different interests and sectors. In those cases where participation was exclusively by invitation – Guadalete and Barbate, Elbe-Lübeck, Hase – selection rules assured representation of environmental advocacy groups. Despite this, representation in Guadalete and Barbate was eventually skewed towards larger administrative actors and entities.

Capacity to participate was further enhanced by the resources available to actors, and supporting mechanisms to assist less well-resourced stakeholders to take part. In the Baix Ter and Miera and Campiazo cases, access for a wide range of stakeholders (including those with limited resources, or not participating in a professional capacity) was supported through meetings held in the evening throughout the sub-basin. The mere invitation of environmental groups, however, did not ensure their strong representation at the table. In Hase, no local representative of an established ENGO willing to participate could be identified. Given that 30 area co-operations exist in Lower Saxony, it was difficult to find voluntary ENGO members to attend all of them (Koontz & Newig 2014). Another contributing factor was the timing of meetings, which were held as full-day events, making it difficult for non-professional stakeholders to attend. In fact, insufficient financial resources and personnel made it difficult for ENGOs to find capable representatives in several area co-operations in Lower Saxony (Newig et al. 2016). In Hase, ENGOs were eventually represented by a member of an angling association who, however, did not represent the full spectrum of environmental concerns. This did not occur in the Lower Main Regional Forum, in which the ENGOs seemed better resourced, as they attended the regional and federal state forums regularly. They continued to do so, despite the process organisers declining a request by participants for evening instead of afternoon meetings, to facilitate attendance by non-professionals.

Finally, stakeholders' incentives and motivation were also important determinants of their participation. In Elbe-Lübeck, meetings took place in a very local context, with locally based stakeholders, from noon or early afternoon on workdays, but stakeholders attended nonetheless. Taking part in decisions to improve water quality in their local rivers acted as a strong incentive for participants. Also in Baix Ter, and Miera and Campiazo, incentives to participate appeared rather strong for groups representing environmental concerns, which were enthusiastic to support the 'new water culture' paradigm embraced by the authorities in both autonomous regions.

In Belfast Lough and Lagan, and Forth, the incentive to take part in the participatory processes seems to have worked differently to the cases

discussed above. ENGOs were invited and did participate, but their involvement was less regular and relatively limited because other participatory venues (especially the national-level forums), formal public consultation processes, and direct lines of engagement with authorities were deemed more important and more effective than Catchment Stakeholder Group or Area Advisory Group processes. In Belfast Lough and Lagan, where ENGOs were largely absent, angling groups were the main advocates for environmental concerns alongside the environmental agencies.

To sum up, opening up of processes – including by active and targeted invitation of stakeholders – led, in most cases, to enhanced representation of environmental concerns (M I.1a). Even where ENGOs preferred different participatory venues, such as in Belfast Lough and Lagan, representation of environmental concerns was brought into the debate.

Representation of environmental concerns in decision-making does not automatically impact positively on the quality of outputs. Hence, the second part of the mechanism chain can work in two directions, as increased representation can either strengthen (Brody 2003) or weaken environmental advocacy (Whelan & Lyons 2005), which in turn influences the environmental standard of final decisions:

M I.2a: *Increased representation of environmental concerns in a DMP fosters environmental advocacy, impacting positively on the environmental quality of the output.*

M I.2b: *Increased representation of environmental concerns in a DMP weakens the position of environmental groups vis-à-vis other actors, impacting negatively on the environmental quality of the output.*

Environmental advocacy was observed in all of our cases, but the influence this had in shaping outputs was in large part dependent on the environmental orientation of the agency organising the process, the actual influence of participants over final decisions, and the perceived impact of the output by participants.

In the Belfast Lough and Lagan, Hase and Lower Main processes, participants do not appear to have had any considerable direct influence over decisions that shaped the final outputs. Environmental interests were strongly asserted in opposition to agriculture (Lower Main), and locally-based groups such as angling groups were very active and highly vigilant on water quality and river ecosystem health (Belfast Lough and Lagan), but this was apparently not reflected in subsequent planning (Hase, Lower Main), or only partially reflected (Belfast Lough and Lagan). In Guadalete and Barbate, environmental concerns were incorporated via multi-stakeholder meetings for civil society stakeholders. Participants' input from one of these meetings, for example, where stakeholders responded to a questionnaire on measure prioritisation, was visibly not taken into account for the final plan.

In those cases where participants were able to directly influence and shape the planning outputs, environmental concerns were also represented in the planning documents. In Miera and Campiazo, environmental concerns were clearly reflected in the priority measure list generated through the participatory process, and in Baix Ter, Elbe-Lübeck and Forth, advocacy appears to have fed into the final RBMPs and programmes of measures for the sub-basins. Nonetheless, in both Spanish cases the administration and process organisers were clearly in favour of a shift in water management towards more sustainable solutions, and therefore open for participants' advocacy and proposals in this direction. However, in Miera and Campiazo, the strong environmental orientation of the participatory output may be strongly related to its symbolic nature: In the final stages of the participatory process, opposing groups from industry had only agreed on the priority measures list because of assurance from the process organiser that it would remain rather symbolic – as the whole participatory process was organised voluntarily by the Cantabrian government and was not mandated.

The Elbe-Lübeck case exemplifies how this mechanism can work in both directions. While ENGOs were particularly active in addressing hydromorphological issues, including connectivity, and this was clearly reflected in the agreed list of actions, the pressing issue of nutrient pollution from agriculture was left out of discussions and therefore not addressed in the output. The main reason for the avoidance of the nutrient pollution issue seems to have been the emphasis that was placed on 'reasonable engagement', and the trustful setting that developed over several years of on-going interaction in the working group. In this setting, also environmental interests subscribed to the general spirit of planning feasible and readily implementable measures, leaving aside the more conflictive – but nonetheless highly pressing – issue of agricultural nutrient pollution. ENGOs at the federal state level did critically question the state-wide disregard of the nitrate problem (NABU 2010), which further suggests that some degree of co-optation of ENGOs occurred within the working group process (M I.2b).

Reviewing the overall evidence on mechanism cluster I, we observed in our cases how the opening up of processes also brought environmental interests to the table that contributed to higher environmental standards of the outputs of participatory processes. However, in cases where participants were allowed only very limited influence over decisions, other political interests often outweighed environmental interests. Further, we identify several important factors influencing the trajectory of environmental advocacy, including the commitment and orientation of the organising agency, the extent to which the output is symbolic in character, as well as the general working atmosphere in which co-optation of environmental groups appears to have weakened their resolve to enforce stringent measures.

Incorporation of environmentally relevant knowledge

Participation can contribute to a high environmental standard of the output through bringing relevant knowledge into the process, by (1) involving actors familiar with the issue at hand (Wynne 1992), and (2) improving understanding of the issue at hand (Laird 1993).

M II.1: *Involving actors directly occupied with the environmental issues at hand in decision-making leads to a higher degree of environmentally relevant knowledge and knowledge relevant for implementation being made available to the DMP.*

M II.2: *Participation improves participants' understanding of the issues at hand, increasing the likelihood of them providing constructive, environmentally relevant input.*

M II.3: *A higher degree of environmentally relevant knowledge made available to a DMP leads to higher environmental standards of the output.*

Similar to the previous cluster, in the cases in which participants had no clear influence over final decisions (political output), we did not observe any link between environmentally relevant knowledge brought into the process, and an output (Guadalete and Barbate, Hase, Lower Main). Here, process organisers did not view participants as having provided much useful input (Lower Main, see chapter 4), or they perceived participant input into planning in general as not very useful (Guadalete and Barbate, see chapter 5). Participants, for their part, were of the opinion that their input was not taken on board for further planning, and that individual learning through improved understanding of the positions of other actors or the administration did not occur.

Across cases, we observe a variety of environmentally relevant knowledge held and contributed by participants with different 'knowledge backgrounds'. These included organised stakeholders living in the sub-basin with knowledge on local rivers and lakes (Elbe-Lübeck, Belfast Lough and Lagan) and professionalised stakeholders engaged in different capacities in water resource management (Forth). In the Spanish cases Baix Ter and Miera and Campiazo, wide participation led to a diverse knowledge pool, including stakeholders already familiar with water quality measures, for example.

In several cases (Baix Ter, Belfast Lough and Lagan, Elbe-Lübeck, Forth, Miera and Campiazo) process organisers valued the context-specific knowledge that participants brought to the table, and used it to further inform decision-making. Process organisers usually noted that stakeholders had raised important issues which had not previously been considered.

However, in order for additional knowledge to contribute to the environmental quality and implementability of political outputs, process characteristics of interaction and dialogue between different knowledge types played a crucial role.

In the Spanish cases Baix Ter and Miera and Campiazo, process organisers were frequently surprised by the useful lay-local knowledge brought in by rural stakeholders. In both cases, however, participants criticised a lack of knowledge exchange with experts. Proposed measures were not checked for feasibility until after the participatory processes, which had considerable consequences for the output, as measures tended to be mainly generic and unrealistically ambitious in terms of financing (in Baix Ter, and even more so in Miera and Campiazo). This lowered the overall implementability of outputs.

In Elbe-Lübeck and Forth, on the other hand, exchange of local and expert knowledge took place to a much greater extent during the participatory process, which seems to be reflected in the respective outputs: In Elbe-Lübeck a steady dialogue evolved between engineers, biologists and local stakeholders, which appears to be mirrored in the concrete, place-based and feasible output measures. In Forth, the aggregation of knowledge held by a variety of actors engaged in water projects on the ground, contributed to the formulation of implementable measures.

Overall, then, in the cases in which participants were able to influence final decisions (Baix Ter, Elbe-Lübeck, Forth, Miera and Campiazo), relevant additional knowledge (i.e. regarding aspects or issues not known or understood by the administration) impacted positively on the standard of the output (M II.3). Particularly the exchange of different knowledge types, however, seemed to enhance the output through the development and integration of knowledge relevant for the formulation and implementation of measures.

The second mechanism chain describes the development, over the course of the process, of improved capacities among participants to deal with the issues at hand. This should, in theory, enable individual participants and the whole group to arrive at more ecologically sensitive decisions, thus enhancing the overall environmental standard of the output (M II.2 and M II.3). Mechanism II.2, however does not seem to have been overly relevant to the studied cases. Participants in Baix Ter, Elbe-Lübeck, Forth and Miera and Campiazo – and in Belfast Lough and Lagan to some extent – felt that they had learned individually about water resources management. Yet, interviewees described their improved understanding primarily as an outcome of the process, rather than a basis on which they built proposals for new measures within the process. Only in Elbe-Lübeck, where the processes evolved intensively over several years, were improved understanding of, and learning about, more sustainable measures reported. The process organiser highlighted long-running, iterative engagement in the working group as having been instrumental for the development of outputs of a higher environmental standard.

To conclude, it seems that additional knowledge held by participants contributed positively to the environmental standards of outputs in those cases where this knowledge was exchanged via on-going dialogue with

practitioners or experts (Elbe-Lübeck, Forth). Where this direct and steady exchange did not happen, planned measures were often not implementable. As before, participants' actual influence over the output appears to be a necessary pre-condition for this mechanism to work. Individual capacity building, however, appeared to be linked with the duration of the participatory process. In processes running over a shorter timeframe, participants' improved understanding of the environmental issue did not seem to enhance actual planning.

Group interaction, learning and mutual benefits

Whereas the first and second mechanism clusters describe the effects of participation in a more 'additive' logic (wherein participants bring in advocacy or knowledge individually), the third cluster engages with discursive interaction. Different styles and intensities of communication can evolve during group discussion in participatory processes, and impact on the environmental quality of process outputs.

M III.1: *A DMP characterised by a higher degree of communication and bargaining is more likely to lead to the identification of mutual gains than a DMP with little or no communication and bargaining.*

M III.2: *A participatory DMP characterised by open dialogue more likely leads to the development of creative and innovative solutions to environmental problems than one without open dialogue.*

M III.3: *A deliberative participatory process setting is more likely to produce an orientation of participants' views towards the common good, and therefore more likely to produce outputs more favourable to the environment, than a non-deliberative DMP.*

Discursive interaction, which is the basis for the mechanisms in this cluster, was observed to some degree in five of our cases (Baix Ter, Elbe-Lübeck, Forth, Hase and Miera and Campiazo). In the other cases, intensive communication in the sense of negotiation, open dialogue or deliberation was not observed, or was found only to a very limited degree. In Belfast Lough and Lagan, the original terms of reference (NIEA 2008) implied more interaction, but the actual process did not exhibit this.

By negotiating preferences and stakes within an intensive face-to-face dialogue, participants can identify mutual gains or shared preferences (Ansell & Gash 2008; Emerson & Nabatchi 2015), which can be beneficial for the standard of outputs (M III.1). Deliberation goes even further, as the 'best' argument succeeds in a rational, transparent discourse, potentially transforming participants' views towards a common good orientation in relation to the issue at hand (M III.3) (Fung & Wright 2001; Webler & Tuler 2000; Smith 2003). In our cases, we saw, that providing a space for discursive interaction appeared not to automatically lead to negotiation or

deliberation; again the process design defining this space played an important role.

The Baix Ter and Miera and Campiazo cases (Spain) and the Forth case (UK) illustrate how negotiation and deliberation were essentially ruled out by design. In Baix Ter and Miera and Campiazo, forums and meetings gave ample space for participants to bring in proposals, but actual discussion was limited. Participants prepared their points of view and planning input in sectoral or geographically separated meetings. Prior to the final multi-stakeholder forum, in which measures were prioritised, all proposed measures were collected and aggregated. In both cases professional facilitation was used in the final meetings, but no actual mediation of interests or stakes was sought. The aim was to achieve diversity in opinions and proposals, rather than consensus. Large participant groups certainly made intensive and interactive communication more difficult in both cases. The sectorally separated meetings and the way in which participants' proposals were aggregated hardly provided for a communicative space to learn about other interests and to engage in a wider discussion to find common ground and compromises between conflicting interests. This is particularly clear in the case of Miera and Campiazo, where the tension between divergent ideas and viewpoints could only be accommodated after the process organiser confirmed the symbolic nature of the measure list. In this way, no actual negotiation was needed to identify mutual gains or engage in an intensive dialogue to understand others' preferences. The 'wish-list' character of the final output seemed to reflect this. Similarly, in Baix Ter, the main water conflict over water allocation in the sub-basin and inter-basin transfers to the Metropolitan area of Barcelona was circumvented through a one-sided discussion that excluded representatives of Barcelona. However, given the absence of the main water users, it was not realistic that this decision would be implemented without further protest; the agreement rather postponed decisions on how to achieve this goal.

In Forth, the relatively high environmental standard of the output seemed not to have emerged through discursive interaction: Meetings were run as a combination of the presentation of information by the environmental agency and the identification of important stakeholder projects already happening on the ground. For this reason, it was not necessary to start with a new negotiation on mutual gains regarding new proposed actions, as the environmental agency drew on already existing initiatives. Also framing of the discursive space (i.e. discussion leeway) mattered for intensive communication on environmental issues. In Hase, the whole discussion shifted towards financial issues, as participants disagreed with the requirement to co-finance proposed measures. Area co-operations were planned as highly dialogical forums – similar to the Elbe-Lübeck process – and the communication style also seemed to evolve this way at the beginning. However, after conflict arose and could not be resolved, the general mode

of communication shifted towards a one-way flow of information from the side of the environmental agency.

Deliberation did not develop in Baix Ter, Forth, Hase or Miera and Campiazo. The Elbe-Lübeck process came closest to this ideal (M III.3), as the working group process design allowed for most dialogical interaction among our cases. The multi-year, intensive process with only relatively few participants offered space for dialogue, and for participants to enter into a conversation about different viewpoints that finally led to the vast majority of decisions being taken by consensus. This seemed clearly to lead to decisions with a high environmental standard. Yet, as stressed above, the main potential conflict around agricultural pollution was largely excluded from the discussion. Addressing this topic would have required considerable compromise, as agricultural stakes would have been directly affected (through, for example, requirements to adopt more sustainable management techniques). The environmental quality of the planned measures arguably mirrors this approach, as mainly hydromorphological measures were included.

Mechanism III.2 postulates that open dialogue can produce creative, innovative solutions to the environmental issue at hand as a result of participants' mutual learning through an intensive exchange of perspectives, information and knowledge (Fazey et al. 2013; Heikkila & Gerlak 2013). Participants in Baix Ter, Elbe-Lübeck, Forth and Miera and Campiazo highlighted group learning on more sustainable water management. Yet, in line with our findings above on individual capacity building, group learning – even where we did observe it – did not enhance the environmental standard of the output, as group learning seemed not to shape participant input in such a way as to generate innovative measures and solutions. ENGO participants in Miera and Campiazo, as well as in Elbe-Lübeck, who were open to trial-and-error pilot actions, even stressed that other participants preferred established measures, and did not value discussions which could potentially lead to improved learning and ultimately foster innovative ideas.

Overall, in the cases that displayed two-way communication and procedural fairness through provision of a safe space for participants to speak freely (usually supported by facilitation), discursive interaction actually occurred. Particularly in Elbe-Lübeck, common understanding developed among participants through repeated interaction led to comprehensive engagement with one of the main water problems in the sub-basin. In Baix Ter, Forth and Miera and Campiazo the decisions taken in the participatory processes targeted all main water issues. Nonetheless, in all cases conflicts that would have required a genuine mediation of stakes, or the identification of mutual preferences, were deliberately or strategically avoided. In Baix Ter, Forth and Miera and Campiazo intense discussions were largely precluded by virtue of the process design, and in Elbe-Lübeck

by avoidance of one of the main conflicting issues. The Spanish cases show in addition the trade-off between inclusive meetings with many participants, and intensive communication. The timeframe, with 14 to 15 meetings over just three months, appears to have further limited in-depth discussion of topics in both cases.

Participants in all four cases discussed above reported that collective learning on the topic of sustainable water management had taken place. This was not reported by participants in the cases with less communicative interaction. Nevertheless, learning appeared to be a process outcome rather than a step towards sustainability innovations (mechanism III.2) within the process. Again, an open, fair space for dialogue (even in a case with long-term engagement and intensive communication, such as in Elbe-Lübeck) did not automatically induce mutual learning to drive innovation.

Distilling the case evidence: which mechanisms linking participation with environmental outputs *matter most?*

We found that in all cases the identifiable participatory output met our proposed criteria for environmental quality: Measures targeted important water management issues in the sub-basins, and the 'more' participatory cases mostly generated likely implementable measures and plans. In the 'less' participatory cases, participatory outputs were generally not identifiable, and agreed measures were integrated into the final plans in only the three 'more' participatory cases (Baix Ter, Elbe-Lübeck, Forth). In Hase and Miera and Campiazo, where participants had a final say over decisions according to the process design, final plans seemed not to draw on the input of participants. Therefore, all but the 'more' participatory cases (Baix Ter, Elbe-Lübeck, Forth) did not delegate power to participants to any great extent. This was true for the process design in some cases, and for the actual delivery of decision-making processes. Power delegation to participants through the genuine incorporation of participant input into the output constitutes a crucial pre-condition for a positive effect of participation on the output. These effects appeared rather positive in the cases in which participatory process results were taken into account in the final output. While these outputs were of a rather high environmental standard according to our definition, we found that the 'less' participatory processes tended to produce outputs for which implementability was doubtful. In the two cases in which the outputs of participation did not flow into the final plans, the latter tended to exhibit a lower environmental standard.

The central question that emerges from this is whether the standard of the outputs observed in our cases can be explained by stakeholder participation. Through exploring the different mechanisms that potentially link participation to enhanced environmental quality, we identified likely explanations for plan quality.

First, we saw that the opening up of processes actually led to environmental advocacy that impacted on the output – in those cases in which participants had influence over decisions (Baix Ter, Elbe-Lübeck, Forth, Miera and Campiazo[2]). However, the mechanism chains showed important nuances, in that various incentives and the resources available to stakeholders matter to stakeholders' participation in the respective processes. Commitment and environmental orientation of the organising agency had an important effect on the integration of environmental advocacy into decisions. Nonetheless, environmental advocacy did not necessarily extend to all water management problems, as seen in the Elbe-Lübeck case.

Second, we found that knowledge brought into the processes also improved the environmental standard of outputs. Particularly in the cases, in which an exchange of lay-local and expert knowledge was part of the process, the environmental standard and implementability of outputs appeared to be rather high (Elbe-Lübeck, Forth). In the cases, in which knowledge was brought in without that interaction, measures seemed difficult to realise (Baix Ter, Miera and Campiazo).

Third, in five cases (Baix Ter, Elbe-Lübeck, Forth, Hase, Miera and Campiazo), participatory venues afforded space for discursive interaction. Only in Elbe-Lübeck did the mode of communication approach deliberation. Through long-lasting engagement in Elbe-Lübeck, constructive discussions developed, which led to consensus-based measures that clearly addressed the main water problems in the sub-basin. In the remaining four cases, discussion aimed at realising mutual preferences or developing a common understanding on the issue at hand appears not to have shaped the output to a similar degree. Intensive discursive interaction was precluded by the process design in three cases, as emphasis was put on collecting proposals (Baix Ter, Miera and Campiazo), or information on pre-existing projects on the ground (Forth), which did not require mediation of stakes. In these cases, environmental advocacy and knowledge brought into the process offer more plausible explanations for the high environmental standard of the output than discursive interaction.

In the three cases of processes designed predominantly on the basis of one-way information flow and low participant influence on decisions (Belfast Lough and Lagan, Guadalete and Barbate, Lower Main), the respective environmental agencies generally controlled final decisions, which frequently blocked or significantly limited integration of participants' input into final planning. While environmental advocacy by participants appears to have occurred in these processes, this did not tend to have a notable impact on final decisions. This was observed in particular in Guadalete and Barbate, as final planning measures contradicted the decisions taken by participants that would have enhanced the environmental quality of the plan. In Belfast Lough and Lagan, however, a small number of measures were added to the final plans on the basis of participants' comments and suggestions.

From participatory processes to actual implementation

Having examined the paths by which participatory processes informed outputs, we now examine the link between participation and actual implementation. In only five of our eight cases did the implementation of measures actually take place (see Figure 7.2). In three of these, implementation was rather limited (Belfast Lough and Lagan, Hase, Lower Main), and in only two cases (Elbe-Lübeck, Forth) did substantial implementation occur.

Substantially more measures have been implemented in Elbe-Lübeck and Forth than in the other cases. Elbe-Lübeck employed an early implementation strategy, initiating actions even before the issuing of the first RMBP. Measures decided on in the working group process were steadily implemented. In Forth, a co-deliverer model did stimulate a shared sense of purpose in tackling water problems, and fostered on-going implementation from the side of both the agency and stakeholders.

In Belfast Lough and Lagan, Hase and Lower Main, measures were implemented, but to a minimal extent or at a slow pace. In all three cases, implementability of actions was assessed as being rather low, as described above. In Belfast Lough and Lagan, it is not clear whether a lack of resourcing decelerated implementation, or whether the mainly generic measures simply afforded the authorities a great deal of leeway in terms of where implementation is focused. Increased co-operation between authorities and local stakeholders did, however, appear to strengthen existing local projects.

In Spain, there was almost no implementation. In all cases, the RBMPs from the second WFD planning cycle (to 2015) were rather disconnected from the first-cycle plans, and there did not appear to be much continuity in planning efforts from the first to the second cycle, including the implementation of measures identified during the first cycle. This should be seen in light of the fact that the governments of all Autonomous Communities changed following issuance of the first-cycle plans. Interviewees indicated that WFD planning was effectively begun anew, rather than drawing on the processes established in the first planning cycle.

We also observed social outcomes that potentially increased stakeholder acceptance and ownership of decisions, as well as action on the ground, and were therefore conducive to implementation. In Elbe-Lübeck we saw that organised excursions to sites where the impacts of actions such as the replenishment of fish stocks were observed, fostered a common sense of purpose and group learning among participants that arguably boosted motivation to continue with such measures. In the UK cases, we observed the strengthening of ties among stakeholders and the emergence of networks stimulating implementation. In Belfast Lough and Lagan, some stakeholders even stopped attending the process in order to devote their efforts to implementing local projects. In Hase and Lower Main networks developed, but without them taking over implementation tasks.

Causal mechanisms linking participatory processes and environmental outcomes

Mechanism M II.4 links relevant knowledge incorporated into the final output, with improved implementation (Ulibarri 2015):

> **M II.4:** *Environmentally relevant and implementation-relevant knowledge included in a decision makes implementation of the decision more likely.*

As discussed above, in Elbe-Lübeck and Forth, the only cases displaying a high degree of implementation, proposed measures or projects were constantly 'cross-checked' through a process of exchange between lay-local and professional/expert knowledge, which seemed to favour local-level implementation.

In Baix Ter, the third of the 'more' participatory cases, there was a clear implementation gap. One process design feature was that environmental agency personnel representing different fields of expertise could give input on measures proposed by participants in each meeting session. Some participants claimed, however, that these experts were mainly ecologists, and not well versed in the financial implications of measures. Although this may be overstated, the potential for implementation by the water agency (as the main implementer) does not seem to have been an important topic during the meetings. New measures brought into the process, based for example on lay-local knowledge, did not have to undergo a feasibility check during discussion. This case suggests that environmentally relevant knowledge brought into the process cannot necessarily be equated with implementation-relevant knowledge.

Acceptance for implementation

In addition to implementation-relevant knowledge, stakeholders' acceptance of the process and resultant output can support implementation of, and compliance with, decisions:

> **M IV.1:** *A higher degree of participation leads to the accommodation of more diverse interests in the output, which increases acceptance by stakeholders.*
>
> **M IV.2:** *A DMP that is perceived as fair and legitimate is likely to be accepted by participants, their respective constituencies and other stakeholders.*
>
> **M IV.3:** *Raising stakeholders' awareness of issues, and their involvement in decision-making, leads them to consider possible negative effects of decisions and thus increases opposition to environmentally beneficial measures.*

M IV.4: *The greater the degree of acceptance by stakeholders, the higher the likelihood of implementation and compliance.*

Acceptance can emerge through stakeholder satisfaction with the process output where this output reflects stakeholder interests and priorities (M IV.1) (Brody 2003; Newig & Kvarda 2012), or through satisfaction with the process itself, where it is seen as fair and just (M IV.2) (Susskind & Cruikshank 1987; Webler & Tuler 2000). Acceptance may be important on the one hand when stakeholders also have a role in implementation, and on the other hand for reducing the likelihood of stakeholders obstructing implementation (e.g. through litigation). In our cases, the German and UK processes involved participants that were expected to implement or co-implement measures. Both mechanisms (M IV.1 and 2) appear interrelated, as exemplified in those cases in which both output and process were accepted (Elbe-Lübeck, Forth). In all three Spanish cases, responsibility for implementation did not lie with process participants. Dissatisfaction with outputs did not lead to litigation, which seemed to be linked in particular to process acceptance.

In Elbe-Lübeck, the decision mode, which sought unanimity among participants, excluded by design measures that were not accepted by all participants. Participants appreciated this procedure, even if it meant making compromises in terms of what issues could be addressed. Interviewees also identified fair procedural rules, on-going facilitation and early involvement of participants as very important. These process features formed the basis for participants to interact effectively and arrive at highly implementable measures that ultimately led to action on the ground. In addition, the fact that stakeholders were able to observe tangible results in local rivers (e.g. through organised excursions) arguably encouraged on-going implementation. Similar tendencies could also be observed in Forth: Apart from the general acceptance of process and outputs, stakeholders' being able to witness actual environmental improvement was important in maintaining their commitment to implementation.

Implementation was not aided by widespread acceptance to a similar degree in the remaining cases in which stakeholders were also responsible for implementation (Belfast Lough and Lagan, Hase, Lower Main). In all three cases, neither output nor process was unequivocally accepted by all participants. Despite being able to voice their concerns and interests during the process, some participants in the Hase, Lower Main and Belfast Lough and Lagan cases saw these as having been misrepresented in the final output, which served to lower acceptance of outputs. Processes were perceived by some as unfair (Belfast Lough and Lagan, Lower Main) and most participating stakeholders were critical of the predominantly top-down flow of information, which limited possibilities to bring in stakeholder views (Belfast Lough and Lagan, Hase, Lower Main). However, dissatisfaction with processes or outcomes did not lead to any actions to change the output or block its implementation. In Hase, participants were very critical of the

requirement to co-finance any measures they proposed. While this did not seem to trigger opposition to environmentally beneficial decisions, it did not motivate stakeholders to implement measures either.

In the Spanish cases, in which implementation almost exclusively lay in the hands of the administration, participants were sometimes dissatisfied with the process and output, but did not attempt to block decisions. In particular the Miera and Campiazo process, which was widely perceived as fair and just, generated high acceptance by participants. Even though participants' concerns that were brought into the output were not reflected in the final RBMP, stakeholders did not protest or attempt to block this plan, but highlighted instead how much they valued having an opportunity to have a say. Those who saw the process as legitimate valued it more highly than the actual results. In Baix Ter, some stakeholders were frustrated as the agreed outcomes were not implemented. These stakeholders, usually with strong stakes, did not take part in participatory processes in the next WFD planning cycle. Although it is postulated (e.g. Coglianese 1997) that, stakeholders' involvement in decision-making leads to the realisation of potential negative effects, which can eventually impede acceptance, we did not find evidence for this mechanism (M IV.3).

In conclusion, in the cases in which stakeholders were responsible to a certain degree for implementing actions agreed in the participatory process, the combination of process (M IV.2) and output acceptance (M IV.1) supported on-going implementation. In none of our cases did we observe participation having provoked the formation of new coalitions of actors in opposition to, or attempting to block, implementation.

Capacity building for implementation and compliance

Participation can also produce social outcomes conducive to implementation. Networks built up through participation, or improved understanding of the environmental issue among actors responsible for delivering actions, may aid implementation and compliance. Actors may even develop a sense of ownership and motivation that can induce voluntary action.

> **M V.1:** *Participation of policy addressees in decision-making improves implementation and compliance.*

Through involvement in decision-making processes, actors responsible for implementation may gain know-how and capacity for better implementing decisions or outputs (Brody 2003; Innes & Booher 2004). They can come to better understand the issue at hand, and recognise possible barriers to implementation. In addition, they may develop a sense of decision ownership, and thereby be motivated to implement actions.

In the UK cases, the processes specifically targeted potential delivery partners or co-deliverers. In Belfast Lough and Lagan, as well as Forth, many

participating stakeholders were already engaged in water-related projects prior to the participatory process, and therefore already had a rather good appreciation for realising actions on the ground. In these processes, a sense of ownership over projects or actions was genuinely built up with particular stakeholders through early involvement or direct engagement on the ground. The administration's acknowledgement of and support for pre-existing and on-going projects appears to have motivated stakeholders further.

Participants of the Elbe-Lübeck working group developed a good understanding of, and a sense of ownership for, hydromorphological measures in the sub-basin. Stakeholders implementing measures, in particular the Water Board (representing landowners and chairing the process), were involved early on via monthly meetings. The visible progress that was made through measures agreed and implemented by the participants, such as the replenishment of fish stocks, motivated on-going implementation.

The same degree of ownership for projects did not evolve in those cases where co-implementers were not engaged and supported during the processes. In Hase, stakeholders responsible for implementation were involved early on. Apart from the refusal by the environmental ministry, discussed above, to revise the financing structure for implementation of measures, there was apparently minimal support from the side of the administration, as the process chair himself complained about the overwhelming amount of information that had to be processed and the high workload, which overall hampered participants' motivation for implementing measures. In Lower Main, the administration relied heavily on voluntary implementation of measures to tackle agricultural pollution. Various high-level representatives of agricultural groups and individual farmers were at the table in the Regional Forum. Yet, actual implementation on the ground seems to have been minimal. Programmes outside of the process offered voluntary consultancy to farmers, but appeared not to be used to a great extent. As with the Elbe-Lübeck case, where the approach to addressing agriculture was mainly sought outside of the process, stakeholders within the process did not function as multipliers to spread information or gain support from farmers.

Although in the Spanish cases, processes were rather oriented towards consultation and the development of strategies of action for the administrations of the respective Autonomous Communities, stakeholder understanding for agency work increased over the course of the participatory processes in Baix Ter and Miera and Campiazo.

In addition to actors formally responsible for implementation, participants may come to realise that they can achieve common goals more easily through collective action (Emerson & Nabatchi 2015; Poocharoen & Ting 2015).

M V.2: *Participation fosters the formation or strengthening of networks among participants, which leads to improved implementation and compliance.*

This was observed in our cases inside and outside of the participatory processes, and depended on several factors, including the degree of participants' satisfaction with the process, support for network building by process organisers, and the perceived importance of the participatory venue by participants.

In the UK, the co-deliverer model strengthened networks and contacts. In Forth, we observed what may be the early stages of an implementation network involving administration and stakeholders engaged in concrete projects for the implementation of measures. In Belfast Lough and Lagan, in contrast, particularly the slow rate of implementation by the administration seemed to motivate co-operation in joint activities, such as monitoring activities, by local stakeholders. Not all stakeholders deemed the Area Advisory Group process in the Forth or the Catchment Stakeholder Group in Belfast Lough and Lagan important enough to devote a lot of resources and attention to. Some larger ENGOs and agricultural groups, for example, opted to pursue their interests primarily through alternative venues or at other (e.g. national) levels. This did not appear to hamper implementation activities in general however.

In the remaining cases, we see network formation as strongly related to the way in which participants were able to voice their concerns and be part of decision-making, and ultimately to the acceptance of processes and outputs. In Elbe-Lübeck, Baix Ter and Miera and Campiazo, where stakeholders were given ample opportunity to express their concerns, no new networks emerged. It appears that the possibility to voice opinions, and then to have these also taken into account in subsequent planning, was a highly appreciated aspect of these processes, and a significant contributor to participants' satisfaction with the process. In Elbe-Lübeck and Forth, in addition, implementation activities by stakeholders of the working group were on-going.

In the cases with relatively limited communication, and where participants' influence over decisions was low, network formation was more pronounced. Participants engaged with already existing networks outside the process (Guadalete and Barbate), or formed new networks with stakeholders in other sub-basins (Hase). Under these conditions, stakeholders sometimes only remained in the processes in order to improve their ties to other stakeholders or the administration (Guadalete and Barbate, Lower Main). In all three of these cases, participants were not satisfied with the process, and were therefore searching for alternative venues and strategies by which to exert influence both inside and outside of the participatory processes.

To sum up, the involvement of implementing addressees in decision-making improved implementation activities (M V.1) in those cases in which actors responsible for implementation were involved early on, where a sense of ownership over measures and actions developed, and where actors were already engaged in water management projects that were recognised or supported by the administration. The degree of support by process organisers

and the administration was rather important, as reliance on stakeholder-led implementation without further support led to a sharp decrease in participants' motivation. Networks for implementation (M V.2) were only built up or strengthened in cases in which this was part of the planned approach, such as in the UK cases, or in cases in which participants were rather frustrated with the process, and searched for alternative avenues for action.

Distilling the case evidence: which mechanisms linking participation with implementation *matter most?*

In only two of our eight cases, did we observe high levels of measure implementation. Both of these were cases we had identified as 'more' participatory (Elbe-Lübeck, Forth). Belfast Lough and Lagan, Hase and Lower Main, which were not characterised by the same high levels of participation, showed slightly or substantially lower implementation. In the Spanish cases, there was almost no implementation. This implementation gap seems, however, to be connected to government change in the Autonomous Communities. Nonetheless, we included these cases whenever they potentially illuminated important aspects of the link between mechanisms and outcome. As above with our mechanism clusters explaining outputs, below we discuss the different mechanisms linking participation to environmental outcomes in order to see which of them might have played a greater or lesser role in stimulating implementation in our cases.

Capacity building for implementation was an important – and perhaps the most important – mechanism driving implementation. In Elbe-Lübeck, early, repeated involvement of policy addressees (that is, actors responsible for implementation), an on-going, practical implementation approach, and agency support for this effort provided favourable conditions for pro-active involvement of stakeholders in implementation. Similar findings emerged in Forth, especially as participants were already involved in a range of water management initiatives and projects, but without being necessarily linked directly to the environmental agency. Also, stakeholders in Belfast Lough and Lagan engaged in pre-existing implementation actions and sometimes even opted out of the participatory process in order to pursue implementation independently or in bilateral collaboration with the environmental agency. These findings show that the involvement of policy addressees is not only helpful for advancing implementation through improved understanding of the issues at hand, but that on-going involvement in carrying out actions on the ground (through directly implementing activities or regular observation of results) can create a sense of ownership and motivate further implementation.

Knowledge relevant for implementation did actually improve the application of measures on the ground. In Elbe-Lübeck and Forth, knowledge developed through close interaction among stakeholders with different backgrounds and expertise fed into final measures that could be and were

being implemented. In cases where this cross-check via knowledge exchange did not take place (Baix Ter, Miera and Campiazo), proposals were not necessarily implementable.

Elbe-Lübeck and Forth were also the only cases in which acceptance of process and output for improved implementation could be clearly observed. Acceptance in this context took the form of a pre-condition for implementation, rather than an actual driver of implementation. Particularly process delivery proved important: Stakeholders were frequently dissatisfied with the process providing little scope to influence decisions. And where stakeholders perceived the process to be dominated by one-way information flows coming from the process organisers, and with limited possibilities to voice their own opinions, there seemed to be less motivation to implement measures than in cases where participants were satisfied with how the process was run.

In cases where participants were not satisfied with the process and/or its outputs stronger bottom-up tendencies among participants to establish or strengthen contacts and networks were observed. These networks, however, did not imply voluntary measure implementation. In the UK cases, the co-delivery approach that was actively pursued by the environmental agency actually supported and strengthened network building for implementation, as discussed above. In this regard, whether or not participants perceived the participatory process as relevant, and as the most effective venue for their purposes, was important.

In conclusion, our analysis of the influence of participation on outputs and outcomes has shown an overall tendency for cases with higher power delegation and intensive communication to contribute to environmentally effective water resources management, in that they successfully balanced environmental quality and implementability of outputs (Elbe-Lübeck, Forth). Cases where processes allowed for discussion, but in large forums in which proposed measures were eventually collected rather than discussed (Baix Ter, Miera and Campiazo) displayed high environmental standards of the output, but at the same time measures that were rather difficult to implement. In the remaining cases, where communication and power delegation did not evolve to the same extent, participants were less able to shape processes and outputs, and the link between participatory process and action on the ground was not observed. This includes cases where mainly information provision and consultation were applied during the actual process (Guadalete and Barbate, Lower Main, Belfast Lough and Lagan, Hase), and that genuinely were run in a way that opened up space for dialogue with the possibility of input, but ended in decisions not being taken up in further planning (Miera and Campiazo). The environmental impact of these processes therefore remained rather limited.

Independently from the qualitative analysis conducted above, a semi-quantitative coding of our case studies produced consistent findings: Figure 7.3 presents results of the case coding in relation to overall (potential)

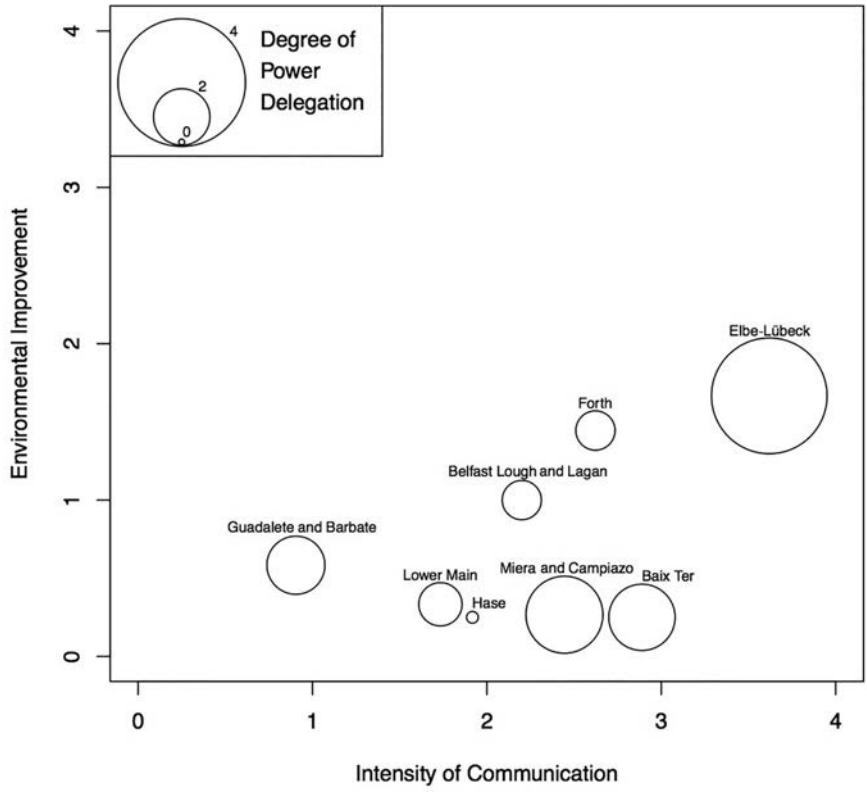

Figure 7.3 Overall environmental improvement assessed through case coding

environmental impact of participatory processes (degree of improvement of environmental conditions in terms of natural resource protection and conservation through the process output). Our findings, derived from a mixed-methods approach, indicate that an increased intensity of participation (in the sense of the communication mode and degree of power delegation) produces outputs and outcomes of a higher environmental standard. By analysing the cases through the lens of causal mechanisms, we aimed to trace the chain of links between processes and outputs and to offer explanations of how these links work towards (environmental) effectiveness. By employing this approach, we were able to observe how each of our eight cases reflects a unique and context-dependent configuration of multiple mechanisms and factors that, in interaction, determine the actual shape of the process output. Contextual factors and process design choices played an important role in this, including the respective political cultures, approaches towards on-going implementation, and the re-connection of participants

with their local waterways. Despite these specific factors that emerged within or characterised the particular settings our cases were embedded in, the mechanism frame we provided in chapter 2 allows for a comprehensive analysis of cases over different contexts. Clustering the dynamics of participation into environmental advocacy, knowledge and discursive interaction for environmentally beneficial decisions, as well as process/output acceptance and capacity building for improved implementation, allowed for a nuanced picture of the different pathways by which participation shaped environmental outcomes in our cases.

Notes

1 Hereafter: Baix Ter, Belfast Lough and Lagan, Elbe-Lübeck, Forth, Guadalete and Barbate, Hase, Lower Main, Miera and Campiazo.
2 We include Miera and Campiazo in the following as the process and participatory output could be analysed, and the non-integration of results took place 'outside' and after the process by a different agency to that organising the process.

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Article 4:

Learning in participatory environmental governance – its antecedents and effects. Findings from a case survey meta-analysis

Abstract

Theory on participatory and collaborative governance maintains that learning is essential to achieve good environmental outcomes. Empirical research has mostly produced individual case studies, and reliable evidence on both antecedents and environmental outcomes of learning remains sparse. Given conceptual ambiguities in the literature, we define governance-related learning in a threefold way: learning as deliberation; as knowledge- and capacity-building; and as informing environmental outputs. We develop nine propositions that explain learning through factors characterizing governance process and context, and three propositions explaining environmental outcomes of learning. We test these propositions drawing on the 'SCAPE' database of 307 published case studies of environmental decision-making, using multiple regression models. Results show that learning in all three modes is explained to some extent by a combination of process- and context-related factors. Most factors matter for learning, but with stark differences across the three modes of learning, thus demonstrating the relevance of this differentiated approach. Learning modes build on one another: Deliberation is seen to explain both capacity building and informed outputs, while informed outputs are also explained by capacity building. Contrary to our expectations, none of the learning variables was found to significantly affect environmental outcomes when considered alongside the process- and context-related variables.

Keywords: Participatory governance; collaborative governance; sustainability governance; knowledge exchange; multiple regression; case survey method

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Learning in participatory environmental governance – its antecedents and effects. Findings from a case survey meta-analysis

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ABSTRACT

Theory on participatory and collaborative governance maintains that learning is essential to achieve good environmental outcomes. Empirical research has mostly produced individual case studies, and reliable evidence on both antecedents and environmental outcomes of learning remains sparse. Given conceptual ambiguities in the literature, we define governance-related learning in a threefold way: learning as deliberation; as knowledge- and capacity-building; and as informing environmental outputs. We develop nine propositions that explain learning through factors characterizing governance process and context, and three propositions explaining environmental outcomes of learning. We test these propositions drawing on the 'SCAPE' database of 307 published case studies of environmental decision-making, using multiple regression models. Results show that learning in all three modes is explained to some extent by a combination of process- and context-related factors. Most factors matter for learning, but with stark differences across the three modes of learning, thus demonstrating the relevance of this differentiated approach. Learning modes build on one another: Deliberation is seen to explain both capacity building and informed outputs, while informed outputs are also explained by capacity building. Contrary to our expectations, none of the learning variables was found to significantly affect environmental outcomes when considered alongside the process- and context-related variables.

KEYWORDS

Participatory governance; collaborative governance; sustainability governance; knowledge exchange; multiple regression; case survey method

1. Introduction

Theory on participatory and collaborative governance maintains that learning plays an essential part in achieving good environmental governance outcomes (Armitage, 2008; Leach, Weible, Vince, Siddiki, & Calanni, 2013). It is assumed that both the design of governance processes, and the way processes are actually conducted, impact whether and how such learning occurs (Armitage et al., 2018: Challies, Newig, Kochskämper, & Jager, 2017; Gerlak, Heikkila, Smolinski, Huitema, & Armitage, 2018; Heikkila & Gerlak, 2013; Leach et al., 2013; Newig, Challies, Jager, Kochskämper, & Adzersen, 2018; Rodela & Stagl, 2011). With this contribution we test these claims, analyzing how and under what conditions learning occurs in participatory governance, and how it may contribute to the environmental quality of decision-making outcomes.

Learning in environmental governance has been studied predominantly through individual case studies (Gerlak et al., 2018). While there is merit in rich, qualitative case accounts, relying solely on single or small-N studies makes comparability across cases difficult. Despite conceptual advances in the field, cumulation of empirical evidence has been limited (Gerlak et al., 2018). Hence, robust empirical evidence on which conditions enable or facilitate learning, and on whether and how learning actually improves environmental outcomes, is

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still lacking. This contribution draws on a database of 307 coded case studies on public environmental governance – the 'SCAPE' database (Newig, Adzersen, Challies, Fritsch, & Jager, 2013).[1] Data were derived from a meta-analysis of published case studies with varying degrees of public and stakeholder participation from 22 developed Western democracies. Qualitative case study data were transformed into numeric data through a coding process utilizing a comprehensive, theoretically-informed coding scheme (case survey method). The method thus combines the richness of case study research with the rigor of a quantitative, large-N comparative analysis (Larsson, 1993).

We study learning in three different respects (described in detail in the next section): deliberative learning in collaborative or participatory environmental decision-making processes; learning and capacity building on the part of the participating actors; and knowledge gains and innovation incorporated into the resulting decision. All three aspects of learning are expected to lead to more environmentally oriented decisions, and to foster the acceptance of decisions by stakeholders, and hence implementation and compliance.

The remainder of this article is organized as follows. In the subsequent section, we elaborate on the conceptual foundations of learning in participatory governance settings and derive a set of hypotheses on both the contextual and process-related conditions under which learning likely occurs, and the environmental governance effects of learning. We then describe the case survey method used and briefly characterize the resulting dataset. Drawing on the case survey data, we use a step-wise multiple regression approach in order to (1) identify the causal factors, including different dimensions of participatory governance, that impact different dimensions of learning, and (2) test to what extent the different dimensions of learning impact the environmental standard of outputs, controlling for the influence of the other causal factors involved. After presenting and discussing the results of our analysis, we conclude by identifying broader implications for research and practice on learning in environmental governance.

2. Concepts and theory

Our conceptualization of the role of learning in environmental governance is outlined in Figure 1. We are interested in the process features and contextual conditions that enable learning in (participatory) environmental governance, and how learning, among other factors, shapes and contributes to environmental governance outcomes.

2.1. Conceptualizing learning

As shown in the recent overview by Gerlak et al. (2018), concepts of learning differ hugely within the academic literature on learning in environmental policy and governance. Some authors focus on learning as mutual

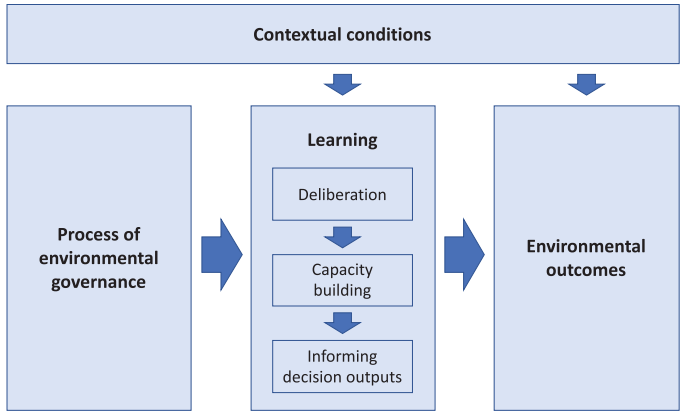

Figure 1. Conceptual model to assess how features of a (participatory) governance process and contextual conditions impact different kinds of learning, and how learning impacts environmental outcomes.

exchange and deliberation (Daniels & Walker, 1996; Newig, Günther, & Pahl-Wostl, 2010). Others focus on good information as the basis for decision-making:

> In the context of public administration, learning can be understood as the process by which people develop a more comprehensive and accurate understanding of the science, technology, law, economics, and politics that underlie the decisions they make or the recommendations they advance. (Leach et al., 2013, p. 2)

Some assume that it is mainly participants who learn (Leach et al., 2013), while others focus on learning as knowledge creation (Kolb, 1984), or as harnessing non-scientific (e.g. lay and local) knowledge for decision-making (Fischer, 2000).

Acknowledging these different perspectives on learning – or rather, these different concepts, which are all subsumed under the learning label – we consider three distinct and complementary modes of learning, which are derived from the literature. As knowledge plays a key role in the context of learning – as the substance of learning (Dunlop & Radaelli, 2018) – and has been regarded as the 'currency' of collaboration (Emerson & Nabatchi, 2015), we express the three perspectives on learning in terms of the different ways in which they relate to knowledge: learning as knowledge-exchange, as knowledge-building, and as knowledge-uptake (see Table 1). We assume that the three modes of learning are interrelated: that deliberation may benefit capacity building, and that both deliberation and capacity building may benefit informed decision outputs (see Figure 1).

Our first mode is *learning in the sense of deliberation*. It is very much about the process, and less about the outcomes of learning. Here, learning is conceptualized as a process of exchange among participants, often termed 'social learning': 'Social learning is the process of framing issues, analyzing alternatives, and debating choices in the context of inclusive public deliberation' (Daniels & Walker, 1996, p. 73). Public deliberation, in turn, has been defined as a means by which 'opinions can be revised, premises altered, and common interests discovered' (Reich, 1988, p. 44). Deliberation implies 'equality among the participants, the need to justify and argue for all types of (truth) claims, and an orientation toward mutual understanding and learning' (Renn, 2004, p. 292). Learning in the sense of deliberation can be conceived as *knowledge-exchange* (Emerson & Nabatchi, 2015, p. 62).

Second, we consider *learning in the sense of knowledge and capacity building by individuals*. In their analysis of participation processes, Webler and Tuler (2002) distinguish between process, outcomes related to the policy objectives, and outcomes related to capacity building. Here, we focus on capacity building, which includes aspects such as civic competence, knowledge levels, self-confidence, and ability to cooperate (Baird, Plummer, Haug, & Huitema, 2014; Webler & Tuler, 2002). In defining variables for their case survey of participatory processes across the United States, Beierle and Cayford (2002, p. 13) study capacity building, and understand capacity as participants' 'ability to understand environmental problems, get involved in decision-making, and act collectively to implement change' (Beierle & Cayford, 2002, pp. 45–46). While we assume capacity building to profit from deliberative learning, participants' capacity building in one decision-making process may also enable them to better deliberate in subsequent processes. Learning in this sense may be expressed as *knowledge-building*.

Table 1. Three modes of learning.

Learning in the sense of …	Deliberation	Capacity building	Informing decision outputs
Relation to knowledge	Knowledge exchange	Knowledge building	Knowledge uptake
Stage in the decision-making process (Webler & Tuler, 2002)	Process	Outcomes related to capacity building	Outcomes related to the policy objectives
Who learns	Participants, officials	Participants (and their constituencies)	Decision-makers (state officials and beyond)
What is learned	Perspectives, facts and values regarding the issues at stake; changed preferences; innovation	Improved understanding of environmental problems, capacity to be involved in decision-making, and to collectively act to implement change.	Output takes up knowledge shared and innovation developed by participants

Finally, we consider *learning in the sense of an informed output*, acknowledging the role of information, knowledge and innovation. This concept of learning builds on the argument that one of the key functions of participatory processes is to harness (lay, local) knowledge of relevance to decision-making that is not already available to the decision-makers in charge (usually the responsible government authorities) (Fischer, 2000; Smith, 2003; Wynne, 1992). Interaction and dialogue among diverse participants potentially produces innovative results through the exchange of different perspectives, information, and knowledge conducive to mutual learning (Fazey et al., 2013; Heikkila & Gerlak, 2013). We ask: Has new knowledge, information, or insight been made available for decision-making; have innovative solutions been found; and is any of this incorporated into the decision? We use decision and output synonymously, referring to the agreement, plan, contract, bill or other somewhat formalized product of decision-making. Learning in this sense refers to 'outcomes related to the policy objectives' (Webler & Tuler, 2002), and can be classified as learning as *knowledge-uptake*.

2.2. Factors assumed to foster learning

Below, we consider nine variables that figure prominently in the literature on learning in environmental governance. While many of the identified factors are hypothesized to impact all three kinds of learning outlined above, some are specifically linked to just one or two. We begin by discussing factors characterizing governance processes (hypotheses 1 to 6), and subsequently discuss contextual conditions (hypotheses 7 to 9).

2.2.1. Factors characterizing the governance process

In participatory environmental governance settings, learning is generally thought to be fostered through 'intensive' processes (Beierle & Cayford, 2002; Daniels & Walker, 1996). There appears to be some agreement in the literature on measuring the 'intensity' of participation according to three dimensions (Fung, 2006; Newig & Kvarda, 2012): communication and information exchange; delegation of power to participants; and breadth of participant involvement.

Opportunities for participants in an environmental governance process to communicate intensively are in many ways a prerequisite for learning (Heikkila & Gerlak, 2013). In particular, structured methods for (knowledge) exchange have been observed to foster learning among participants, because they serve to focus and channel communication and exchange on aspects deemed of particular importance, rather than allowing for very open and unstructured discussions. Structured methods include individual interviews, participatory modeling (Renn, 2006; Rowe & Frewer, 2005), transactive memory systems (Heikkila & Gerlak, 2013), and methods that translate between 'lay' and 'expert' types of knowledge (Edelenbos et al., 2011). Such methods, which also include professional facilitation or moderation, can also help achieve procedural fairness (Leach et al., 2013). In principle, these methods can be hypothesized to benefit all three kinds of learning: Deliberation should profit from structured exchange, as should capacity building; and in particular, the uptake of information in decision-making should be fostered by structured methods that help to identify information that is more important to incorporate. We therefore hypothesize that:

H 1: Intensive communication among those involved in an environmental governance process benefits learning.

H 2: Structured methods of facilitation and knowledge exchange in an environmental governance process benefit learning.

As a measure of 'genuine' participation, delegation of power to participants may have a more indirect influence on learning. Daniels and Walker (1996) argued that 'when people are given opportunities to "do" – to participate in tasks, to speak from their experiences, to be 'players' – they are more likely to learn than when they passively observe' (Daniels & Walker, 1996, p. 75). Therefore, we may assume that the more participants have the opportunity to shape decision outputs, the more likely they are to learn. On this basis we can expect positive effects of power delegation on deliberation and on capacity building, and of course by its very definition on the uptake of learning in decisions and outputs. Therefore, we hypothesize that:

H 3: Power delegation to participants in an environmental governance process benefits learning.

Regarding the breadth of participation, one core assumption is that the involvement of non-state actors, i.e. civil society and private sector stakeholders, is key to learning, at least in the sense of uptake of lay and local knowledge in decision-making (Fischer, 2000; Smith, 2003; Wynne, 1992). Further, business stakeholders often possess specific information that is not available to state authorities (Emerson & Nabatchi, 2015). Generally, non-state actor participation is expected to broaden the knowledge base, and to bring environmental advocacy into decision-making processes (Newig et al., 2018). Specifically, it has been argued that heterogeneity among participants increases learning because participants bring multiple sources of knowledge to the process (Leach et al., 2013). We hypothesize that:

H 4: Broad non-state actor participation in an environmental governance process benefits learning.

H 5: A diverse set of stakeholders in an environmental governance process benefits learning.

Finally, the duration of a process has been identified as an important factor impacting learning. Several studies from the United States on collaborative partnerships have shown that it takes time for participants to learn and build capacity (Beierle & Cayford, 2002; Leach et al., 2013). It is therefore hypothesized that:

H 6: The duration of a participatory environmental governance process is positively associated with learning and capacity building among participants.

2.2.2. Factors characterizing contextual conditions

Trust towards other participants as well as governmental actors has repeatedly been identified as a factor for the 'success' of collaborative governance (Emerson & Nabatchi, 2015), and specifically as conducive to learning (Juerges, Weber, Leahy, & Newig, 2018; Leach et al., 2013). Trusting others arguably makes the uptake of information and the updating of beliefs more likely. Moreover, true deliberation is more likely to occur if participants trust each other's intentions.

H 7: A trustful setting in an environmental governance process, where participants trust each other and governmental actors, impacts positively on deliberation and capacity building among participants.

It has been assumed that less adversarial settings are conducive to learning (Leach et al., 2013). While there is a link to trust – assuming that trust is low when the level of conflict is high (Heikkila & Gerlak, 2013) – there may be settings in which both generalized and interpersonal trust is high, but conflicts prevail. Adversarial settings may be defined as settings with both high levels of conflict, and low levels of willingness to cooperate.

H 8: An attitude of cooperativeness among participants in an environmental governance process is conducive to learning.

It is less evident whether low levels of conflict are conducive to learning. Daniels and Walker (1996), remind us that conflict may have a productive role in stirring constructive debate: 'The challenge in social learning is therefore not to resolve or eliminate conflict; rather it is to learn about complex issues in an inherently conflictual environment' (Daniels & Walker, 1996, p. 74). Reconciling both the potentially conducive and obstructive roles of conflict for learning, Weible & Nohrstedt (2013, p. 131) suggest that learning is best fostered where 'there is enough of a threat to attract the attention of rivals but not too much of a threat to entrench opponents on rigid policy positions'. Given these arguments, we may hypothesize that:

H 9: Conflictual settings in environmental governance processes are likely to impact learning.

2.3. Assumed relations between learning and environmental outcomes

Why should learning lead to improved environmental outcomes? Drawing on earlier work by the authors (Newig et al., 2018), we consider arguments linking the different forms of learning to the environmental standard of decision-making outputs. By 'output' we mean the decision made at the end of the decision-making process, which is typically set down in writing, in the form of a management plan, a permit, a law, etc.[2]

Deliberation is expected to lead to a common good orientation of the discourse, characterized by 'preferences and justifications which are "public-spirited" in nature [because] preferences held on purely self-interested grounds become difficult to defend in a deliberative context' (Smith, 2003, p. 63). Deliberation is expected to 'transform initial policy preferences (which may be based on private interest […], prejudice and so on) into ethical judgements on the matter in hand' (Miller, 1992, p. 62) and toward an output that secures benefits for all parties as well as the environment (Aldred & Jacobs, 2000).

H 10: Learning as deliberation benefits the environmental standard of the decision output.

Learning in the form of capacity building among participants is important for environmental outcomes because it is expected to improve participants' understanding of the issues at hand, increasing the likelihood of their providing constructive, environmentally relevant input. As Beierle and Cayford (2002, p. 15) assert, '[i]ncreasing public understanding of environmental problems builds capacity for solving those problems [… and] to formulate alternatives.'

H 11: Learning as capacity building benefits the environmental standard of the decision output.

Finally, learning in the sense of informed decision outputs is likewise expected to improve the environmental standard of decision outputs. The general assumption is that better informed decisions will also benefit the environment.

H 12: Learning as informed decision outputs benefits the environmental standard of the decision output.

3. Data and methods

3.1. Data: case-survey meta-analysis

Our analysis utilizes the 'SCAPE' database (Newig et al., 2013) comprising 307 cases of public environmental decision-making, covering a range of more- and less-participatory processes from standard administrative decision-making to highly inclusive and collaborative processes. This database was compiled through a case survey meta-analysis (Larsson, 1993; Newig & Fritsch, 2009a) of published case studies. This type of meta-analysis involves conversion of the rich qualitative information contained in narrative case study accounts into quantitative data, and as such represents a numeric interpretation of the case study texts. This approach therefore suits our research aims particularly well, as it provides the means to synthesize emergent findings where empirical evidence is mainly contained in a large number of single or small-N comparative case studies.

We define a 'case' as a public environmental decision-making process aimed at reaching a collectively binding decision, which is to a lesser or greater extent participatory in the above outlined sense. In order to be able to test our specific hypotheses on the links between participation, learning, and the environment, we quantify for each case (1) the 'degree' of participation, (2) the extent of learning achieved through the process, and (3) the environmental standard of the output or decision, each in multiple dimensions and thus via a number of different variables.

In conducting the case-survey, we followed the following steps:

(1) Case study identification and selection: Based on a thorough search of several scientific databases and library catalogues[3] for studies published up until 2014 in English, German, French, or Spanish language, we identified over 3300 texts, containing more than 2000 cases of environmental decision-making with varying degrees of participation. We limited our search to cases from Europe, North America, and Australia and New Zealand. Given the varied terminology with which participatory process are described in the literature, we used a number of combinations of search terms in several iterations. Our search targeted peer-reviewed journal articles, books, edited volumes, theses, working papers, and various forms of grey literature, so long as these were publicly available. Having continued the search until saturation was reached and no new cases were being discovered, we assume that we have covered a nearly complete set of relevant, publicly available cases. The identified

texts were screened for suitability, and those containing insufficient information for our purposes were eliminated, resulting in a database of 639 'codeable' cases, from which we randomly sampled 307 cases for full coding.

(2) Coding scheme development: Based on our conceptualization of participatory decision-making processes (described above), we developed an analytical coding scheme (Newig et al., 2013) to capture information on process attributes, outputs and outcomes, and environmental impacts, as well as relevant contextual factors. These components were broken down into 259 quantitative, and additional qualitative variables. Most variables were coded on a five-point quantitative scale (from 0 to 4).

(3) Case coding: Each case was independently read and coded by three trained raters. In addition to the coding of actual variables, each rater assigned a confidence score to each measurement (4-point scale, 0 = insufficient information to code the variable; 3 = explicit, detailed and reliable information). After initial coding, raters met to discuss and address coding mistakes and explore divergent interpretations; however, to be able to accommodate different interpretations of the texts, raters were not required to seek agreement on codings (Kumar, Stern, & Anderson, 1993). Despite this deliberate assimilation of divergent codings, interrater reliability, measured through G(q,k) (Putka, Le, McCloy, & Diaz, 2008) was 0.77, and interrater agreement (rWG, James, Demaree, & Wolf, 1984) was 0.73, indicating high validity of data overall. Finally, the three rater scores were averaged, weighted with the respective confidence scores, as suggested by van Bruggen, Lilien, and Kacker (2002).

3.2. Specification of variables

3.2.1. Learning variables

Following the multi-dimensional conceptualization of learning outlined above, we distinguish between learning as deliberation, capacity building, and informed outputs.

To assess deliberation, we measured the

> degree to which deliberation in the sense of a 'rational' discourse among participants took place. The notion of deliberation refers to a process of interaction, exchange and mutual learning preceding any group decision. During this process, participants disclose their respective (relevant) values and preferences, avoiding hidden agendas and strategic game playing. Agreements are based on rational arguments, and principles such as laws of formal logic and analytical reasoning. (Newig et al., 2013)

The variable was measured on a 0 to 4 scale, with 0 indicating that no deliberation took place, and 4 indicating a decision-making process characterized by sustained deliberation among participants.

Learning as capacity building, as understood here, assesses whether and how participants and the wider public were able to learn and develop capacities during a participatory process. We capture this learning mode through two interrelated variables: societal learning and individual capacity building. Societal learning measures the 'degree to which participants, stakeholders or broader society learned about the issue such that they gained new or improved understanding or knowledge of the issue, enabling them potentially to contribute to future joint problem solving efforts' (Newig et al., 2013). Individual capacity building assesses the

> degree to which the skills and capabilities of individual participants or stakeholders were enhanced through involvement in or engagement with the DMP [decision-making process]. These skills and capabilities may be specific to the issue at hand, or incidental and applicable to a range of social situations. (Newig et al., 2013)

Again, both variables were measured on a 0 to 4 scale, with 0 indicating no learning and 4 indicating significant enhancement of capacities and learning. As both dimensions are conceptually related and highly correlated ($r = .75$, $p < .001$), they were aggregated to form a single scale (alpha = .86).

Finally, we operationalize learning as informed outputs by assessing the extent to which new knowledge and innovation informed the output. Information gain is defined as the

> degree to which additional information in the sense of contextualized, local (including traditional and indigenous) knowledge informed the output. This kind of knowledge is characterized as implicit, informal, context-dependent, and resulting

> from collective experience, and can concern known parameters and/or new perspectives. This includes knowledge that may be 'expert' knowledge (e.g. of local people) but not in the sense of knowledge that is published (e.g. in a handbook). (Newig et al., 2013)

Innovation, on the other hand, asks

> did the output present an innovative, novel solution in the sense of a solution addressing the issue at hand that had not been discussed before the DMP? This need not be an innovation in the sense of an 'invention' in global comparison. (Newig et al., 2013)

Again, both variables were measured on a five-point scale, with 0 indicating the absence, and 4 the high abundance of the variable. As both variables contribute to learning as reflected in the output, we aggregated them into one.[4]

3.2.2. Environmental outcomes

In order to be able to compare the environmental quality of governance outputs across diverse contexts, we follow Underdal (2002) who assesses regime effectiveness against a hypothetical collective optimum; i.e. 'one that accomplishes […] all that can be accomplished – given the state of knowledge at the time' (Underdal, 2002, p. 8). On this basis, our output variable captures the

> degree to which the environmental output aimed at an improvement (or tolerated a deterioration) of environmental conditions […]. This is to be assessed moving from the 'business as usual' scenario (projected trend) towards a hypothetical 'optimal' (or 'worst case') condition. (Newig et al., 2013)

For this variable, we employ a scale ranging from −4 to 4, where 0 indicates no divergence from a hypothetical business-as-usual scenario, while −4 means that the governance output approaches a 'worst-case' scenario, and 4 a hypothetical optimum.

We distinguish between two different but related aspects of environmental quality of decision outputs, namely the extent to which the output aligns with conservation and natural resource protection goals. We define conservation as aiming 'to preserve, protect or restore the natural environment and ecosystems […] largely independently of their instrumental value to humankind'; and natural resource protection as aiming 'to protect, preserve, enhance or restore stocks and flows of natural resources that are of instrumental value to humans, and provide for their sustainable use' (Newig et al., 2013). As both dimensions are related and statistically correlated ($r = 0.89$, $p < .001$), they were aggregated to form a single scale (alpha = .94), which we call Environmental Standard of the Output.

3.2.3. Independent variables

As outlined above, we conceptualize participation as a multi-dimensional concept, comprising the dimensions of non-state actor representation, communication intensity and power delegation. For a detailed description of independent variables, including some descriptive statistics, see the online supplementary material.

We operationalize the representation of non-state actors as the average

> extent to which the composition of participants in the process mirrors the interest constellation in the public. Full representation is reached when there are a sufficient number of representatives and when those representatives are fully accepted as such by their constituencies. (Newig et al., 2013)

In this, we consider all concerned actors from civil society and private business, as well as individual citizens.

Intensity of communication is operationalized as a composite variable, combining variables that measure the intensity of one-way information flows to and from participants (information dissemination and consultation), as well as two-way dialogue among participants and process organizers. Further, we consider whether communication took place directly, through the variable face-to-face. We constructed a composite factor (alpha = .93) by means of a principal component analysis (PCA) with oblique rotation (promax).

Finally, power delegation to participants was operationalized through the 'degree to which the process design provided the possibility for participants […] to develop and determine the output' (Newig et al., 2013).

Beyond these basic dimensions of participation we identified more specific process-related and contextual factors potentially influencing learning. Aiming to go beyond mapping flows of communication, we assess to what extent structured communication methods were used during the process to facilitate knowledge exchange and learning. Our measurement of such methods includes variables to assess methods of information elicitation, aggregation and knowledge integration, alongside a measurement for professional facilitation. Again, these were aggregated to a composite factor (alpha = .89) by means of a PCA.

Two further variables assess the diversity of interests and societal sectors represented in the process. To this end, we computed a Shannon diversity index, (a) for the relationship between pro-nature and pro-development interests, and (b) for the relative abundance of actors form different societal sectors (government, private sector, civil society, lay citizens).

Learning as a process evolves over time. Therefore, we introduced a variable for process duration into our model, measuring the time between the first interaction and the final decision reached in a participatory process.

Finally, we assessed a set of contextual factors that we hypothesized as contributing to the success of learning processes and products. To this end, we measured the extent of existing value conflicts, as well as the cooperativeness of the actors involved (PCA over all interests, alpha = .89). For the measurement of trust, we computed a composite variable combining the initial levels of trust with changes in trust levels during the decision-making process.

3.3. Methods of analysis

We conducted a series of regression analyses for learning, with the environmental standard of the output as the dependent variable. The rationale is to provide a basic path analysis that traces the effects of the identified process characteristics on the three modes of learning, and ultimately the effect of learning on the environmental standard of governance outputs (see Leach et al., 2013 for a similar approach). To this end, we first fit a model with deliberation as dependent variable and participation-related factors as independent variables. In a next step, capacity building served as dependent variable of regression models that use the same independent variables as the previous model, plus deliberation as a predictor for capacity building. In step three, we fit regression models that rely on participation variables, deliberation, and capacity building as explanatory factors for informed outputs. The final step includes all participatory and learning variables as predictors for the environmental standard of the output.

Generally, our models performed well and met the criteria for linearity, homoscedasticity and normality, without undue influence of any outliers (see online supplementary material). However, as the last two sets of models – with informed outputs and the environmental standard of the output as dependent variables – showed signs of heteroscedasticity, we computed robust standard errors (Table 1).

4. Results and discussion

We find, first, that all three forms of learning occur to a considerable degree in the cases studied. Considering the original, non-aggregated learning variables (all measured on a scale from 0 to 4), Deliberation has an arithmetic mean of 1.74 across all cases, Capacity Building of 1.69, and Informed outputs of 1.09.[5] This suggests that learning as knowledge exchange (deliberation) is most likely to happen, followed by learning as knowledge-building (capacity building). However, it is less likely that outputs are actually informed by information acquired during the process, or even that the output includes innovation generated in the process. Below, we describe and discuss the results of the multiple regression models linking process and context factors, modes of learning, and environmental outcomes (see Table 2).

4.1. Explaining learning through process- and context-related factors

Table 2 shows eight regression models, clustered into four sets, each of which relates to a different dependent variable: Clusters 1–3 show models which explain the three modes of learning; cluster 4 shows models which explain the environmental standard of the output. Our results show that our conceptual model, consisting of

Table 2. Results of the regression analysis.

	Dependent variables:							
	Learning as deliberation	Learning as capacity building		Learning reflected in output		Environmental standard of the output		
Model no.	(1a)	(2a)	(2b)	(3a)	(3b)	(4a)	(4b)	(4c)
Communication intensity	.31***	.11	.04	−.16**	−.22**	.07	.07	
Structured communication methods	.26***	.37***	.32***	.46***	.35***	.10	.02	
Power delegation to participants	.18***	−.06	−.09	.23***	.21**	.21**	.18*	
Non-state actor representation	−.05	.06	.07	.06	.05	−.10	−.11	
Diversity of interests	.02	−.04	−.04	−.06	−.06	−.09	−.08	
Diversity of sectors	.00	.04	.04	.05	.04	.05	.04	
Process duration (log)	.03	.18***	.17***	.01	−.03	.05	.03	
Trust towards govt. and participants	.24***	.23***	.18***	.14	.05	.20**	.17*	
Cooperativeness of actors	.09	.21***	.19***	.12	.06	.19*	.16*	
Value conflict	.06	.16***	.14***	.11*	.07	−.02	−.04	
Learning as deliberation			.20***		.15*		.04	.29***
Learning & capacity building					.20**		.06	.12
Learning reflected in output							.09	.16*
Intercept	1.14***	−1.40***	−1.63***	.53**	.62**	.51	.49	−.18
Observations	296	296	296	286	286	276	276	280
R^2	.67	.54	.56	.46	.49	.34	.35	.25
Adjusted R^2	.66	.53	.54	.44	.47	.32	.32	.24
F-value	57.04***	33.70***	32.23***	23.25***	21.69***	13.65***	10.77***	30.45***
AIC	538.09	629.71	622.92	457.08	444.84	849.54	852.06	882.05

Dependent variables are the three modes of learning (model clusters 1 to 3), and the environmental standard of the decision-making output (cluster 4). Independent variables are process-related factors (power delegation, communication, and non-state actor representation, as well as process duration, use of structured methods, trust-building, diversity of interests and sectors represented), and context factors (cooperativeness of actors; level of value conflict). The three modes of learning also serve as independent variables in model clusters 2, 3 and 4. Depicted are standardized beta values.

Note: Statistical significance is depicted as * $p < .05$; ** $p < .01$; *** $p < .001$.

carefully selected variables representing process and context features of participatory decision-making, adequately describes our data and captures a large proportion of its variance. As the overall significant and high R^2 values indicate, all three modes of learning can be explained to some extent by the process- and context-related factors we have investigated. The models further highlight that the identified modes of learning can indeed be interpreted as a sequence, where capacity building benefits from deliberation and where the uptake of knowledge in the output is fostered by the previous modes of deliberation and capacity building. Comparing model (2a) with (2b), and (3a) with (3b), we can observe a significant ($p < .001$) improvement in model fit[6] (increased R^2 and decreased AIC) between the respective models (a) and (b). This indicates – together with the significant individual effects of deliberation and capacity building – that the previous modes of learning contribute significantly to the explanatory power of our models.

However, we also observe that goodness-of-fit decreases with the causal distance of each learning mode from the actual decision-making process: model (1a), assessing learning as deliberation, achieves an R^2 of .67, model (2a) with learning and capacity building as dependent variable has an R^2 of .54, while model (3a) for learning informing decision outputs has an R^2 of .46. This decrease in model fit can be interpreted as a sign of increasing causal distance (Gerring, 2007) between independent variables and the phenomenon these aim to explain. Deliberation, itself a process feature, is more directly determined by choices of process design than by capacity building among participants and stakeholders. The fate of learning products and their incorporation into the output is even further out of the ambit of process design decisions and subject to many confounding influences, as our analysis suggests.

Beyond these broader trends, the models reveal particularly distinct patterns of factors determining the respective kinds of learning, providing specific answers to the hypotheses formulated above.

Communication variables show significant effects for all three kinds of learning, emphasizing the essential importance of communicative exchange for learning in all of its facets. In particular, we find the use of structured communication methods for information elicitation and aggregation, and for facilitation, to be a stable and significant predictor for all kinds of learning, confirming hypothesis 2. However, the mere intensity of communication *ceteris paribus* displays contradictory influence depending on the mode of learning, thus showing a mixed result for hypothesis 1. While communication intensity has a positive effect on deliberation, this effect vanishes when it comes to capacity building, and even becomes significantly negative for learning products reflected in the output. This highlights that learning does not automatically flow from communicative interactions of any kind, but depends on certain communicative qualities. While the intensity of communication may still be an essential ingredient in deliberation (model 1a), particularly models (2b) and (3b), controlling for deliberation and the use of structured communication methods, suggest that communication without these qualities may introduce dynamics that restrict capacity building and knowledge uptake in the output. Our large-N analysis of course cannot reveal these dynamics in detail, but the literature suggests for example politicized communication (Wood, 2015), groupthink (Janis, 1982), or communication as the mere voicing of individual opinions and concerns without wider discussion (Kochskämper, Challies, Jager, & Newig, 2018), as relevant factors in this respect.

Hypothesis 3, postulating a positive effect of power delegation to participants, is supported for learning as deliberation and as reflected in the output, with no detected effect for capacity building. We predicted the positive effect of power delegation on the uptake of learning products into the output earlier in Section 2, as power over the specific content of a political output may be a prerequisite for participants to make use of capacities developed and knowledge gained. For deliberation however, being taken seriously as a participant seems to foster willingness to engage wholeheartedly in a participatory process, to open up to the viewpoints and knowledge of fellow participants, and to strive for solutions for the common good (see also Daniels & Walker, 1996).

For the hypotheses related to the composition of the participant group (hypotheses 4-6) we could not find conclusive evidence in any of our models.

The duration of the decision-making process is significantly correlated to learning as capacity building. This provides support for hypothesis 6, emphasizing that capacity building is a process that takes time, and therefore has resource and commitment requirements that organizers must address (Beierle & Cayford, 2002; Leach et al., 2013). However, process duration did not explain any of the other learning modes, suggesting that deliberation may happen independent of a longer process, and that learning may likewise inform outputs independent of process duration.

Turning to the contextual factors, trustful relationships among stakeholders and government actors apparently play an important role in explaining deliberation and capacity building. In model (1a) and (2b) trust emerged as a robust significant factor, confirming hypothesis 7 for these modes of learning. Trustful relationships may make it more likely that participants open up to the perspectives and knowledge of others, as participants trust each other's intentions and consider each other as credible and legitimate sources of information, fostering deliberation and capacity building overall. Note that we did not assume trust to impact informed decision outputs, and indeed we do not find any significant coefficients that would indicate this.

Other contextual conditions – cooperative attitudes and conflict levels (hypotheses 8 and 9) – show significant effects for learning as capacity building (model (2)). The levels of both cooperativeness and value conflict are positively correlated to capacity building. While a positive relation was expected for cooperativeness, we did not necessarily expect a positive relation for value conflicts (nor did we expect a negative relation). As outlined above, conflict levels may have different effects on capacity building, on the one hand hindering productive interaction, and on the other acting as a catalyst for questioning one's own positions and for learning about complex issues and situations. Our results point towards the latter effect.

Taken together, these findings reveal insightful patterns of co-variance and correlation for each mode of learning: Each mode of learning supports the subsequent one, with deliberation fostering capacity building, and both fostering informed decision outputs. While deliberation and informed decision outputs are largely correlated with process-related factors, capacity building is mainly related to contextual conditions. Our

findings reinforce the sequential relation between deliberation, capacity building, and learning as informing decision outputs. This could also be relevant from the perspective of process organizers and participants. Advancing deliberation may be most easily achieved, and might be fostered, through process design that promotes communication and power delegation to participants. Deliberation may then serve as a catalyst for capacity building. However, in this case more demanding contextual (and mixed) rather than procedural factors also come into play. Levels of conflict, trust and cooperativeness have here proven significant predictors. However, these are much harder for process organizers to plan for and influence, and suggest that special attention must be paid to the institutional and societal context in which a decision-making process plays out. Finally, deliberation and capacity building may foster the incorporation of knowledge into decision outputs. Here again, our results suggest that special attention to procedural features is warranted, especially concerning communication structures.

4.2. The impact of learning on the environmental standard of the output

Inspecting hypotheses 10–12 reveals a mixed picture. While in model (4c) different kinds of learning display significant positive effects on the environmental standards of the output, these effects vanish when controlling for the influence of the previously identified process- and context-related variables (model 4b). Best model fit is actually reached in the model where learning variables were left out altogether (model 4a with lowest AIC). Hence, we cannot find robust support for hypotheses 10– 12. Instead, power delegated to participants, a trustful atmosphere, and cooperativeness show significant effects.[7]

These findings suggest that participation of stakeholders in environmental decision-making sets in motion processes and mechanisms through which participation influences the environmental standard of the output, beyond the identified modes of learning. Exploring what those mechanisms may be goes beyond the scope of this analysis. However, other studies emphasize the role of environmental agency (Brody, 2003), also in the sense of the environmental orientation of the entity organizing participatory processes (Kochskämper et al., 2018), government commitment (see Mukhtarov, et al. 2018 in this special issue), and the wider institutional context as important factors (Newig & Fritsch, 2009b) – aspects that were not a focus of this study, but would warrant further research.

5. Conclusions

In this study we have tested whether learning in environmental governance can be explained by collaborative and participatory process features and contextual conditions, and whether learning affects environmental governance outcomes. Drawing on a case survey of 307 cases of public environmental decision-making allows for some generalization across very different kinds of environmental governance processes, encompassing 22 different countries, a wide range of issues, and several decades of environmental governance. To our knowledge, this is the largest meta-study on environmental governance processes available. The general patterns we find may of course change when considering subsets of cases, such as different jurisdictions or issue areas. Despite their broad range, there is no guarantee that our cases are representative of all the environmental decision-making processes having taken place, most of which have not been described in scholarly publications. With these caveats in mind, we point to three main findings.

First, our analysis demonstrates that it is useful to distinguish the three modes of learning we introduced: learning as deliberation, learning as capacity building, and learning as informed decision outputs. We find that, as expected, the modes of learning build on one another: deliberation fosters capacity building, and both these modes foster informed decision outputs. Moreover, the learning variables show distinct patterns as to their antecedent factors.

Second, we were able to identify factors conducive to learning. Most prominent are structured methods of communication, facilitation and knowledge-exchange, which foster all modes of learning. To a lesser extent, power delegation and process duration also affect learning. Context factors such as trust and stakeholder cooperativeness, and the level of value conflict, were found to foster learning, too. Contrary to expectation, neither

non-state actor participation, nor stakeholder diversity mattered significantly for any of the studied learning variables. From a practitioner point of view, these findings highlight the importance of using methods for structuring communication and knowledge exchange and the role of professional facilitation – as opposed to simply giving participants opportunities for open exchange.

Finally, and against all expectations, we found no evidence for the assumption that learning benefits environmental outcomes. So, is learning therefore unimportant? Arguably, the effects of learning are more complex and indirect. Learning can be ascribed a value in itself; deliberation and capacity building can be seen as desirable from a social point of view. Learning may also lead to a conscious decision not to change policy. Further, learning may have indirect effects on the environment, which we were not able to assess in our study. For example, these may occur on longer timescales or at other stages of the policy process, such as during the implementation phase.

But having said all this, it seems that we must acknowledge that learning by itself may play less of an immediate role in generating strong environmental outcomes than it has been widely assumed in the literature. More attention may be needed to establish in which ways and under which specific conditions learning in its different modes may in fact be able to benefit environmental outcomes. This we suggest could be done by conducting careful within-case analysis through causal process tracing, potentially relying on the database used here or similar datasets of cases.

Notes

1. This was generated as part of the project 'EDGE – Evaluating the Delivery of Participatory Environmental Governance using an Evidence-based Research Design'.
2. Outputs of participatory processes, for example, are often not legally binding, and considerable time may elapse until they are adopted by the political system, challenged in court, and become finally implemented.
3. Sources searched include: BASE; Google Books; Google Scholar; GVK+; Science Direct; SciVerse Hub; Scopus; SpringerLink; SSRN; Web of Science; Wiley Interscience.
4. Although the correlation between the two variables is relatively low ($r = .29$, $p < .001$), we decided to aggregate these variables nonetheless given their conceptual relation as part of the same mode of learning.
5. Means were calculated over the original variables.
6. See online supplementary material for more information about the model comparison.
7. Here, we cannot exclude the possibility that these factors may stem from a 'halo effect' whereby stakeholders in the original case studies attribute a higher degree of environmental effectiveness simply due to their positive feeling and the atmosphere of trust and cooperation in the process (Leach & Sabatier, 2005). As the data for environmental output stringency stems from very different sources, and most case study authors do not rely merely on stakeholder judgements but on their own assessment of the text of agreements, we do not deem this effect to be substantially distorting.

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Supplementary material to "Learning in participatory environmental governance – its antecedents and effects. Findings from a case survey meta-analysis"

Independent Variable descriptions

Variable Name	Description	Scale
Power delegation to participants	Degree to which the process design provided the possibility for participants to develop and determine the output.	0..4
Communication intensity	Principal component including: - Information provision: Degree to which participants [...] received all relevant information (i.e. actual flow of information in the direction of participants), in relation to the amount of information the process organizer had or could easily access. (mean=2.36) - Consultation: Degree to which participants [...] gave all the input they considered relevant. (mean=2.45) - Two-way dialogue: Degree to which a two-way dialogue and information flow, and direct interaction among participants and between participants and the process organizers, took place. Dialogue implies more than just extensive communication and/or consultation but requires responsive on-going interaction, so that the relevant information is exchanged (i.e. assumes the possibility to ask questions and respond to comments). (mean=2.4)" - Face-to-face: Degree to which process design provided for participants to communicate in person. (mean=2.50)	
Non-state actor representation	We measure the involvement of non-state actors as the average representation of civil society actors, private business actors, and individual citizens in a given case. Representation is defined as "the extent to which the composition of participants in the process mirrors the interest constellation in the public. Full representation is reached when there are a sufficient number of representatives and when those representatives are fully accepted as such by their constituencies."	0..4
Process duration	Duration between a first interaction/meeting with the intention of reaching a collectively binding decision, and the date of the final decision (output) that terminated the particular decision-making process.	Count (days)
Structured communication methods	Principal component including: - Structural information elicitation: Degree to which the process design provided for the structured elicitation of information from stakeholders. Elicitation refers to the process of providing occasions and incentives for stakeholders to provide information. Elicitation methods can be interviews, questionnaires, agenda points with lead questions, etc. (mean=1.34) - Structural information aggregation: Degree to which the process design provided for the structured aggregation of stakeholder input (i.e. through the use of structured / facilitated aggregation methods). Aggregation refers to the process of summarising, combining and prioritising information. Aggregation methods are means of defining which opinions and information become part of decisions and which do not. Examples of aggregation methods include majority vote and selective summary of letters from the public. (mean=1.34) - Knowledge integration methods: Degree to which process design provided for different methods for knowledge integration (e.g. participatory modelling, multi-criteria analysis). Integration of knowledge is conceived of here as the combination of different kinds of knowledge to more comprehensively inform the output. (mean=1.12) - Facilitation: Degree to which the process was characterised by skilled facilitation. A facilitator is a specialist who helps people design effective	

	meetings and problem- solving sessions, and acts as the meeting leader on behalf of the group. A facilitator does not have the authority to make substantive decisions, but may have a say in how the meeting is run, and will consult with the group about major process decisions, such as a significant change in agenda or meeting procedures (adapted from Creighton 1998). Skilled facilitation consists of the following elements: assistance with designing meetings; helping to keep meetings on track; clarifying and accepting communication and feelings; stating problems in a constructive way; suggesting appropriate procedures or problem-solving approaches; summarising and clarifying direction; consensus-testing; managing power imbalances between participants. (mean=1.71)	
Trust towards govt. and participants	Sum of pre-existing trust and trust developed during the process. "Trust is the willingness to accept vulnerability based on positive expecta- tions about another's intentions or behaviors" (McEvily et al. 2003). Pre-existing trust (Levels of trust likely depend on the existence of a prehistory of either antagonism or cooperation between stakeholders and government sector actors. Where there is no prehistory of interaction, there is possibly (but not necessarily) neither trust nor distrust between the parties): - Degree of general public trust in the capabilities and intentions of the government and government sector actors to act in the public interest – before the decision-making process. (mean=-0.41) - Degree of trust of stakeholders and the specific governmental actors potentially involved in the decision-making process – before the decision-making process. (mean=-0.46) - Degree of trust among stakeholders potentially involved in the DMP – before the decision-making process. (mean=-0.31) Trust created during process: - Degree to which trust relationships were created or strengthened among participants (and potentially beyond), which can be expected to "facilitate coordination and cooperation for mutual benefit" (Putnam 1995: 67, see also Ansell & Gash 2008). (mean=0.80)	-8..8
Diversity of interests	Shannon diversity index of interests represented in the decision-making process. Interests include: - Nature interests: To preserve, protect or restore the natural environment and ecosystems (including the atmosphere, biodiversity, terrestrial and aquatic habitats, and flora and fauna) largely independently of their instrumental value to humankind or to protect, preserve, enhance or restore stocks and flows of natural resources that are of instrumental value to humans, and provide for their sustainable use. (mean=1.50) - Development interests: To cause or tolerate or accept harmful effects on the environment including pollution or general degradation of the quality of the environment and its ecosystems, the endangerment of human health as well as the unsustainable utilisation of natural resources and capacities. (mean=1.35)	
Diversity of sectors	Shannon diversity index of sectors represented in the decision-making process. Sectors include: - Government: All governmental actors and organisations at various levels engaged in the formulation of policies and their execution (i.e. involved state agencies), including quasi non-governmental organisations fulfilling functions of government. (mean=2.25) - Private sector: All for-profit organisations that are owned or operated by private individuals, and companies engaged in the supply of goods and services (i.e. productive private enterprises, farmers, industry, etc.), including umbrella organisations representing industry, and state-owned enterprises that are mandated to return a profit from their commercial activity. (mean=1.47) - Civil society: A collection of entities and groups that are organised (institutionalised), non-governmental, non-profit, self-governing, and voluntary (e.g. NGOs, churches, unions) (adapted from Salamon & Anheier 1997: 33f). (mean=0.96)	

	- Lay citizens: Non-organised individuals (e.g. consumers, residents, etc.), and ad-hoc, temporary and issue-related citizen initiatives. (mean=1.03)	
Cooperativeness of actors	Degree of cooperativeness of all actors. Cooperativeness is an aggregate concept describing the willingness to engage in a collaborative process, to contribute information and to reach a compromise or consensus. Principal component including all interests: - pro-conservation (mean=2.40); - pro-human health (mean=2.26) - pro-natural resource use (mean=2.39); - pro-exploitation (mean=1.96).	
Value coflict	Degree to which there was an actual or potential conflict of values associated with the issue at stake. Consider diverging ethical, social, cultural and ideological values. Indicators include: latent conflict because of ('objectively') conflicting values; manifest conflict or actual dispute among stakeholders. Code the degree of conflict of values in comparison to other cases, and not in comparison to alternative potential scenarios for the same case.	0..4

All variable descriptions from [ANONYMOUS].

Communication intensity

Variable	*Factor 1 "Communication"*
Face-to-face communication	0.92
Information provision	0.88
Consultation	0.92
Two-way dialogue	0.93
Eigenvalues	3.32
Per cent of variance	0.83
Reliability (Cronbach's alpha)	0.93

Structured communication methods

Variable	*Factor 1 "Structured Communication Methods"*
Structural information elicitation	0.92
Structural information aggregation	0.91
Knowledge integration methods	0.84
Facilitation	0.81
Eigenvalues	3.02
Per cent of variance	0.76
Reliability (Cronbach's alpha)	0.89

Trust towards government and participants

Composite variable, adding trust built up during the decision-making process to the level of pre-existing trust.

Pre-existing trust: mean value of General_Trust_Government, Trust_Government_Actors, Trust_Stakeholders (Cronbach's Alpha=.78, mean= -0.40).

Cooperativeness of actors

Variable	*Factor 1 "Cooperativeness"*
Cooperativeness pro-conservation interests	0.89
Cooperativeness pro-human health interests	0.89
Cooperativeness pro-natural resource use interests	0.93
Cooperativeness pro-exploitation interests	0.76
Eigenvalues	3.01
Per cent of variance	0.75
Reliability (Cronbach's alpha)	0.89

Descriptive Statistics

[1]*Note:* For composite variables, the average information reliability is calculated.

	Variable	Min	Mean	SD	Max	Confidence Score[1]	Correlations (Spearman's Rho)												
							(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
(1)	Environmental standard of the output	-3.36	0.87	1.33	3.25	1.51													
(2)	Learning as deliberation	0.00	1.74	1.00	4.00	1.45	.42												
(3)	Learning & capacity building	-2.25	0.00	1.00	2.53	1.39	.39	.61											
(4)	Learning reflected in output	0.00	1.09	0.70	4.00	1.60	.38	.58	.56										
(5)	Communication intensity	-2.84	0.00	1.00	1.77	1.73	.38	.72	.52	.44									
(6)	Structured communication methods	-1.50	0.00	1.00	2.76	1.31	.35	.66	.59	.63	.62								
(7)	Power delegation to participants	0.00	1.91	1.11	4.00	1.81	.43	.64	.38	.47	.69	.51							
(8)	Non-state actor representation	0.00	1.06	0.51	2.81	1.61	.17	.35	.43	.36	.42	.43	.26						
(9)	Diversity of interests	0.00	0.61	0.16	0.69	1.63	.00	.08	.06	.04	.11	.11	.14	.22					
(10)	Diversity of sectors	0.00	1.12	0.29	1.38	1.63	.13	.22	.33	.24	.25	.34	.10	.74	.07				
(11)	Process duration (in days)	1	1,389.28	1,542.96	15,707	2.51	.07	-.14	.10	-.03	-.23	-.12	-.18	.05	.04	.05			
(12)	Trust towards govt. and participants	-4.99	0.18	1.77	5.00	1.31	.48	.60	.52	.44	.44	.43	.41	.28	-.02	.17	-.05		
(13)	Cooperativeness of actors	-2.87	0.00	0.97	2.38	1.56	.44	.55	.51	.45	.54	.42	.47	.35	.05	.17	-.04	.60	
(14)	Value conflict	0.00	1.81	0.79	3.75	1.71	-.15	-.09	-.01	-.04	-.08	-.08	-.08	.00	.18	-.15	.11	-.32	-.25

Extended regression table

	Dependent variables:							
	Learning as deliberation	Learning & capacity building		Learning reflected in output		Environmental standard of the output		
Model no.	(1a)	(2a)	(2b)	(3a)	(3b)	(4a)	(4b)	(4c)
Power delegation	0.16*** (0.05)	-0.05 (0.05)	-0.08 (0.05)	0.15*** (0.04)	0.13** (0.04)	0.25** (0.10)	0.22* (0.10)	
Communication intensity	0.31*** (0.06)	0.11 (0.07)	0.04 (0.07)	-0.11** (0.05)	-0.15** (0.05)	0.09 (0.14)	0.09 (0.15)	
Structured communication methods	0.26*** (0.05)	0.37*** (0.05)	0.32*** (0.06)	0.32*** (0.05)	0.24*** (0.05)	0.13 (0.08)	0.03 (0.09)	
Non-state actor representation	-0.09 (0.10)	0.12 (0.12)	0.14 (0.12)	0.08 (0.09)	0.07 (0.09)	-0.27 (0.20)	-0.28 (0.20)	
Diversity of interests	0.10 (0.23)	-0.24 (0.26)	-0.26 (0.26)	-0.28 (0.20)	-0.25 (0.19)	-0.80 (0.48)	-0.72 (0.49)	
Diversity of sectors	0.01 (0.17)	0.13 (0.19)	0.13 (0.19)	0.12 (0.17)	0.09 (0.16)	0.24 (0.37)	0.20 (0.38)	
Process duration (log)	0.03 (0.03)	0.15*** (0.04)	0.15*** (0.04)	0.01 (0.03)	-0.02 (0.03)	0.05 (0.07)	0.04 (0.08)	
Trust towards govt. and participants	0.14*** (0.03)	0.13*** (0.03)	0.10*** (0.03)	0.05 (0.03)	0.02 (0.03)	0.16** (0.06)	0.13* (0.06)	
Cooperativeness of actors	0.09 (0.05)	0.22*** (0.07)	0.20*** (0.06)	0.09 (0.05)	0.04 (0.05)	0.26* (0.10)	0.23* (0.10)	
Value conflict	0.08 (0.05)	0.20*** (0.06)	0.18*** (0.05)	0.09* (0.04)	0.06 (0.04)	-0.03 (0.10)	-0.07 (0.10)	
Learning as deliberation			0.20*** (0.07)		0.11* (0.04)		0.05 (0.10)	0.39*** (0.09)
Learning & capacity building					0.14** (0.05)		0.08 (0.10)	0.17 (0.10)
Learning reflected in output							0.18 (0.13)	0.32* (0.13)
Intercept	1.14*** (0.14)	-1.40*** (0.32)	-1.63*** (0.33)	0.53** (0.20)	0.62** (0.24)	0.51 (0.75)	0.49 (0.78)	-0.18 (0.22)
Observations	296	296	296	286	286	276	276	280
R^2	0.67	0.54	0.56	0.46	0.49	0.34	0.35	0.25
Adjusted R^2	0.66	0.53	0.54	0.44	0.47	0.32	0.32	0.24
Residual Std. Error	0.59 (df=285)	0.69 (df=285)	0.68 (df=284)	0.53 (df=275)	0.51 (df=273)	1.10 (df=265)	1.10 (df=262)	1.16 (df=276)
F-value	57.04***	33.70***	32.23***	23.25***	21.69***	13.65***	10.77***	30.45***
AIC	538.09	629.71	622.92	457.08	444.84	849.54	852.06	882.05

Note: Regression coefficients with standard errors in brackets. Models 3a to 4c report robust standard errors (Huber-White). Statistical significance is depicted as * p<.05; **p<.01; *** p<.001.

Model comparisons

(2a) vs. (2b): (2b) has significantly better model fit, *F(1,284)=8.56, p=.004.*

(3a) vs. (3b): (3b) has significantly better model fit, *F(2,273)=7.98, p<.001.*

(4a) vs. (4b): (4b) has no significantly better model fit, *F(3,262)=1.11, p=.35.*

Diagnostics for main models

The following displays for each full model some model diagnostics, analyzing whether the models meet assumptions of multicollinearity, homogeneity of variance (homoscedasticity), normality, linearity, and the influence of outliers. Used criteria are:

Multicollinearity – VIF < 4

Homoscedasticity – Breusch-Pagan test is non-significant

Outliers – Bonferroni p-values of studentized residuals non-significant

Normality – graphical inspection (points should remain within dotted lines)

Linearity – graphical inspection (inspection for strongly non-linear components)

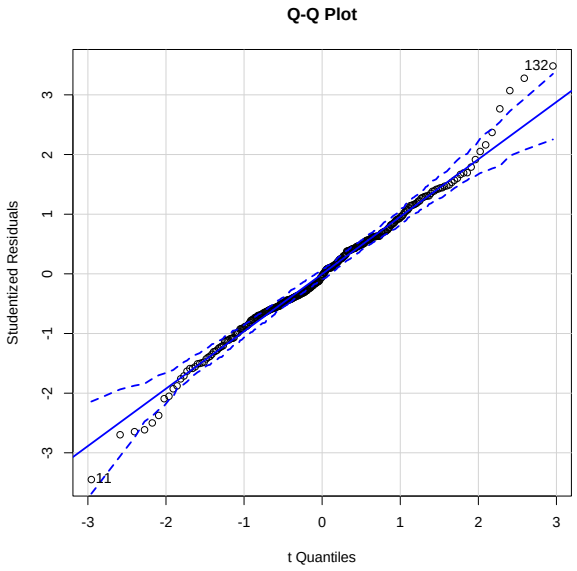
Model (1a)

Multicollinearity: VIF < 2.97

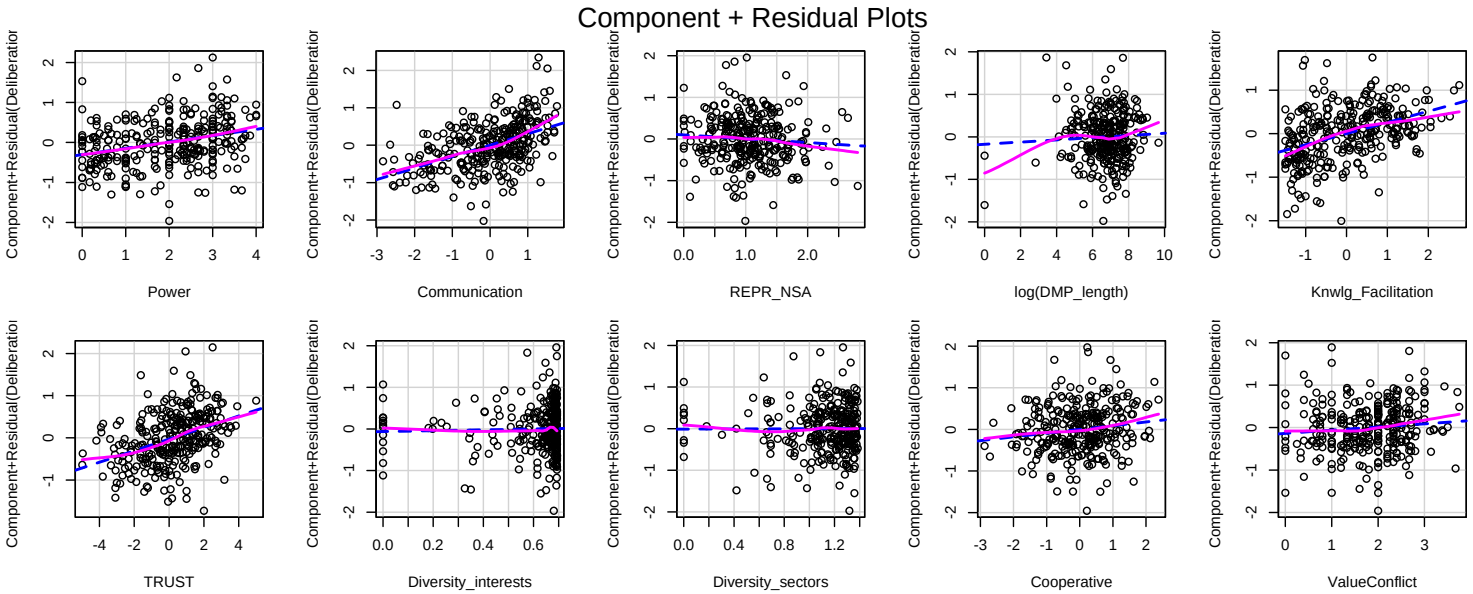
Homoscedasticity (Breusch-Pagan test): p=.79

Outliers (Bonferroni p-values of studentized residuals): p=.17

Normality:



Linearity



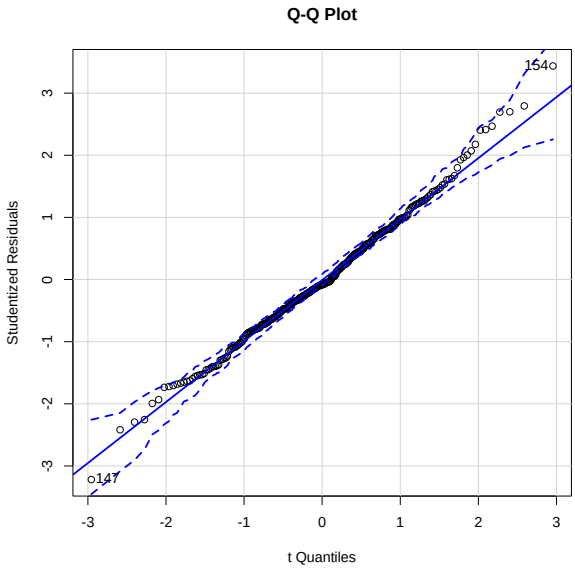
Model (2b)

Multicollinearity: VIF < 3.26

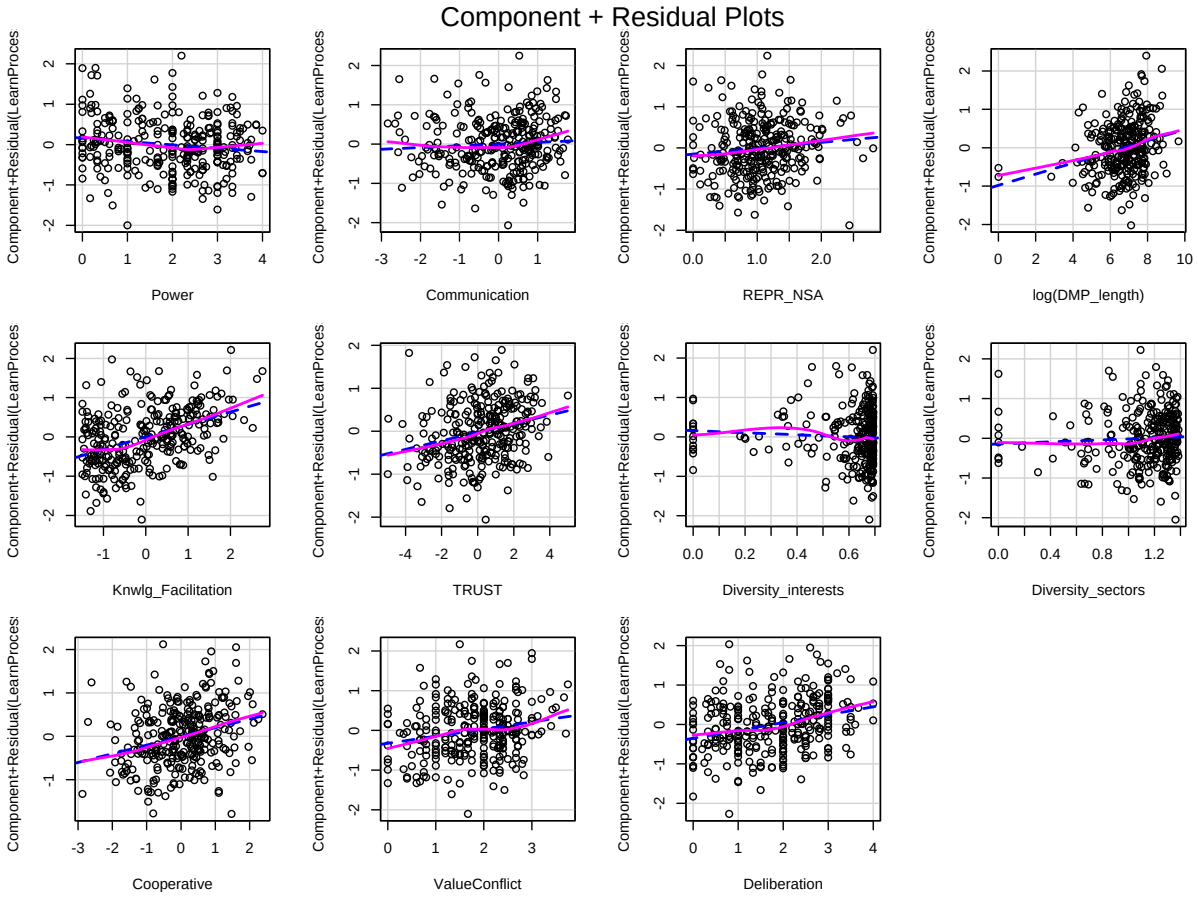
Homoscedasticity (Breusch-Pagan test): p=.19

Outliers (Bonferroni p-values of studentized residuals): p=.20

Normality:



Linearity:



Model (3b)

Multicollinearity: VIF < 3.46

Homoscedasticity (Breusch-Pagan test): p<.01 => Potentially problematic

Hence, robust Huber-White sandwich estimators for standard errors.

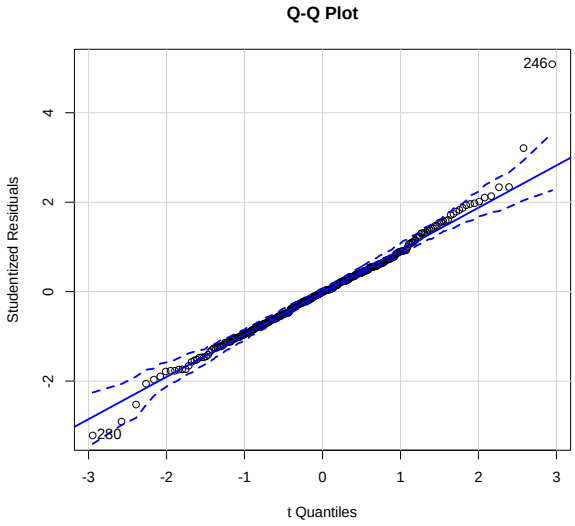
Outliers (Bonferroni p-values of studentized residuals): p<.01 => Potentially problematic

Closer inspection:

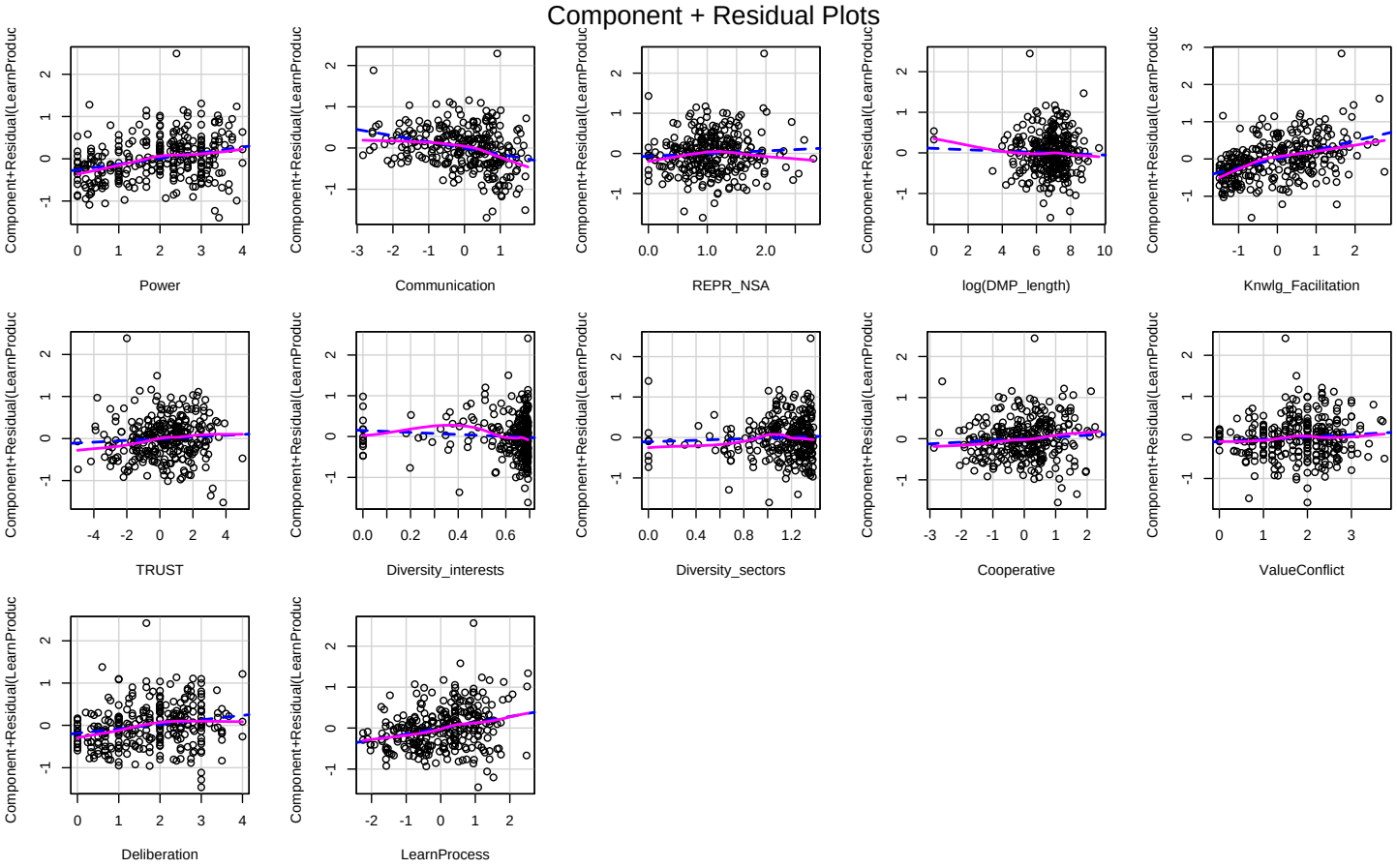
- Number of cases with large residuals (standardized residuals > abs(2)): 10, i.e. below 5%, as expected
- Two cases with standardized residuals >3
- However, Cook's distance <0.13, hence, no influential case
- Leverage < 0.15 (average for the model (k+1/n = 13/286 = 0.45), i.e. no high-leverage points

→ Given these diagnostics, outliers should not be a problem for the model

Normality:



Linearity:


Component + Residual Plots
Component+Residual(LearnProduc
Power
Communication
REPR_NSA
log(DMP_length)
Knwlg_Facilitation
TRUST
Diversity_interests
Diversity_sectors
Cooperative
ValueConflict
Deliberation
LearnProcess

Model (4b)

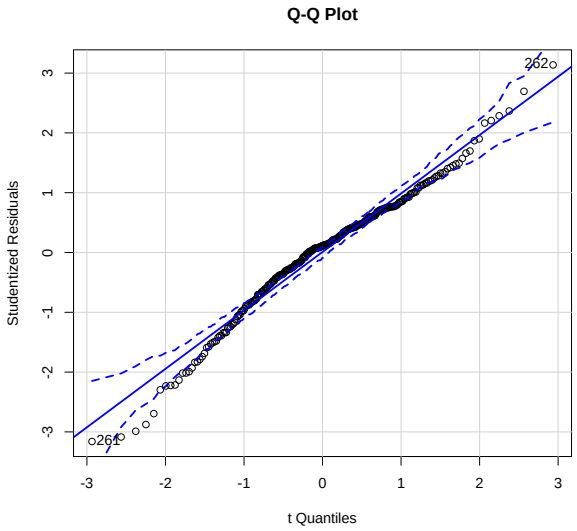
Multicollinearity: VIF < 3.47

Homoscedasticity (Breusch-Pagan test): p<.01 => Potentially Problematic

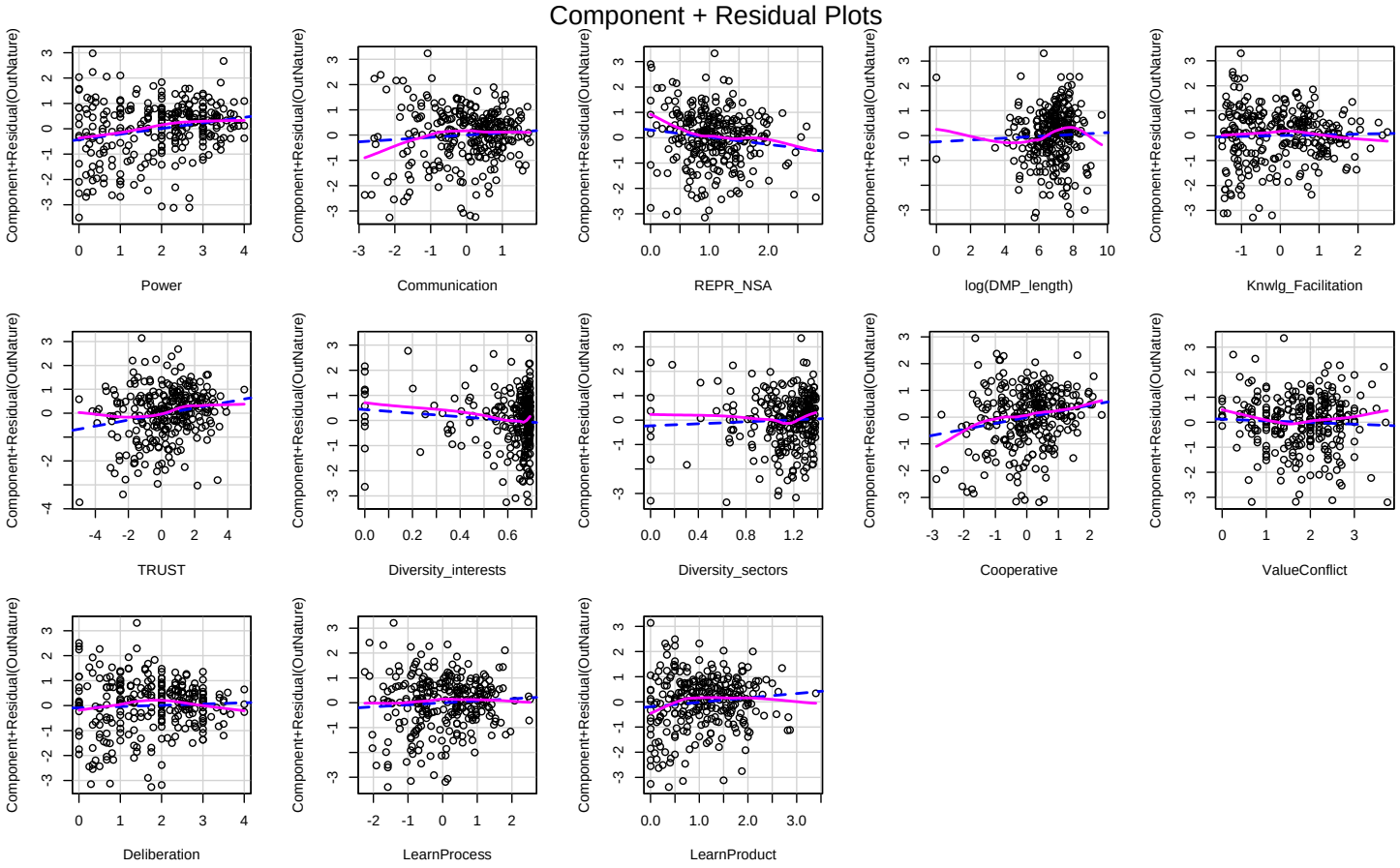
Hence, robust Huber-White sandwich estimators for standard errors.

Outliers (Bonferroni p-values of studentized residuals): p=.49

Normality:



Linearity:



Article 5:

Systematic Learning in Water Governance: Insights from Five Local Adaptive Management Projects for Water Quality Innovation.

Abstract

Adaptive management has been proliferating since the 1970s as a policy approach for dealing with uncertainty in environmental governance through learning. Learning takes place through a cyclical approach of experimentation and (possible) adjustment. However, few empirical studies exist that cover full iterations of adaptive management cycles. We report on five adaptive management projects on water quality enhancement, of which four led to innovations in the small-scale management of waterways in northern Germany. We trace processes as well as outcomes, to identify factors affecting learning, environmental improvement, and the successful delivery of a project throughout a management cycle.

Our findings point to a key difference between two kinds of uncertainty in the studied processes: ecological uncertainty (whether and how interventions will be effective in improving water quality) and what we term "social uncertainty" (how stakeholders will respond to interventions). We find that those managers performed better who addressed both kinds of uncertainty. Factors for dealing with social uncertainties were usually rather different than the ones linked to knowledge gain for the results in the rivers, and their acknowledgment was decisive for successful project delivery. On a conceptual level, our findings suggest that the model of a dual feedback cycle, including both types of uncertainties, allows for more clear-cut conceptual differentiation and empirical outcome measurement of adaptive management processes.

Keywords: Water Framework Directive, implementation, environmental governance, public participation, comparative research.

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Research

Systematic learning in water governance: insights from five local adaptive management projects for water quality innovation

Elisa Kochskämper [1,2], *Tomas M. Koontz* [3] *and Jens Newig* [1]

ABSTRACT. Adaptive management has been proliferating since the 1970s as a policy approach for dealing with uncertainty in environmental governance through learning. Learning takes place through a cyclical approach of experimentation and (possible) adjustment. However, few empirical studies exist that cover full iterations of adaptive management cycles. We report on five adaptive management projects on water quality enhancement, of which four led to innovations in the small-scale management of waterways in northern Germany. We trace processes as well as outcomes, to identify factors affecting learning, environmental improvement, and the successful delivery of a project throughout a management cycle.

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Key Words: *comparative research; environmental governance; implementation; public participation; Water Framework Directive*

INTRODUCTION

Achieving sustainable water governance is a prime example of complex environmental problems that face humanity. In recent years, scholars and practitioners have called for a transformation in how we address such problems because current governance arrangements are not sufficient (see, e.g., Blackmore et al. 2016).

Adaptive management (AM) is praised as an approach to solve complex problems (Armitage et al. 2009), deal with uncertainty (Walters 1997, Gunderson 1999), improve resilience (Folke et al. 2005), and advance governance of natural resource systems in general (Fabricius and Cundill 2014). The main tenet of AM conveys its intuitively appealing logic: learning and subsequent adaptation of management (Allen and Garmistani 2015) through continuous testing, monitoring, evaluating, and adjusting of policy options within a cyclical approach (Holling 1978, Walters 1986). Despite its allure, and while research on AM abounds, scholars have voiced several concerns with how the field develops. First, the concept is used in a very broad sense (Allen et al. 2011), and conceptual clarity of learning itself is lacking (Fabricius and Cundill 2014). In addition, scholars are skeptical about the applicability of the experimental approach to a range of natural resource field settings (Gregory et al. 2006, Rist et al. 2013). Finally, few empirical studies exist on full iterations of AM cycles (Chaffin and Gosnell 2015; see Allan and Stankey 2009 as a notable exception) or reporting on actual implementation (Keith et al. 2011, McFadden et al. 2011).

With this article we aim to explore the potential of AM for environmental improvements and learning, stressing two types of uncertainties (ecological and social) that the experimental approach encounters. We examine five German cases of small-scale AM projects that tested innovative measures in water quality enhancement.

ADAPTIVE MANAGEMENT: UNRAVELING A CONCEPT

Origin, content, and growth of the approach

Grounded in Holling's studies on ecosystem functioning in the 1970s (see Holling 1978), AM acknowledges nature as a dynamic and complex system that is difficult, if not impossible, to predict because of our incomplete and uncertain knowledge (de Groot and Lenders 2006, Pahl-Wostl et al. 2008, Foxon et al. 2009). Through a combination of trial and error and scientific learning (Meffe et al. 2002), AM aims to close knowledge gaps by uncovering how management interventions will in fact work; e.g., how do different regulated flow regimes from dam operations affect water quality, sediment loads, and fish populations (Lee 1993, Pulwarty and Melis 2001)? To do so, the AM approach involves designing and employing management actions in the form of experiments within a cyclical process (Walters and Holling 1990, Folke et al. 2005; see Fig. 1): First, management problems are defined and potential solutions formulated, and subsequently existing knowledge is synthesized to identify key knowledge gaps of the (sub)system of interest, leading to the design of management actions; afterward these actions are implemented and monitored to generate data for evaluation, which allows managers to learn about the actions' impact and (if necessary) to adjust them; and then add the gained understanding to the knowledge base (Meffe et al. 2002, Gunderson 2015). Through learning from these experiments and adaptation of practices, the approach is claimed to instruct more effective natural resource management (Medema et al. 2008, Allen and Garmistani 2015).

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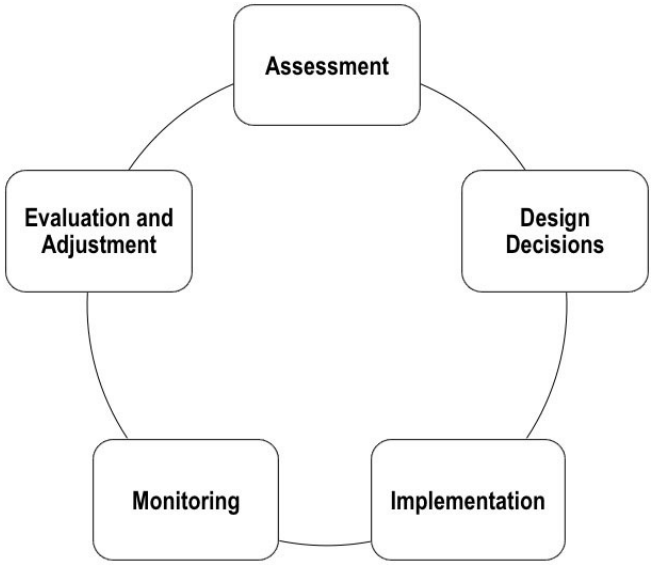
Fig. 1. The adaptive management cycle (adapted from Chaffin and Gosnell 2015)



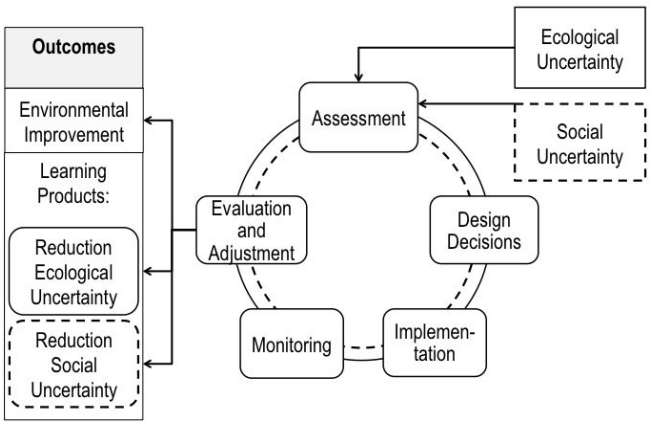
The notion of addressing incomplete knowledge and uncertainty through learning has made its way into related environmental management approaches. The main examples in this regard are participatory and collaborative approaches, which stress that different knowledge types (not only scientific knowledge) are needed for a solid knowledge base to tackle uncertainty and foster learning (Pahl-Wostl et al. 2007, Armitage et al. 2009, Plummer et al. 2012). To highlight the collaborative element, this concept was labeled adaptive comanagement (Plummer 2009). Similarly, polycentricity scholars conceptualized an adaptive institutional system having multiple centers or units of power providing redundancy and opportunities for units to learn from each other (Huitema et al. 2009, Chaffin et al. 2014). In addition, scholarship on social-ecological systems and resilience developed the concept of adaptive governance, which emphasizes dynamic learning through multilevel, polycentric, and collaborative characteristics of comanagement (Walker et al. 2004, Folke et al. 2005, Folke 2006). Both adaptive comanagement and adaptive governance address the expansion, operationalization, and scaling of AM and are frequently used synonymously (Chaffin et al. 2014).

These conceptual amplifications highlight the promising appeal of AM. At the same time, the body of literature on failures of AM and specific barriers to its implementation is growing (Rist et al. 2013, Allan and Watts 2018). It has not yet been shown whether failures or barriers are attributable to the method itself or exogenous factors, such as unfeasible contexts for application, generic obstacles for management implementation, inappropriate expectations, and under-reporting of success (Rist et al. 2013, Allan and Watts 2018). One major difficulty to disentangle this is the missing consensus on measuring success: According to Rist et al. (2013) the main goal of AM is the reduction of uncertainty surrounding an environmental problem; Chaffin and Gosnell (2015) put emphasis on a sound process for successful management, whereas Fabricius and Cundill (2014) as well as Allan and Watts (2018) propose the occurred learning as the key success outcome. However, who learns what and how is understood very differently (Fabricius and Cundill 2014, Allan and Watts 2018). Therefore we dissect the outcome-side of AM and define success criteria.

Measuring success in adaptive management

AM acknowledges that "systems to be managed are, in broad terms, complex, unpredictable, and characterized by unexpected responses to intervention" (Pahl-Wostl et al. 2007). Learning in AM is therefore deliberate and result oriented (Hillmann 2009) by integrating uncertainty into a decision-making framework, and reducing it through management (Williams and Brown 2016). Uncertainty in AM "arises from imperfect information about system response" (Keith et al. 2011:1175). Environmental resource managers anticipate cause-and-effect relations between actions and ecological components. Rist et al. (2013) call this "ecological uncertainty." The possible adjustment of management actions allows for various iterations of the feedback cycle, thereby narrowing this uncertainty until the anticipated environmental improvement is achieved, thereby refining future management (Williams and Brown 2014; see Fig. 2). Improved environmental conditions are ingrained into the learning endeavor and one successful outcome of AM. Although the identification and reduction of uncertainty is key in AM (Allen et al. 2011), Walters (1986) stresses that it is not possible to completely reduce uncertainty. There are simply indeterminable and irreducible sources of uncertainty, i.e., when objective probabilities cannot be assigned to potential outcomes (Tyre and Michaels 2011).

Fig. 2. Success in adaptive management projects in relation to ecological and social uncertainty.



This indeterminism is even more accentuated when it comes to socially induced uncertainties (Tyre and Michaels 2011). Interdependent social-ecological uncertainty describes an inherent property of systems defined by human-environment interaction and related management (Armitage et al. 2008). First, socially induced uncertainties can stem from different beliefs about reality or differing subjective probabilities assigned to an event by individuals (Tyre and Michaels 2011). Second, AM implies experimentation in the real-world context with consequences of actions for affected stakeholders, which can lead

to "the questioning of who has the knowledge and capacity to manage" (Jacobson et al. 2009:485). Rist et al. (2013) highlight the importance of a feasible social, political, and institutional context to allow managers to implement different management actions. Lee (1993, 1999) as well as Voß and Bornemann (2011) point to conflict and political struggle as being integral to or unavoidable in the experimental approach.

We follow Tyre and Michaels (2011) in their call to distinguish ecologically and socially induced uncertainty, and define social uncertainty as the potential unanticipated response from people in the social system to an AM intervention. A collaborative decision-making structure prior to experimentation might prevent unbounded conflict (Lee 1999), however, there is no guarantee that stakeholders will agree on results, or that unforeseen surprises such as shifting objectives in management regimes will not occur (Tyre and Michaels 2011). Again, a complete reduction of social uncertainty is out of reach, yet learning about social factors affecting how stakeholders respond to interventions is crucial for AM to be understood as not overly mechanistic or technical. This learning is often left out in AM literature (Pahl-Wostl 2009, Williams and Brown 2014, 2016). Of course other components influence social uncertainty in managing social-ecological systems, e.g., processes of individual and group identity building that affect individuals' behavior and perceptions. The AM literature, when mentioning social uncertainty, typically focuses on how stakeholders respond to experiments (Lee 1993). Therefore, as a first step in bringing social science more fully into AM, in this study our data on social uncertainty depict how stakeholders responded to experiments.

We understand the learning outcome in AM to be reduction of ecological and social uncertainty. When both ecological learning and social learning are achieved, opportunities for double-loop learning conducive to innovation emerge (Williams and Brown 2014). Double-loop learning leads to reflection on questions underlying values, beliefs, or the status quo and explores innovative approaches. This contrasts with single-loop learning, which refers to instrumental changes without overhauling belief or value systems and management regimes (Argyris and Schön 1978, 1996, Pahl-Wostl et al. 2007, Fabricius and Cundill 2014).

Apart from what is being learned, it is crucial to define who learns. Early work entirely focused on individual learning by scientists and resource managers (Holling 1978, Walters 1986, Foxon et al. 2009, Fabricius and Cundill 2014). Lee (1993) expanded this view to organizational and social learning, including stakeholders. Gunderson and Holling (2002) also acknowledge that it is not sufficient for the project's resource managers alone to learn. Learning by stakeholders or societal actors can lead to acceptance of outcomes as well as the spreading of AM successes (Graham and Hicks 2015), which is in line with general assumptions of participatory environmental governance (Newig et al. 2018). Although ecological learning relates to managers and stakeholders, we see the learning about social uncertainties mainly linked to organizers or managers of AM.

Factors influencing successful adaptive management

Literature on AM offers an abundant set of factors that are expected to impact the success of projects. In order to provide structure, we assign these factors to the individual management phases as conditions that might impact each type of uncertainty in potentially reducing the unanticipated response by the ecological and/or social (sub)system of interest (see Table 1).

Table 1. Factors for reducing uncertainties in AM projects, aligned with types of uncertainty and management phases.

Phase of Adaptive Management	Ecological Uncertainty	Social Uncertainty
Assessment/ Design decisions	Local scale	Enabling legislation
	Rigorous design	Communication
	Knowledge incorporation	Reversibility
		Bridging organizations
Implementation	Networks	Trust
Monitoring	Long-term monitoring	Leadership
	Participatory monitoring	Sufficient budget
Evaluation and adjustment	Possibility for adjustment	Documented, communicated effects

At the outset of an AM project is the assessment/design decisions phase, where management problems are defined and potential solutions formulated before existing knowledge is synthesized to identify knowledge gaps. Here a local scale for testing is recommended to enhance predictability of ecological cause-and-effect chains (Cook et al. 2004, Chaffin and Gosnell 2015, Murray et al. 2015). AM blends scientific rigor with practicality (Meffe et al. 2002), which leads to different project designs: passive AM, documented trial and error learning, and active AM. The latter uses rigorous experimentation with hypotheses and controls to structure learning, arguably making it more effective (Meffe et al. 2002, Allen and Garmestani 2015, Gunderson 2015). The emphasis on a rigorous design links back to the origins of AM seen as navigated by scientific and expert knowledge as a science inquiry process based on models, simulations, and deduction (Holling 1978, Walters 1986, Foxon et al. 2009, Fabricius and Cundill 2014, Gunderson 2015). The adaptive learning process is similar to organizational learning, which entails the integration of new, viable, and effective insights and findings into organizational or institutional structures (Thomas and Allen 2006). In principle, it does not matter how these are discovered. Adaptive comanagement and governance scholars draw on participation for the inclusion of complementing knowledge. This idea has also made its way into AM literature (Stringer et al. 2006, see also Fabricius and Cundill 2014 on this). To reflect both views, knowledge incorporation to reduce ecological uncertainty can occur through the elicitation of expert knowledge or the integration of different knowledge types.

As already mentioned, stakeholder involvement is also seen as key in preventing conflict and in building a shared understanding of the objectives and the management process (Lee 1999, Chaffin and Gosnell 2015). Thus, communication pertains to this component of social uncertainty, which can take the form of one-way information or two-way exchange, including dialogue or deliberation as an equal exchange of arguments (see, e.g., Newig et. al 2018). AM can allow managers to identify the most viable way to achieve agreed upon outcomes, and to clarify trade-offs within different options, but is not per se a conflict resolution strategy, particularly when it comes to conflicts of values over desired outcomes (Murray et al. 2015). The reversibility of interventions and treatment responses is seen as an additional

strategy to prevent conflict (Murray et al. 2015). Further, bridging organizations are supposed to function as intermediaries between agencies and projects on the ground (Hahn et al. 2006, Plummer et al. 2012, Allen and Garmistani 2015). Considering the immanent political dynamics and path-dependencies in policy planning and management (Voß and Bornemann 2011), a legal context that does not hinder (Murray et al. 2015) or even support AM (Allen and Garmestani 2015) embodies a prerequisite within the social system for realistic planning of management interventions.

Once the project design is complete, AM moves to the implementation phase, in which experiments are applied. In line with the process of organizational learning, new knowledge brought in is seen as ongoing in AM (Walters 1986). Regarding policy experiments, McFadgen and Huitema (2017) distinguish between the ideal types of technocratic and boundary experiment: the former is issued by policy actors to experts for instrumental problem solving through (assumedly) objective knowledge independent of context and subjects; the latter is inclusive by involving stakeholders to produce evidence and develop shared values based on multiple knowledge types. For participatory forms of AM, networks in which individuals, e.g., managers, stakeholders, or public officials, interact are thought to stimulate learning through enhanced information flow and exchange (Plummer et al. 2012, Fabricius and Currie 2015, Koontz et al. 2015). They can also operate as science-management-policy networks fostering the implementation of best available science through stakeholders (Chaffin and Gosnell 2015, Berkley and Gunderson 2015). Therefore we see them as mainly helping to reduce ecological uncertainty. For a smooth functioning and reduction of sudden disruptions or conflicts, trust is vital between managers and stakeholders, which is perceived in general as catalyzing AM projects (Gunderson 1999, 2015, Hahn et al. 2006) and thus placed into the category of factors reducing social uncertainty about how stakeholders will respond to interventions.

Monitoring, which follows the implementation phase, is critical for AM because it provides feedback on management experiments (Aceves-Bueno et al. 2015, Gunderson 2015, Holling and Sundstrom 2015). A system should be in place that secures minimum quality of and consistency standards for data, so that changes can be clearly attributed to interventions, and unintended consequences can be quantified (Aceves-Bueno et al. 2015, Waylen and Blackstock 2017). Persistent, long-term monitoring supports sound and useful data collection to reduce ecological uncertainty (Koontz and Thomas 2006, Holling and Sundstrom 2015). Additionally, participatory monitoring is increasingly recommended for integrating different knowledge types to reduce ecological uncertainty (Aceves-Bueno et al. 2015, Waylen and Blackstock 2017). The lack of financial resources can disrupt the AM cycle particularly during this phase (Butler and Koontz 2005, Aceves-Bueno et al. 2015, Williams and Browns 2016, Waylen and Blackstock 2017). Costs for monitoring are more challenging than in other management approaches, thus a sufficient budget is crucial. In addition, leadership (organizational or individual) is seen as a key factor for the successful delivery of AM (Plummer et al. 2012, Gunderson 2015, Koontz et al. 2015, Murray et al. 2015) and is especially important during this critical phase.

The final phase is evaluation and (potential) adjustment. The possibility of adjustment is the main feature in AM to reduce ecological uncertainty. Documentation and communication of effects support the proper use of results in the future, thereby addressing social uncertainty. In a survey of 70 river enhancement projects, O'Donnell and Galat (2008) found that lack of documentation and accessibility to project information, especially project monitoring, are notable obstacles for conducting AM.

CASE SELECTION AND METHODOLOGY

Data for this comparative case study come from five AM projects conducted as part of the implementation of the European Water Framework Directive (WFD, Directive 2000/60/EC). The WFD is arguably the single most important piece of recent European legislation in water governance (Hering et al. 2010), stipulating action conducive to cleaner waters throughout the European Union (EU). The main categories of action are restoring the natural river flow and reducing pollution. Up until now, EU Member States have focused mainly on improving river connectivity, by removing disruptive infrastructure (Kochskämper et. al. 2017). In addition, innovative small-scale approaches targeting mainly diffuse source pollution from, for example, nitrate and renaturalization, have emerged. These approaches include pilot projects that test new types of actions for water quality improvement. For this study, an AM case is a project that aims at learning about replicable actions, following an experimental approach.

We selected five such cases in Germany, two in Schleswig-Holstein, the most northern federal state, and three in the adjacent city state of Hamburg. Thus, all cases were embedded in a similar climatic, cultural, and legal context. The WFD required a status assessment of all EU water bodies that had to be made publicly available. The assessment revealed poor water quality in the states of Hamburg and Schleswig-Holstein. The cases share the same pursuit, namely water quality enhancement (see Table 2): three of them through in-stream modifications, i.e., installing gravel, deadwood, or similar material into river stretches to improve dynamic meandering in the water flow (Case 1, 3, 5), one through changes in riparian vegetation and waterway management to improve water quality without reducing run-off too far (Case 2), and one through reintroducing different water plants with a cleaning function for rivers (Case 4). The similar case context comes close to a "most similar" case design (Gerring 2007).

We engage in an exploratory qualitative within-case inference and cross-case comparison. The first author held interviews between 2015 and 2017 with the main managers of all projects (N = 7), and examined case material documents for data triangulation. Documented material included meeting minutes, reports, funding requests, memoranda of agreement, and newspaper articles totaling nearly 1000 pages. Interviews were conducted using a semistructured format following Lamnek (1989) based on the conceptual basis presented, asking for the project course and outcomes. They lasted between 45 and 90 minutes each and were conducted in person. The interviews were conducted in German by a native German speaker fluent in English, who translated them for this article. We performed a content analysis on the transcribed interviews and documentary case material. Following

Table 2. Features of case studies.

Design Factors	Case 1: In-stream modification	Case 2: Riparian vegetation	Case 3: In-stream modification	Case 4: Reintroduction water plants	Case 5: In-stream modification
Project initiator	District agency	Environment agency	University	ENGO	ENGOs (3)
Running time	2013 -2015	First 2009 to 2013; then to 2017	2008 to 2014	2010 to 2014; additional monitoring 2017	2009 to 2017
Bridging organization	Environmental planning bureau	Biologist team			
Funding	Environment agencies of Hamburg or Schleswig-Holstein				
Legal context	EU Water Framework Directive (WFD)				
Scale	Local scale				
Reversibility	High				

Miles and Huberman (1994), the content was coded based on the different management phases and related enabling factors as well as potential outcomes defined as measures of success above. The coding was performed in a deductive way, based on prior literature, identifying the presence or absence of factors and outcomes in the case material to trace trajectories for each case. Below interviews are cited with a case code according to the case number, and interview quotes are used as representative examples for this coding procedure.

It is important to note that, according to McFadgen and Huitema's (2017) terminology, Cases 1 to 4 were planned as technocratic and only Case 5 as a boundary experiment with stakeholder involvement planned from the outset. Technocratic experiments include the problem definition and determination of solutions to be tested by (policy) actors in advance. In Case 1 a district agency in Hamburg contacted an environmental planning bureau to test in-stream modifications in a river suffering from particularly high pollution levels. In Case 2 the environmental agency of Schleswig-Holstein contacted a biologist team to test altered riparian vegetation in different rivers throughout the federal state. In both cases these contacted experts acted as bridging organizations because the experiments had to be communicated to stakeholders. Nonstate actors initiated the remaining projects: In Case 3 a university proposed in-stream modifications in a larger renaturalization project to the environmental agency of Schleswig-Holstein for funding, and to the water board, an association mainly comprising landowners, overseeing a certain catchment for coimplementation. In Cases 4 and 5, environmental nonstate organizations (ENGOs) perceived a window of opportunity through WFD implementation and obtained funding from Hamburg's environmental agency. In Case 4, the botanic association noticed through the water status assessment that in 80% of Hamburg's rivers water plants were missing (I:C4). In Case 5, the local branches of three major German ENGOs observed the district agencies' main focus on improved river connectivity for WFD implementation (I1:C5). This allowed them, under the lead of one ENGO, to step in for additional small-scale actions targeting pollution, particularly in-stream modifications, in the River Alster, which crosses the whole city (I1:C5). In all cases interventions could be easily reversed through a removal of installed material, riparian vegetation or water plants. Apart from water plants, slight negative effects for stakeholders, e.g., landowners or farmers, were possible, such as erosion or reduced water run-off.

LOCAL APPLICATION OF FIVE ADAPTIVE MANAGEMENT PROJECTS FOR WATER QUALITY IMPROVEMENT

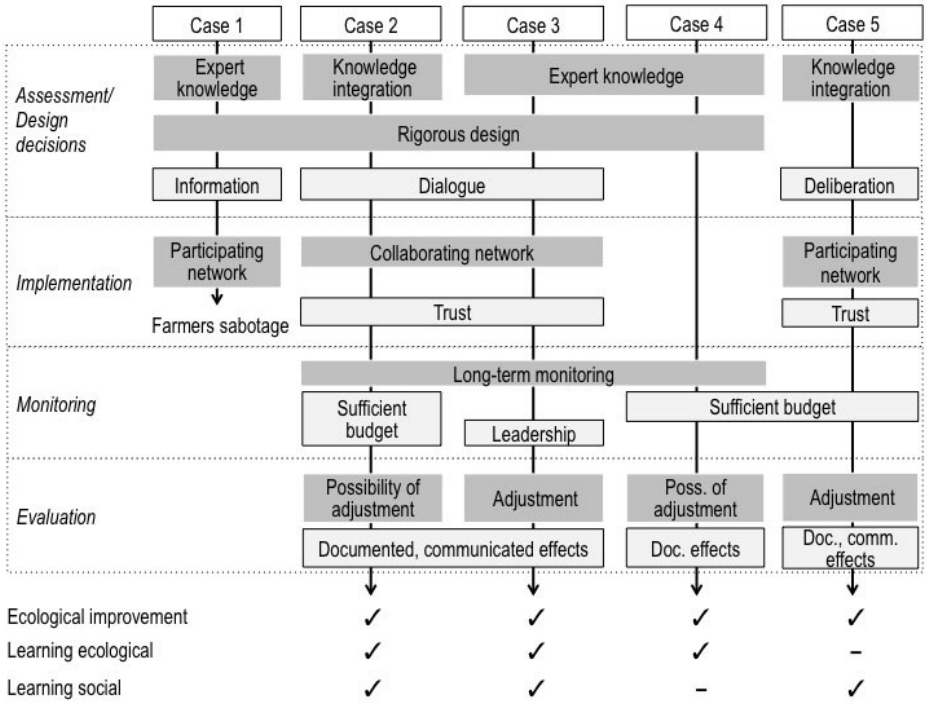
Assessment and design decisions

In all of the cases the problem definition and determination of actions to be tested was already established in advance, although the ENGO in Case 5 provided the possibility to bring in further proposals through deliberative workshops. Knowledge about the ecological effects of particular interventions varied across the cases. Actors in Hamburg (Cases 1 and 5) already had experience with in-stream modifications, while managers in Schleswig-Holstein (Case 3) were inexperienced ("There was no manual") and their river was one of the first test sites for this type of action in the federal state (I:C3). Knowledge about effective altered water maintenance (Case 2) and in particular water plants (Case 4) was almost nonexistent (I:C1; I:C4). Figure 3 shows the presence of particular factors in each case trajectory.

In Case 1 managers relied on expert knowledge for modeling flow dynamics, and they developed a rigorous design for cause-and-effect predictions. They selected test sites on the basis of favorable ecological conditions and designed an active, iterative implementation procedure for interventions. Communication with stakeholders was one-directional in an information event on planned actions, which elicited resistance from farmers who feared flooding of their fields with pollutants by hindered run-off (I1:C2). The planning bureau representative confirmed that flooding by toxic sewage waters had happened previously several times (I2:C2). The district as well as the planning bureau representative considered the planned interventions causing such effects as worst-case scenarios (I1:C1) and the perceived fears frequently exaggerated (I2:C2): Farmers "did not believe the numbers" (I2:C2) of the presented, calculated run-off estimations. "They say they know their waterways and those weird calculations that nobody understands are nonsense" (I2:C2).

Apart from expert knowledge, the managers in Case 2 also elicited lay-local knowledge about current water maintenance techniques at 169 rivers via questionnaires (Stiller and Trepel 2010). Altered riparian vegetation directly affected agricultural practices, therefore the managing biologist first sought permission by the umbrella organization of all water boards at federal state level, mostly constituted by landowners and farmers, and afterwards by five local water boards that agreed on collaborating at five test rivers. These were integrated into a rigorous design as parallel test

Fig. 3. Phases of adaptive management projects with influencing factors and results found in the cases. Dark grey boxes refer to ecological uncertainty; light grey boxes to social uncertainty. The factors of bridging organizations, local scale, legal context, and reversibility are integrated into Table 2.



sites. Working plans for each of the five pilot river sites were agreed upon with these water boards in bilateral dialogue (Stiller 2014), which brought the project closer to a bounded experiment.

In Case 3 the university conducted flow measurements to construct a database and developed a rigorous, iterative testing design for in-stream modifications. Test sites were selected with agencies and deliberately chosen to lie in areas with low potential conflict, primarily not affecting agriculture. Managers and the only farmer renting land at one test river stretch agreed on the cautious implementation of only one action (I:C3). This test site selection was similar in Case 4, where once more a rigorous, parallel testing design was developed based on expert knowledge such as the only existing review of water plants the interviewee knew of (I:C4).

In Case 5 the ENGO selected test sites mainly according to acceptance of stakeholders and agency representatives via bilateral talks and within two deliberative workshops with residents, recreational sport associations, anglers, and interested citizens (I1:C5, I2:C5). Apart from integrating local knowledge, planned interventions were presented and discussed with the possibility to bring in new proposals, and later put online for voting. The participants agreed on all actions and did not bring in new proposals for in-stream interventions, but contributed new ideas for implementation techniques (NABU 2013*a, b*). Although participants asked for a scientific backing because of the pilot character of test sites in the inner urban area (I1:C5), the ENGO did not develop a rigorous design.

Implementation

Despite the high disagreement of stakeholders, i.e., farmers, the fixed plan in Case 1 was not changed and no further communication took place. A network of ENGO volunteers, which did not include the affected farmers, implemented the actions. After the first implementation, a farmer sabotaged the project by dredging out all installed material during the night. The project came to a halt afterwards (I1, 2:C1).

In the first test phase on altered riparian vegetation of Case 2 new ideas from water boards and the leading biologist were constantly brought in (I:C2). The five water boards formed a small network that collaborated closely, bringing specific resources, such as excavator operators, and know-how to the project (Stiller 2014).

In Case 3 the university initiating the project opted out after the first round of implementation and monitoring because of an unexpected research project conclusion. The water board and particularly their biologist were keen on continuing the project, and took it over entirely (I:C3). They started a collaboration with the water and shipping administration and their trainees program through which a new flow measurement could be carried out serving as a new knowledge base (I:C3). Together they expanded their implementing network to additional agencies (Lübeck Port Authority; I:C3). The trainees developed and implemented the in-stream modifications through annual competitions, which led to innovative ideas according to the biologist (I:C3). The biologist also maintained a constant dialogue with stakeholders, such as anglers (I:C3).

In Case 4 one stretch of the river of Case 1 had also been chosen as one of the four, parallel test-sites. During water plant installation the biologists were chased away by the same farmer who had sabotaged the project in Case 1, therefore they selected another test stretch further down the river in order to continue without drawing conflict from any stakeholders (I:C4).

In Case 5, the ENGO organized special days for implementation in which participants from the workshops, interested citizens, and other actors could participate (I1:C5; I2:C5). In addition, so-called creek partnerships, already established groups of residents, stakeholders, and interested citizens that look over certain river stretches in Hamburg, were always invited (I1:C5; I2:C5). Schools and companies could participate on demand (https://hamburg.nabu.de/natur-und-landschaft/gewaesser/18093.html; I2:C5). In comparison the network was ad-hoc and looser than in the other two cases, as the main aim seemed to be participation in implementation instead of shared and exchanged knowledge. Managers also upheld a constant dialogue with stakeholders (I2: C5). According to both interviewees in Case 5, early communication with agencies and stakeholders was crucial for implementation: "You have to talk to the people, then it's ok" (I1C:5) and "you first have to build up trust" (I2C:5). Trust building via early communication played a crucial role for understanding and acceptance in all cases with potentially affected stakeholders (Cases 2, 3, 5). Trust built between managers and stakeholders until implementation started supported this phase substantially through no disruptions of the experimental interventions or joint implementation. In contrast no trust was generated in Case 4, nor was it needed, because test sites were selected that did not generate any conflict with stakeholders.

Monitoring

Relying on sufficient funds by the federal state agency, the project managers in Case 2 carried out monitoring continuously and in the long term. It took place in the same month of three consecutive years (Stiller 2014) and four years later, showing the same results (I:C2).

In Case 3, the water board obtained new funding by the county, yet no resources for monitoring were foreseen, so the biologist started her own monitoring via photo documentation, supported by a local forester. They take photos at least once a year at the same position and from the same angle at various river sites: "This [the monitoring] is very important; without the assessment this is useless" (I:C3). Together with the adoption of the project management, the continuous, long-term monitoring over years implies substantial leadership by the water board and particularly the leading biologist in this case. In the other cases managers were all ambitious in delivering this phase, for instance also testing new monitoring practices in Case 5 according to the interviewee (which were not documented), but the voluntary action by the manager in Case 3 represented a vital element to maintain the delivery of this phase and the whole project, which we categorize therefore as leadership.

In Case 4 monitoring was carried out several times, two years apart and also three years later (I:C4). In Case 5 monitoring was carried out once at the end of the project at several points of the river (Hammer 2018). According to one ENGO representative, they already knew as much about effects that continuous monitoring was not necessary (I2:C5). In none of the cases did participatory monitoring take place; rather monitoring was directed by managers.

Evaluation and adjustment

In Case 2 adjustment was possible, yet actions were not adjusted, because they showed the anticipated results already in the initial and particularly final monitoring round. This case provided the most systematic documentation on effects, with comprehensive reports on the process of interventions and results (Stiller 2014). The results were communicated via training to water boards, ENGOs, and local administration.

In Case 3 iterative adjustments were employed to see how far river flows could be altered through in-stream modifications for achieving anticipated effects. The water board documented the process of in-stream modifications and provided a summary on its website. The photo monitoring was compared to initial measurements on flow and breadth of the rivers to detect erosion at riverbanks (DSV Rantzau 2017, *unpublished data*). This assessment was communicated to their collaborating network.

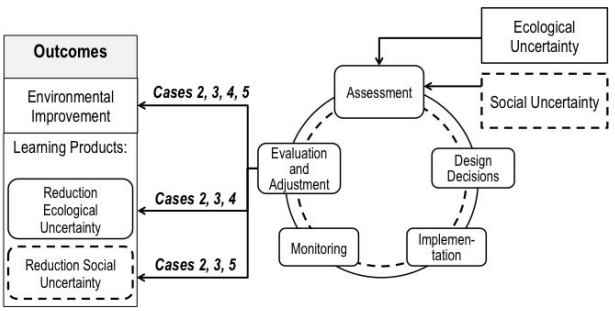
In Case 4, which had an experiment with parallel test-sites like Case 2, the monitoring round also showed that adjustments were not necessary. Documentation of effects was also systematic and contained practitioner instructions (Stiller and Engelschall 2014). No further communication of results occurred.

In Case 5, where iterative adjustments to in-stream modifications were applied, project managers held an annual event sharing the project's progress and results with Hamburg's water administration, ENGOs, and interested citizens. There is no overall evaluation and aggregated documentation planned in Case 5, yet all presentations held at these events are available online.

Outcomes

In all cases that completed at least one feedback cycle (Cases 2, 3, 4, and 5), there was evidence of improved ecological results (see Fig. 4). In Case 2, the altered riparian vegetation and waterway management led to improved water quality without reducing run-off too far (Stiller 2014). In Case 3 it became clear what kind of meandering can be produced by which type of installed material (DSV Rantzau 2017, *unpublished data*). In Case 4 managers learned which type of cleaning water plants can be introduced best (Stiller and Engelschall 2014). In Case 5 the assessments even showed improved fish and invertebrates population (Hammer 2018).

Fig. 4. Outcomes of adaptive management projects.



Regarding the learning products, the documentation of implementation techniques in Cases 2 to 4 indicate ecological learning by managers. In contrast, informants criticized the monitoring in Case 5, which precluded tracking of erosion or of blocked waterways by material that got washed away. "Several things can go wrong. ... One has to find middle ground between inspiring and activating a lot of people and doing it adequately for the waterway and everyone [affected]. This is difficult." (I:C2). Ecological uncertainty was not reduced substantially in this case.

In Cases 2, 3, and 5, learning about the social and organizational structures of the entire process was indicated. In Case 5, the process of involving stakeholders is documented (NABU 2013*a, b*), and an interviewee said the project showed "how far they can go with different stakeholders," and included a "steep learning curve" (I2:C5) in this regard. Cases 2 and 3 included no written documentation of how social factors were considered; therefore it is more complicated to identify learning about social uncertainty during the AM process. Nonetheless, managers in both cases continued with the strategies that appeared to have worked for the first project application. In Case 2 the new management practices were replicated with landowners and water boards at 37 rivers in Schleswig-Holstein, and afterward piloted in rivers in the neighboring federal states of Hamburg and Lower Saxony. The main manager in Case 2 involved landowners gradually via mediation and dialogue: "... You have to get to know their current position, ... even with the hardliners. ... One has to involve people slowly" (I:C1). She first targeted landowners with moderate positions, and organized training with a theory and praxis part on site. Likewise, the grown implementing network in Case 3 replicated the project at further river stretches. Managers once more deliberately sought acceptance of land-owning farmers by showing tested in-stream modifications, which had not affected riverbanks through erosion (I:C3).

Apart from the main managers, additional stakeholders learned in Cases 2 and 3. As the project replication in Case 2 shows, farmers adopted the ecologically more sensitive management of riparian and waterway vegetation. In Case 3, the trainees have replicated the project in cooperation with another water board at a considerably smaller waterway since 2017 (I:C3). The project manager confirmed: "... To take the project in [our] own hands has led to a learning effect of all participants" (I:C3). Regarding public officials, it was more difficult to trace learning. From the point of view of interviewed nonstate actors, the up-take of knowledge and actual application of know-how depends on the interest, time, or political considerations of the respective responsible public official (I2:C1, I:C4, I2:C5). Also the participating network in Case 5 showed no clear signs of learning. Some of the participants from the initial workshops participated in the "implementation days," yet, according to the interviewee the interest in ecological effects was usually not high (I2:C2).

It is worth noting that in Case 1, where implementation failed and the AM process did not complete a full cycle, nevertheless some social learning about how stakeholders will respond to interventions did occur. When asked about lessons learned, the district representative highlighted the importance to "built up trust with the actors on site" (I1:C1) and the planning bureau representative put emphasis on early information and transparency (I2:C1). Nonetheless, according to him "It's whether they [stakeholders] are affected [that matters]" (I2:C1).

In sum, Cases 2 to 5 achieved ecological improvement. However, learning about managing ecological uncertainties appeared to evolve to a lesser degree in Case 5, where the adaptive management design was less rigorous than in Cases 2, 3, and 4. In the cases that confronted social uncertainties (Cases 2, 3, 5), there were indications that managers learned how to deal with those. In the cases with a collaborating network and a rigorous design, participants of the network indicated learning about implementation techniques, i.e., managing ecological uncertainties, as they continued with the new management approaches by themselves in Case 2 or replicated the whole approach with new actors in Case 3.

DISCUSSION

The five examined AM cases exemplify important steps toward innovations in water management practices. Having examined all cases in detail, we discuss in the following which of the enabling factors outlined in the concepts played an important role for successful outcomes.

All cases with at least one full iteration of an AM cycle showed environmental improvement. Learning by managers about how to reduce ecological uncertainty was indicated in the cases that developed a rigorous experimental design, systematically incorporated new knowledge, and applied long-term monitoring as well as evaluation (Cases 2, 3, 4). The degree of learning about ecological uncertainty was lower in Case 5 with a less rigorous design. However, iterative adjustment of interventions made it also possible to achieve enhanced water quality in Case 5.

Interestingly, whether knowledge was gained via expert knowledge or the integration of different knowledge types appeared not to make a substantial difference for learning about the ecological effectiveness of measures, nor for environmental improvement. This supports McFadgen and Huitema (2017), who found that cognitive learning was higher in technocratic than in bounded experiments. However, in the cases in which knowledge was elicited from stakeholders or participants on actions and likely impacts the contributed knowledge ranged from helpful to very important. Networks beyond the case in hand learned about management approaches by adopting new techniques (Case 2) or even spreading the successful results by starting projects of their own (Case 3). The direct on-site involvement in implementation appeared to encourage learning by stakeholders, which corresponds to other studies on participation in water governance (Kochskämper et al. 2016, 2017).

Although involvement of stakeholders might not be a necessity for the reduction of ecological uncertainty, communicating with stakeholders was vital for dealing with social uncertainties through gaining trust and building a shared understanding to support the intervention. All experiments were conducted on a local scale and within the legal context of the WFD that fosters water quality enhancement, and they included easily reversible interventions, yet the reaction toward experiments varied. Particularly Case 1 and 2 seem telling in this context. Both cases included a bridging organization and in both cases management actions could slightly reduce run-off in the rivers crossing farmers' land. Trust built between managers and farmers in Case 2, through constant dialogue and mediation from early on, led to cooperation. Without this bond, understanding of information about the potential impact and thereby acceptance of interventions did not evolve in Case 1, leading to farmers

sabotaging the experiment. Research shows that the sharing of information is a prerequisite for trust-building and effective collaboration (Pahl-Wostl 2009, Hurlbert and Gupta 2015, Kochskämper et al. 2017). Moreover, trust might be critical in situations of adaptive experimentation, which implies the possibility of failure; Kahneman and Tversky (1979) showed actors being more risk averse to potential future losses than gains. Understanding and processing of information might not be rational when potential future losses are perceived (Simon 1985), and requires therefore highly trusted sources.

The importance of communication also points to conflict as being part of an experimental approach (Lee 1993, 1999). Jacobson et al. (2006) found a lack of management flexibility to be one of the most challenging barriers for AM in a survey of U.S. agency staff. Gunderson (1999) identified a lack of flexibility in the social system, namely in the existent power relationships between stakeholders, to be one of the reasons for failure of active AM. However, following Voß and Bornemann (2011), political struggle and power dynamics are integral parts of policy- and governance-related management, frequently overlooked in AM literature. The experiments in our cases were designed to affect agriculture, which is the main nitrate polluter, as little as possible, and nonetheless encountered resistance when the technocratic approach seemed detached from the social context. Managers learned not only about ecological but also social factors in the experiments under expert lead with stakeholder involvement (Cases 2, 3). The replication of the management approach with farmers (Case 2) or by administrative actors (Case 3) led to the spreading of the innovative practices, which can be seen as a first step toward the direction of double-loop learning. Last, social uncertainty about how stakeholders will respond to interventions includes both negative and positive surprises. An example of the latter is the continuation of the project in Case 3 by the water board following unexpected closure of funding and leadership by the managing biologist.

Taken together, the factors identified by literature for the success of AM projects played an important role in the indicated management phases throughout these cases. Only bridging organizations and sufficient budget faded into the background, once other more important factors, such as trust and leadership, were missing or emerged. The cases show that factors can be distinguished regarding ecological and social uncertainty.

CONCLUSION

In this study, we explored five adaptive management (AM) projects on water quality enhancement, which led to innovations in the small-scale management of waterways in northern Germany. We clarified the core conceptual components of AM and found evidence of learning and environmental improvements through the approach.

On a conceptual level, our findings suggest the model of a dual feedback cycle, including management of both ecological and social uncertainty. The conceptual differentiation of uncertainties allows for a more clear-cut analysis of the approach: The cycle linked to social uncertainty about how stakeholders will respond to interventions was crucial for successful implementation of experimental interventions and project completion, while the cycle linked to ecological uncertainty about how ecosystems will respond to interventions was crucial for environmental improvement. The first one is arguably the prerequisite to keep the second running. All cases that considered both types of uncertainties and related factors succeeded in a full feedback cycle and in achieving environmental improvement in the rivers.

The importance of considering social alongside ecological uncertainty during AM might explain why Fabricius and Cundill (2014) found in a systematic review on completed AM projects the main documented learning to be about social factors rather than—as initially intended by projects—how management interventions impacted environmental improvement. Out of our cases, in the ones indicating learning about implementation techniques and the social and organizational structures of the entire process, results spread beyond the initial project and administrative boundaries more easily. These findings put learning about process design and delivery to achieve successful outcomes in the forefront in AM, similar in this sense to what Newig et al. (2016) have defined as governance learning.

Our study highlights the importance of stakeholders accepting experimental approaches. The cases reveal that even in a favorable political environment the concerns of stakeholders (actual or perceived) can jeopardize effective AM and require careful attention. Alongside institutional structures, and political commitment, particularly for monitoring (Butler and Koontz 2005), the low tolerance of uncertainties by stakeholders is a frequently overlooked point in AM literature (see Bijlsma et al. 2011 as a positive counterexample).

By adding social uncertainty about how stakeholders respond to experiments, we point to a need for AM to address both social and ecological aspects of what are, after all, social-ecological systems. This could also serve as a gateway to more fully incorporating other aspects of social systems into AM, for example, including experiments to learn about what factors affect individuals' behavior. If, for example, ecological experiments point to the value of specific riparian vegetation in improving water quality, we could also conduct policy experiments to learn which policy tools might shape landowners' behavior toward vegetation management.

Our study helps to fill the substantial gap in literature of empirical studies on implementation of AM projects and full iterations of the AM cycle. Four successful (of the five) cases are not sufficient for generalizations, particularly because of the specific type and context of experiments. The WFD context provided all the experiments with a high leeway as alternative management designs to achieve water quality enhancement, which cannot be assumed automatically for other policy experiments. The study is also limited by our focus on the main project managers and documentation material without additional interviews of stakeholders. Still, the in-depth approach allowed for a thorough exploration of case trajectories. The majority of factors identified as influential in the literature proved to play an important role in the cases, not all the time, but tied to specific phases of the management cycle as a response to both types of uncertainty. Some factors, such as trust and adjustment, stood out in this respect. Others showed unexpected results: Despite being widely assumed in literature to improve knowledge gain, successful ecological knowledge incorporation was not contingent on the integration of stakeholder knowledge.

Although these findings can provide a more nuanced view on AM projects and results, it seems challenging to translate them from the local scale onto higher or multiple policy levels, as identified in the multilevel, polycentric, and collaborative context of adaptive governance (Walker et al. 2004, Folke et al. 2005, Folke 2006, Chaffin et al. 2014). Continuous collaboration in AM implementation at the local level fostered interactive learning and motivation building conducive to collective action, which is still a blank spot in the learning literature for adaptive governance (Berkes 2017). However, when more levels and actors come into the picture, sustaining multiactor collaboration in implementation becomes challenging, and anticipating degrees of effects for stakeholders through experimental approaches becomes increasingly complex. Social and political dynamics in general are more prominent in adaptive comanagement and adaptive governance literature (Voß and Bornemann 2011). Nonetheless, differentiating social and ecological uncertainty and related learning in these more complex settings might constitute an important venue for future research.

Responses to this article can be read online at:
https://www.ecologyandsociety.org/issues/responses.php/12080

Data Availability:

The data/code that support the findings of this study are available on request from the corresponding author, [E.K.]. The data/code are not publicly available because they contain information that could compromise the privacy of research participants.

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Article 6:

Exploring Governance Learning: How Policymakers Draw on Evidence, Experience and Intuition in Designing Participatory Flood Risk Planning

Abstract

The importance of designing suitable participatory governance processes is generally acknowledged. However, less emphasis has been put on how decision-makers design such processes, and how they learn about doing so. While the policy learning literature has tended to focus on the substance of policy, little research is available on learning about the design of governance. Here, we explore different approaches to learning among German policymakers engaged in implementing the European Floods Directive. We draw on official planning documents and expert interviews with state-level policymakers to focus on learning about the procedural aspects of designing and conducting participatory flood risk management planning. Drawing on the policy learning and evidence-based governance literatures, we conceptualise six types of instrumental 'governance learning' according to sources of learning (endogenous and exogenous) and modes of learning (serial and parallel). We empirically apply this typology in the context of diverse participatory flood risk management planning processes currently unfolding across the German federal states. We find that during the first Floods Directive planning cycle, policymakers have tended to rely on prior experience in their own federal states with planning under the Water Framework Directive to inform the design and carrying out of participatory processes. In contrast, policymakers only sporadically look to experiences from other jurisdictions as a deliberate learning strategy. We argue that there is scope for more coordinated and systematic learning on designing effective governance, and that the latter might benefit from more openness to experimentation and learning on the part of policymakers.

Keywords: Evidence-based governance, Policy experimentation, Policy learning, Policy design, Flood risk management, EU Floods Directive.

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Exploring governance learning: How policymakers draw on evidence, experience and intuition in designing participatory flood risk planning

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ABSTRACT

The importance of designing suitable participatory governance processes is generally acknowledged. However, less emphasis has been put on how decision-makers design such processes, and how they learn about doing so. While the policy learning literature has tended to focus on the substance of policy, little research is available on learning about the design of governance. Here, we explore different approaches to learning among German policymakers engaged in implementing the European Floods Directive. We draw on official planning documents and expert interviews with state-level policymakers to focus on learning about the procedural aspects of designing and conducting participatory flood risk management planning. Drawing on the policy learning and evidence-based governance literatures, we conceptualise six types of instrumental 'governance learning' according to sources of learning (endogenous and exogenous) and modes of learning (serial and parallel). We empirically apply this typology in the context of diverse participatory flood risk management planning processes currently unfolding across the German federal states. We find that during the first Floods Directive planning cycle, policymakers have tended to rely on prior experience in their own federal states with planning under the Water Framework Directive to inform the design and carrying out of participatory processes. In contrast, policymakers only sporadically look to experiences from other jurisdictions as a deliberate learning strategy. We argue that there is scope for more coordinated and systematic learning on designing effective governance, and that the latter might benefit from more openness to experimentation and learning on the part of policymakers.

1. Introduction

In the face of massive implementation problems, governments across the globe have increasingly sought to improve environmental policy delivery. One vehicle for this is stronger decentralisation and proceduralisation of policy-making (Flynn and Kröger, 2003), witnessing what has been described as a shift from 'government' to 'governance' (Pierre and Peters, 2000; Stoker, 1998). Polycentric and collaborative systems of governance, involving non-state actors (including the general public) in decision-making, are expected to enhance the knowledge-base of decisions and support improved implementation (Newig and Fritsch, 2009). However, it remains unclear just which problems and programmes might best be managed via participatory and collaborative models (Buss and Buss, 2011). This question has been a focus of research from different disciplinary perspectives, but it has also directly occupied policymakers responsible for designing and conducting public environmental decision-making processes. The issue we seek to address in this paper is: How do these actors learn about, design and adapt effective participatory processes? And does this change governance in practice?

To address this, we turn to the literature on policy learning. This rich, but also rather conceptually crowded literature (Dunlop and Radaelli, 2013), intersects and overlaps with work on policy transfer, social learning, diffusion and convergence, and policy experimentation to name just a few neighbouring fields. Much work has focused on learning about the substantive effects of policy, but less attention has been devoted to learning about how to design and implement participatory (or less participatory) governance processes, and the benefits of participation under specific contexts. However, precisely because participatory and collaborative decision-making is becoming more prevalent and the repertoire of participatory instruments is becoming more complex, policymakers increasingly need to learn how to design and conduct effective participatory processes (see Howlett, 2014). By 'effective', we refer to decision-making processes that meet the goals of

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policymakers, such as reaching well-informed, implementable, acceptable decisions that are beneficial to environmental sustainability. Thus, questions of process design are increasingly relevant in the context of contemporary governance.

In this paper, we empirically examine policy learning about how to conduct participatory governance – or 'governance learning' – in the context of EU Floods Directive (FD) implementation in Germany. As a recent example of 'mandated participatory planning' (Newig and Koontz, 2014), and with close links to the earlier Water Framework Directive (WFD), the Floods Directive requires local administrations to develop flood-risk management plans by 2015, and in six-year cycles thereafter. Authorities are required to 'encourage' the 'active involvement' of non-state actors in order to improve planning. This affords considerable leeway on how participation is realised. Having triggered diverse forms of (more and less participatory) flood risk management (FRM) planning across Europe, the FD presents an ideal case to study learning on the design of participatory governance. We focus here on decentralised FD implementation in Germany, exploring in particular how federal state authorities actually design, conduct and adapt participatory FRM planning. Within this, we are especially interested in whether, and how, FD implementation stimulates governance learning on the part of competent authorities in FRM.

The research contributes to wider discussions on participatory and collaborative environmental governance, evidence-based policy and governance, (adaptive) policy learning and policy transfer. We seek to advance the debate in that we deliberately depart from the traditional focus of the policy learning (and related) literature on the *content* of policy to focus on procedural dimensions and the *process* of planning and governance (Emerson and Gerlak, 2014; van der Heijden, 2013).

The paper proceeds as follows: Section 2 outlines our conceptual framework, which draws on key ideas from the literature on policy learning and evidence-based policy and governance. Section 3 then describes the German context and the transposition of the FD into national and federal state law. Section 4 comprises the empirical core of the paper and presents findings from top-level expert interviews with flood risk management planning officials across 11 German federal states. The discussion focuses on how the FD has been received within German FRM planning circles, the design and execution of participatory FRM planning processes, and the extent to which FD implementation has afforded opportunities for governance learning. Section 5 concludes with a discussion of the relevance of our findings for theory and practice, and suggests avenues for further research.

2. Conceptual framework: governance learning for participatory planning

Several typologies of policy learning have been advanced in the literature in efforts to systematise the variety of ways in which policy-relevant learning takes place (e.g. Dunlop and Radaelli, 2013; Gilardi and Radaelli, 2012; Hall, 1993; May, 1992; Toens and Landwehr, 2009). We focus here on what has generally been referred to as instrumental policy learning, and seek to disaggregate this category for the purposes of our analysis of *governance learning*. We define learning as the reflexive updating of beliefs on the basis of evidence, experience and new information. Referring to Bennett and Howlett's (1992) three dimensions,[1] we build on instrumental policy learning as learning (1) *by* policymakers and other government actors, (2) *about* designing and running participatory planning processes, (3) *in order to* improve their effectiveness. We argue that a focus on policymakers and how they learn is important given the increasing prominence of participatory and collaborative modes of governance, yet mixed results and continued uncertainty around 'what works'.

Policymakers may learn intentionally, e.g. through policy experimentation and evaluation of systematically collected evidence on implementation and impacts (Sabel and Zeitlin, 2012; Sanderson, 2002), or learning may be rather incidental or intuitive, via trial and error or ad hoc assimilation of experience (Bennett and Howlett, 1992). While policy learning can also be forced via coercive pressure from superordinate levels or more powerful jurisdictions (Dolowitz and Marsh, 1996; Shipan and Volden, 2008), we focus here on open and voluntary (though not necessarily uninhibited) learning by policymakers.

The experiential basis for policy learning is potentially very broad (May, 1992). Learning may be self-referential, drawing on endogenous (to a jurisdiction/policy network) sources and direct experience (Grin and Loeber, 2007), or it may draw on exogenous sources of learning and build on observed experience from other jurisdictions or policy fields with similar procedural requirements (Table 1 – sources of learning). *Endogenous* sources of learning refer to experience or new information originating from within a given jurisdiction and policy field. *Exogenous* sources of learning are differentiated according to experience drawn from other jurisdictions, and from other policy fields. Learning from other jurisdictions typically entails policy transfer and adaptation to the 'domestic' context (Benson and Jordan, 2011; Stone, 2012). Policymakers may also look to other policy fields – within or beyond their jurisdiction – for evidence and lessons. Policy-relevant lessons are perhaps more likely to come from neighbouring/related policy fields. However, lessons may also be available from distant and apparently unrelated policy fields, when the object of learning relates to the *procedural* policy aspects, which we focus on here. Indeed, it is a focus on learning about governance *processes* that opens up this cross-policy-field dimension of policy learning.

Further, policy learning may result from examining one's past experiences or those of others through time, in a serial or sequential view (Hall, 1993), or it may imply observing the parallel unfolding of governance experiences and their outcomes (Table 1 – modes of learning). *Serial* learning typically occurs through updating and adaptation over the course of successive policy cycles, and via sequential policy pilots or less formal processes of 'trial-and-error'. Serial learning may also draw on other jurisdictions or policy fields. *Parallel* learning on the basis of endogenous sources includes strategies such as simultaneous piloting and policy experiments or randomised controlled trials conducted to a set timeframe or policy cycle. Parallel learning from exogenous sources may occur via coordinated implementation of a policy programme or similar programmes across two or more networked jurisdictions in the context of joint knowledge generation and mutual learning. Parallel learning is also possible without deliberate cross-border coordination, insofar as policymakers draw lessons and assimilate new information on the basis of the unfolding experiences of other jurisdictions grappling with the same policy issues.

The varieties of learning described above are generally consistent with 'lesson drawing' and 'updating' (Gilardi and Radaelli, 2012; Toens and Landwehr, 2009), wherein prior beliefs and approaches are revised in light of direct experience and/or new information. Rose (1991, 2005) explains how lessons drawn from policy successes or failures in other contexts, can inform changes to existing policy programmes. Policy change may occur via outright copying or emulation, as well as degrees of adaptation, hybridisation, synthesis and innovation (see Rose, 2005, pp. 80–84). In the context of the EU (and other decentralised planning contexts), such lesson drawing

[1] Bennett and Howlett (1992) consider the (1) subject of learning (who learns?); (2) object of learning (learns what?), and; (3) result of learning (to what effect?).

Table 1
Types of instrumental governance learning.

Modes of learning	Sources of learning		
	Endogenous	Exogenous	
	Same jurisdiction and same policy field	Other jurisdictions	Other policy fields
Serial learning (sequential)	Learning from sequential instances of policymaking and implementation (e.g. successive policy/planning cycles, serial pilots, 'trial-and-error')	Learning from other jurisdictions' past experiences in the same policy field e.g. lesson drawing, policy diffusion, policy transfer)	Learning from previous experiences in other policy fields with similar procedural requirements
Parallel learning (simultaneous)	Learning from concurrent policymaking and implementation processes (e.g. parallel pilots, policy experiments, randomised controlled trials)	Learning with other jurisdictions, via co-production of knowledge/ evidence (e.g. coordinated planning and implementation)	Learning in parallel across different policy fields with similar procedural requirements

across member states, or subnational units, and policy fields is consistent with the idea of laboratory federalism (Flynn and Kröger, 2003; Kerber and Eckard, 2007; Oates, 1999). Here, parallel 'experimentation' in different jurisdictions with a variety of policies on the same issue is supposed to drive diffusion of effective governance.

3. The EU Floods Directive and its implementation in Germany

The 2007 EU Directive on the Assessment and Management of Flood Risks (Floods Directive–FD) aims to reduce and manage the risks posed by floods to human health, the environment, cultural heritage and economic development. It follows a mandated participatory planning approach (Newig and Koontz, 2014) indicative of a broader shift in European environmental governance, in that it requires the formulation of local plans, with public input, as the main vehicle for implementation. These flood risk management plans (FRMP) – political programmes in themselves – serve to guide the formulation and implementation of programmes of measures. Plans must be updated every six years. The process entails: (1) a preliminary flood risk assessment, (2) identification of potentially significant flood risk areas, (3) production of flood hazard and flood risk maps, and (4) drafting (and updating) FRMPs. While, for the first planning cycle, steps 1–3 were due between 2011 and 2013, step 4 is to be completed by the end of 2015.

Unlike related directives such as the WFD, the FD does not define substantive goals (such as certain levels of flood protection), but only specifies the planning procedures. In that the FD mandates flood risk *management*, but not flood *protection*, it can be seen as an example of almost purely reflexive governance (Newig et al., 2014). Regarding public participation, the FD essentially follows the WFD (Gierk and Stratenwerth, 2010). According to the FD, the public must be granted access to key planning documents (preliminary flood risk assessments, flood maps), but need not be involved in their preparation (Unnerstall, 2010). In production of the actual FRMP, 'active involvement' of 'interested parties' must be 'encouraged'. However, as noted above, this allows member states considerable discretion to choose from an array of participatory forms, including the bare legal minimum – e.g. formal consultation on draft FRMPs within a strategic environmental assessment (SEA) under the SEA Directive (Carter and Howe, 2006).

The FD was transposed into German federal law in 2009, along with its minimum requirements for participation. As jurisdiction over flood risk management lies with the sixteen German federal states, these translated the provisions of the FD and federal law into their respective state Water Acts, without diverging from these regulations (see Albrecht, 2015, this special issue). However, given their status as competent authorities, federal states have considerable leeway to introduce participatory planning processes that surpass the minimum requirements for information provision and consultation (Unnerstall, 2010).

Flood risk management planning was largely absent in Germany before the early 2000s. Instead, the dominant paradigm was to assure flood security (see Hartmann and Spit, 2015, this special issue; Samuels et al., 2006). However, following major floods in the 1990s and early 2000s (Rhine, 1993, 1995; Odra, 1997; Danube and Upper Rhine, 1990; Elbe, 2003) several particularly affected federal states began to develop risk management measures and plans (Thieken et al., 2005). With a 2005 revision of federal law, flood control plans became mandatory for all states (Hartmann and Albrecht, 2014), but these plans differed in detail and scope from those now required by the FD, and lacked in particular the procedural provisions for participation. With the exception of a few local (e.g. Theis, 2014; Vogt, 2012) and state (e.g. Hartmann and Albrecht, 2014; Thieken et al., 2005) initiatives, German federal states have had little experience with public participation and balancing spatial conflicts. It is against this backdrop of very different recent experiences with flooding, and with public and stakeholder participation, that participatory planning under the FD should be examined.

4. Empirical study: Floods Directive implementation, participatory planning, and governance learning across German federal states

4.1. Methodology

Our empirical analysis of FD implementation in Germany is based on an examination of available documentation on participatory FD implementation issued by state governments and their officials (reports, brochures, governmental websites), and semi-structured expert interviews with top-level policymakers. The authorities responsible for FD (and WFD) implementation are the federal environmental ministries. We aimed for coverage of all 16 German states in order to capture the full breadth of approaches. Representatives of two states (Berlin and Mecklenburg-Western Pomerania) declined our request for an interview on the grounds that they are essentially not flood-affected, two states (Hamburg and Rhineland-Palatinate) did not respond positively to our request, and we excluded one further state (Saarland) due to lack of data. Our analysis therefore covers 11 of 14 flood-affected German states. As Lower Saxony and Bremen have combined approaches for both FD and WFD implementation, we consider these as one case. We thus arrive at 10 cases: Bavaria (BA), Brandenburg (BB), Baden-Württemberg (BW), Hesse (HE), Lower Saxony/Bremen (LS), North Rhine Westphaila (NW), Saxony-Anhalt (SA), Schleswig-Holstein (SH), Saxony (SN) and Thuringia (TH).

Interviews were conducted with either heads of department or heads of unit responsible for flood risk management in the state environmental ministries. In all states this responsibility lies with the same department as WFD planning, sometimes even with the same unit. Interviews were conducted between April and November 2014, each lasting 60–120 min, and following an interview guideline encompassing issues of flood affectedness, governance and participation strategy, relations to WFD planning, and policy learning.

4.2. Characterising perceptions of the Floods Directive

The FD has had important implications for flood risk management in Germany. Whereas German states had been rather critical when the Directive was developed (Newig et al., 2014), it is now generally positively received by state-level officials, who see it as an opportunity to improve FRM structures and processes. Eight out of ten informants cited benefits in the structured and systematic planning approach prescribed by the Directive, which was also seen by some as creating clear lines of accountability and fostering transparency. It was noted in particular that the Directive has raised flood awareness among affected municipalities, and improved communication between municipalities and federal environmental ministries. Five interviewees highlighted benefits of the cyclical planning model, and the scope for on-going development of measures and plans. Other reported advantages of the Directive included its introduction of an integrated risk-based approach, which was seen as previously only weakly developed, and the harmonisation of policy across neighbouring jurisdictions. This latter point, however, was also raised as a criticism, with some claiming the Directive neglects regional cultural and environmental specificities. Other negative impressions related to the laborious and time-consuming nature of FD planning and reporting given tight timeframes. Perhaps most telling overall, however, was the appreciation expressed by interviewees that the Directive imposes no concrete, binding objectives.

The German federal states are exposed differently to flood hazards, and perceptions of flood risk are shaped considerably by past flood events (see Table 2). Some interviewees noted that public perceptions are so dependent on experience of past floods, that the recurrence of flooding is an important stimulus for building risk awareness and flood preparedness. Similarly, major floods have in the past prompted authorities to update their FRM planning processes. Consequently, the organisational impact of the FD across the federal states has varied given the variety of pre-existing FRM arrangements. In some states it was claimed that the Directive brought little or no change, except for additional reporting to Brussels, as existing planning practice essentially complied with or surpassed the FD. In other states the Directive triggered a revision or realignment of planning timeframes, more co-ordinated or formalised planning structures, and the orientation of planning units towards flood risk areas (BA, BB, BW, NW, SN).

The environmental dimension of flood risk management is regarded by most states as falling within the purview of the WFD, and is assigned secondary importance behind structural flood protection. In almost all states environmental measures are not considered in terms of a holistic ecosystem-based approach, but rather in terms of specific individual measures, focusing on retention areas in particular. Measures such as afforestation, wetland restoration or other land-use change were not mentioned by any interviewees. Some respondents reported conflicting water quality and FRM goals at the project or implementation level. While in some states there was no overt effort to coordinate FD and the WFD planning, others saw potential advantages in doing so, and some had already aligned aspects of FD and WFD programmes at the state level.

4.3. Collaborative and participatory FD planning

FD planning in almost all German federal states centres on the two governance poles of the state and the municipalities, with differing degrees of concentration on each of these. Legal responsibility for FD implementation and reporting lies with the state environmental ministries, which, together with their environmental agencies, usually also produce the flood risk assessments and flood hazard and risk maps (Gierk and Stratenwerth, 2010). Although FRMPs are typically applied to planning units based on hydrological characteristics and exposure to flooding, it is the municipalities (or flood-specific conglomerations of these) that are in most states primarily responsible for planning and implementation of FRM measures. In some states (BW, LS, SA) municipalities or cross-municipal partnerships are tasked with the definition of measures, which are then collected by higher level authorities in a 'bottom-up' approach. Others (BB, HE)

Table 2
Flood risk, participatory FRM planning strategies, and different forms of systematic governance learning in German federal states (state abbreviations as per 4.1 above).

		BA	BB	BW	HE	LS	NW	SA	SH	SN	TH
Flood risk	Rivers with significant flood risk (km)	7650	2005	4980	NA	2300	6067	1865	936	2994	3400
	Flood damages since 2000	Medium to high	High	Low	Low	High, but locally	Low	High	Low; locally high	High	High
Participation	Deliberative, face-to-face, local level participation	(+)		+			+		+		
	Local knowledge gathering	+	+	+	+	+	+	+	+	+	+
	Participation at the federal state or regional level						+	+			+
Learning strategies	Piloting	+	+		+			+	+		
	Iterative, cyclical learning pursued (from FD processes)	+		+		(+)					
	Planned adoption of other states' strategies				+		+				+
	Learning from own WFD experience			+	+	+	+	+	+		+
	Openness to experimentation	+							+		
	Inspiration from other federal states' involvement models		+								
	External knowledge used or perceived positively	+	+	+	+	+			+		+

Source: Compiled on the basis of primary interview data, and flood risk data from federal state flood risk assessments.

organised the planning process in a 'top-down' manner wherein state-level authorities proposed measures on which municipalities were then consulted. Most states fall somewhere in between these examples, particularly where there are district governments as an intermediate administrative level. Typically, in such cases the state, the administrative districts, and the municipalities divided planning in line with their responsibilities according to the classification of rivers (SN, TH), or offered a variety of possibilities for input by actors at different levels (BA, NW). A noteworthy exception to this pattern is the state of Schleswig-Holstein, which relied mainly on its WFD working groups (see Bruns and Gee, 2009). These hydrologically delimited units, which are coordinated by water boards and include important local stakeholders, have also been given responsibility for FRM planning where applicable, and thus represent a unique governance arrangement beyond the state-municipality spectrum.

A common set of guidelines and recommendations on participation in FRM planning is provided by the federal state working group on water (LAWA) (2012), but governance nevertheless differs across the federal states. Table 2 gives an overview of three important aspects of participation in the federal states studied: (1) deliberative, face-to-face, local-level participation, (2) local knowledge gathering; and (3) participation organised at the state or regional (district) level. The first two aspects relate to commonly cited participation-related dimensions of deliberation or face-to-face communication and consultation (see Newig and Kvarda, 2012; Rowe and Frewer, 2005), and provide an indication of the 'intensity' of local participation. The third aspect relates to the assumption that participation, in particular involving non-governmental organisations, is often more effective on a more aggregated level (Rockloff and Moore, 2006).

There are considerable commonalities between states in terms of communication of information to key stakeholder groups, such as municipalities and water boards. Many states have developed questionnaires to elicit knowledge about stakeholders' current status in relation to FRM planning and, in some cases, their perspectives as reference points for further FRM planning (BA, BB, BW, HE, SA, TH). Also, regional meetings were held to inform municipalities and other local stakeholders about the state of FD implementation (HE, LS, NW, SN, TH). In some states, ministries or representatives of water authorities from different levels established contact with municipalities through personal visits (BA, NW).

Participation beyond mere information exchange varies considerably across the German federal states. Two states (BA, LS) employed an online tool to incorporate input from stakeholders – including organised agricultural and environmental interests. Regional meetings and conferences were a common strategy in several states (BB, NW, SA, SN, TH), with some relying on existing fora established under the WFD (SA, TH). These had different purposes, ranging from information distribution to discussion and decision-making on management alternatives, and typically addressed stakeholders with potential to play a role in implementation. A few states went so far as to establish a broad participatory planning approach (BW, SH and, to a lesser extent, NW). They institutionalised cooperative bodies organised around hydrological units (flood partnerships or working groups), in which responsibility for matters of FRM planning was assigned to important local stakeholders (water boards, municipalities, industrial and commercial actors, agriculture and environmental groups). Higher level authorities mainly play a supporting role and compile the management decisions of these bodies into a FRMP. Surprisingly at first sight, we find that the states employing these more intensive participatory structures are not the ones that have experienced severe recent flooding (post 2000). In fact, those highly affected by the latest flood events engage in much less far-reaching participation mechanisms. This can perhaps in part be attributed to the perceived urgency of planning in states with recent experience of severe flooding, where participation may appear as an obstacle to swift planning. Often the aforementioned structures, irrespective of their intensity, were complemented with state-level advisory boards responsible for wider water resource management, (including WFD and FD planning) and engaging different public actors and stakeholders (BA, BW, SA, SH, TH).

As the described participatory strategies indicate, municipalities, water boards and dike associations (where present) can be seen as central stakeholders in the German flood risk management system. The importance of these organised stakeholders (Meadowcroft, 2004) was supported by almost all interviewees, who saw flood risk awareness-raising, motivation and activation among these actors as foremost rationales for participatory planning. Other stakeholders that were considered important were those with co-implementation potential, such as local water authorities, county and city council representatives, cultural heritage groups, infrastructure managers, public agencies, and affected industrial or commercial actors. To a lesser extent agriculture, environmental interests and the lay public are also considered relevant. Particularly the relatively weak inclusion of affected citizens and the lay public appears remarkable, as many households are directly exposed to flood risk and, hence, may have much higher stakes in FRM than in, for example, water quality management under the WFD (see Newig et al., 2014). This view was shared by some interviewees, who highlighted the difficulties in mobilising citizens for such abstract procedures as the planning of generic flood risk measures. In some cases, citizens were deemed to show no interest and to lack understanding of aspects of FRM. Some interviewees expressed hope that the public may be more strongly involved in subsequent planning steps, where actual measures will be discussed.

4.4. Governance learning by federal states

Having found that approaches to participation in FD implementation vary greatly across the German federal states, just how do officials arrive at decisions for more or less participatory planning designs? Do they rely on evidence, intuition, best practice? Do they learn from their own previous experience or from that of others in similar situations? Relating to the typology developed in section 2, we identified seven areas of potential relevance for learning about how to design (participatory) FRM planning (see Table 3). Three can be characterised as *endogenous learning:* (1) pilots as intentional learning from a completed trial; (2) learning from current FD experiences for application in the next cycle; (3) openness to controlled experimentation. *Exogenous learning* is represented by: (4) potential learning from other federal states' experiences with the current FD cycle; (5) taking inspiration from other states' current or envisaged FD involvement models; (6) learning from previous experience with WFD implementation; and finally (7) seeking advice from researchers or consultancies.

(1) In four federal states (BA, BB, HE, SA), several pilot projects for participatory FRMP development were carried out. However, experiences from these had little impact on the design of actual participation strategies. In one federal state (BA), the results from pilots were not ready in time to inform the definition of participation strategies. In the remaining cases no knowledge on process performance and results was reported, and no emphasis put on pilots. This may be attributable to time restrictions and the need to constantly integrate new developments (e.g. LAWA recommendations) into planning considerations. Nevertheless, one federal state (HE) plans to run pilot projects in order to test participatory flood partnerships that were adopted by its neighbouring state.

Table 3
Observed types of instrumental governance learning in FD implementation in Germany.

Modes of learning	Sources of learning		
	Endogenous	Exogenous	
	Same jurisdiction and same policy field	Other jurisdictions	Other policy fields
Serial learning (sequential)	Pilots (but with little impact on the design of actual participation strategies); learning from current experience for next planning cycle.	*Potentially for the next planning cycle:* Inspiration from other federal states' involvement experiences.	Adaptation of WFD involvement models (with more/less participation).
Parallel learning (simultaneous)	*Considered by few states:* Controlled experimentation.	Inspiration from other federal states' involvement models.	Advice by researchers (*limited*) or consultancy (*more common*).

(2) Several officials referred to the cyclical nature of FD planning, viewing the current, first FD planning cycle as a test-bed for the second, in which the approach to participation could be adapted and improved. There appears a tendency to increase efforts for participation and collaboration in the next planning cycle. Only in one federal state was it anticipated that participatory processes would become more formalised and less open (SN).

(3) In principle, learning about the feasibility and effects of (more or less) participatory forms of decision-making can happen through controlled experimentation. Ideally, in a randomised experiment, a participatory 'treatment' would be contrasted with a (potentially less participatory) 'control' group under the same contextual conditions, thus allowing for the identification of the more successful process. However, no state had so far considered such an approach. In fact, eight out of ten federal states rejected the possibility of conducting randomised experiments based on an inclusive, face-to-face participatory process and a control group with minimal engagement. Experimentation in the sense of testing and improving designs was viewed positively by several officials, given sufficient resources and time. Others outright rejected such approaches, seeing the implementation of a control group as unjust and likely to meet with opposition from stakeholders. An additional reason given was that the field of FRM should not be treated as a 'playground' for trial-and-error experimentation, but rather demands decisive and comprehensive planning and implementation. Those federal states open to experimentation struggled to offer a viable project due to their advanced stage of planning (BA, SH). It appears consistent that the only state currently employing parallel pilots with water boards was also one of the states potentially open to randomised experiments (SH).

(4) Learning from other federal states occurs to some extent but seems to have been limited so far. By design, the LAWA serves as a forum to exchange and discuss (and, where appropriate, harmonise) state approaches. However, this is mostly restricted to technical harmonisation. Issues of governance and participation had been the topic of a 2010 meeting and subsequent document (LAWA, 2012), but this has not played a significant role in LAWA discussions since. Some examples of cross-state learning are however notable. Three federal states (HE, NW, TH) envisage adopting a 'flood partnership' design (as implemented in BW) in the next planning cycle, if sufficient resources are available.

(5) We also found evidence for parallel learning from other states. For example, one smaller state with limited resources (BB) has explicitly considered the strategy from another state with a stronger tradition in water management (BA), resulting in the adoption of a questionnaire strategy.

(6) Several federal states have apparently learned from their own experiences with WFD implementation (BW, HE, LS, NW, SA, SH, TH). Prior experience impacted on the design of FD participation in a variety of ways. In two states, lessons learnt from WFD processes resulted in improved citizen involvement in FRM (BW) or in applying the pre-existing WFD model to FRM (SH). Perhaps contrary to expectation (in the sense of a shift from 'government' to 'governance'), in four federal states learning from WFD experiences led to decreased participation, since bottom-up planning involving a wide range of stakeholders did not produce effective implementation, or the process of engaging citizens was too laborious, or resulted in low citizen participation (HE, LS, SA, TH). Another reason for not simply incorporating FD planning into existing WFD processes and structures was to keep group size manageable given the involvement of many new flood-related stakeholders, and the assumption that they should be organised at a more local scale (NW).

(7) Exogenous, parallel learning through advice by researchers or consultants was valued positively or taken into account by more than half of the federal states (BA, BB, BW, HE, LS, SH, TH). But the role of science in informing participatory FRM planning was generally seen by interviewees as limited. The principal reason given was that scientific advice is deemed too general for the highly specific contexts under which state governments operate. By contrast, the appointment of external consultants with expertise in evaluation or organisation of participatory processes is far more commonplace. However, planning consultancies are also sometimes viewed critically, as each has its own approach, which can result in rather fragmented as opposed to holistic planning. Furthermore, advice by third parties is easily disregarded due to time or resource pressures. According to one public official, they simply 'knew better' at the time final results on a potential participatory design were presented (BA). Therefore, despite the potentially stronger influence of consultant input, the integration of external knowledge is generally not preferred over internal expert knowledge. A noticeable exception is one federal state (HE) where a university planned and carried out the pilot for participatory FRMP development together with a governing district. Only one public official mentioned the continual integration of new knowledge within the field of FRM as being important (SH). Indirect knowledge integration on strategic decisions related to participation through involvement of scientists and academics in steering groups or advisory boards is on the other hand valued positively, although this is only the case in two federal states (BW, SH).

5. Discussion and future research directions

As a recent example of mandated participatory and cyclical planning, the EU Floods Directive – like other European environmental directives such as the Water Framework Directive – holds great potential for learning in relation to the design of public and stakeholder participation in environmental planning. We set out to explore how German policymakers have learned about participatory planning through Floods Directive implementation. We considered the extent to which, and the ways in which, officials at the federal state level have drawn on experience, evidence and information to design, conduct and adapt participatory processes. To this end, we drew on the policy learning

literature to identify a number of instrumental governance learning strategies differentiated according to learning modes (serial or parallel), and sources of learning (endogenous or exogenous). We sought to extend the idea of exogenous sources of learning beyond the common treatment of cross-jurisdictional learning to encompass also cross-policy-field learning.

We find that of the six different types of instrumental learning strategies we conceptualised, most have been exercised or considered by German state-level officials implementing the FD. Generally, policymakers have tended to draw on their own experience in an iterative development, or updating, of participation and collaboration processes. Given that the FD is still only in its first implementation cycle, many states have relied on experiences with participatory river basin management planning under the WFD. Despite the apparent preference for 'serial' lesson drawing (including cross-policy-field lessons) and iterative process development, some states are beginning to exchange information and look to successful models in neighbouring states. Seeking external advice from consultants or universities is another common strategy. Some states are also considering controlled experimentation to systematically learn about the impacts of participation. Such forms of more 'parallel' lesson drawing seem to be in a very early stage of emergence, and may develop over the course of the second FD planning cycle. However, some states clearly rejected the notion of experimentation not only citing costs and time pressures, but also a reluctance to 'play around' with FRM, given the high stakes.

As regards the impact of governance learning on the actual design of participatory strategies, we find mixed evidence. For current FD processes, it was more often the case that federal states opted for less intensive participatory designs, which usually meant changing from local to higher scales or excluding citizens (in comparison to WFD-related processes). Then again, some states planned to intensify participation based on previous experience or learning from neighbouring states. This is a clear indication that systematic governance learning does not automatically lead to 'more' participation.

Whether or not public participation and stakeholder collaboration can contribute to better flood risk management plans and more sustainable FRM, we cannot say on the basis of this study. Therefore, we do not assume that participatory FRM is necessarily more appropriate or effective than other more hierarchical modes of governance. But we do contend that if this is assumed to be the case, and if EU and member state policy is going to build this in to environmental governance, then there is a need to understand whether and how evidence-based governance learning happens in this field.

Furthermore, given our tentative diagnosis that top-level policymakers in German flood risk management tend to rely on their own intuition (and experience), we suggest that there is still some potential for more systematic learning. We therefore make the following observations and recommendations:

First, there should be greater recognition and awareness among planners and policymakers of the potential role of evidence and learning in the *procedural* aspects of FRM. Public participation and stakeholder engagement processes are not yet generally recognised as fields that could benefit greatly from evidence-based process design and systemic learning. The German LAWA guidelines do not even consider that the design of participatory FRM could make use of evidence. This stands in contrast to the way in which flood protection measures and the technical content of flood policy are developed and designed.

Second, existing networks (in this case notably LAWA) do not facilitate the sharing of experiences in relation to designing and conducting governance processes in FRM. Given that such fora are already institutionalised, there is scope for them to function more effectively as a learning platform for the exchange of knowledge and evidence among policymakers and planners, and to promote a more deliberate approach to learning in relation to the procedural dimension of FRM.

Third, purposeful lesson drawing and the incorporation of evidence is a challenge for policymakers, who typically have insufficient time to engage with and draw on research. In this respect there may be a need for authorities to make greater use of the services of intermediaries or consultancies in designing and running participatory FRM processes. For these intermediaries themselves, there is arguably much to be gained (in terms of governance learning and innovation) from searching for, collecting, and drawing more explicitly on evidence as to what is effective under what circumstances.

Fourth, there appears to be a general reluctance among policymakers, at least in the German FRM context, to engage with the idea of experimentation. Indeed negative connotations and risks of experimentalist approaches are far more widely perceived than any potential advantages or benefits. This may be a characteristic of the field of FRM, or of the German administrative culture (or both), but it appears to be more pronounced than in the USA, the Netherlands and the UK, for example (Sanderson, 2002). We suggest there could be much to be gained by fostering more of an experimentalist culture among authorities responsible for German FRM.

It is our hope that this attempt to conceptually structure instrumental 'governance learning' may prove useful to other researchers interested in understanding processes of evidence-based, adaptive governance, and participatory and collaborative decision-making in particular. We argue that focusing on learning about procedural dimensions of governance – in this case learning by policymakers about how to design and conduct participation processes – opens up the notion of lesson drawing across policy fields, in addition to serial or parallel learning within or across jurisdictions. This is particularly interesting in the context of EU environmental governance, where we see evidence of learning between Floods Directive and Water Framework Directive implementation, and potential for similar learning strategies across other directives and policy fields. Therefore, future research might fruitfully examine governance learning in other EU environmental directives and explore the extent of cross-policy-field learning where procedural requirements are similar. Our case study of Germany, while advantageous due to high comparability in terms of institutional context across the federal states, may also exhibit certain particularities (e.g. due to the important role played by municipalities), and therefore further research should look beyond the German federal states to other European and non-European cases. Further, as FD implementation is set to proceed in 6-year cycles, and given that we find evidence to suggest that policymakers are beginning to explore a variety of learning strategies, it will be valuable for future studies to follow up specifically on how far cyclical planning under the Directive supports updating and innovation in participatory planning over time. Finally, insofar as we are interested in understanding 'what works' in participatory flood risk management planning and participatory environmental governance more generally, we see a need for empirically and practically relevant governance learning research. In this sense, transdisciplinary approaches that can potentially facilitate collaboration and learning between policymakers, consultants and scientists, hold some promise, and policy or governance experiments designed in such settings have the potential to inform theory and practice.

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Article 7 [supplementary]:

Pathways to implementation: Evidence on how participation in environmental governance impacts on environmental outcomes

Abstract

There is much enthusiasm among scholars and public administrators for participatory and collaborative modes of governance as a means to tackle contemporary environmental problems. Participatory and collaborative approaches are expected to both enhance the environmental standard of the outputs of decision-making processes and improve the implementation of these outputs. In this article, we draw on a database of 305 coded published cases of public environmental decision-making to identify key pathways via which participation fosters effective environmental governance. We develop a conceptual model of the hypothesized relationship between participation, environmental outputs, and implementation, mediated by intermediate (social) outcomes such as social learning or trust building. Testing these assumptions through structural equation modeling and exploratory factor analysis, we find a generally positive effect of participation on the environmental standard of governance outputs, in particular where communication intensity is high and where participants are delegated decision-making power. Moreover, we identify two latent variables—convergence of stakeholder perspectives and stakeholder capacity building—to mediate this relationship. Our findings point to a need for treating complex and multifaceted phenomena such as participation in a nuanced manner, and to pay attention to how particular mechanisms work to foster a range of social outcomes and to secure more environmentally effective outputs and their implementation.

Keywords: Participatory governance; environmental governance; structural equation modeling; case survey method, collaborative governance.

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Pathways to Implementation: Evidence on How Participation in Environmental Governance Impacts on Environmental Outcomes

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Abstract

There is much enthusiasm among scholars and public administrators for participatory and collaborative modes of governance as a means to tackle contemporary environmental problems. Participatory and collaborative approaches are expected to both enhance the environmental standard of the outputs of decision-making processes and improve the implementation of these outputs. In this article, we draw on a database of 305 coded published cases of public environmental decision-making to identify key pathways via which participation fosters effective environmental governance. We develop a conceptual model of the hypothesized relationship between participation, environmental outputs, and implementation, mediated by intermediate (social) outcomes such as social learning or trust building. Testing these assumptions through structural equation modeling and exploratory factor analysis, we find a generally positive effect of participation on the environmental standard of governance outputs, in particular where communication intensity is high and where participants are delegated decision-making power. Moreover, we identify two latent variables—convergence of stakeholder perspectives and stakeholder capacity building—to mediate this relationship. Our findings point to a need for treating complex and multifaceted phenomena such as participation in a nuanced manner, and to pay attention to how particular mechanisms work to foster a range of social outcomes and to secure more environmentally effective outputs and their implementation.

Introduction

Confronting contemporary environmental problems, scholars and public administrators are increasingly engaging with participatory governance in order to generate and implement policy solutions (Koontz 2016; Wesselink et al. 2011). However, the actual capacity for such governance approaches to improve environmental conditions remains disputed (Gerlak, Heikkila, and Lubell 2013; Young et al. 2013). Few studies provide empirical evidence about the links between participatory processes and environmental outcomes (e.g., Biddle and Koontz 2014; Biddle 2017; Newig and Fritsch 2009a; Scott 2015), and important questions remain as to the specific mechanisms that drive these relations (Bodin 2017; Emerson, Nabatchi, and Balogh 2012; Scott 2015). Several studies provide insights into the proliferation of intermediate social and collaborative outcomes, such as conflict resolution (Emerson et al. 2009; Fisher and Sablan 2018), acceptance (Birnbaum 2016), or learning and belief change (Gerlak et al. 2018; Koebele 2015; Leach et al. 2013), suggesting that such outcomes may in turn also lead to more

environmentally effective policy solutions and improved implementation. However, little is known about whether or under what conditions this actually occurs, or how these intermediate outcomes interact. In fact, empirical research on the link between participatory governance and environmental outcomes is largely limited to single or small-N case studies.

In this study, we examine whether and how participation contributes to the environmental performance of public governance, analyzing, in particular, the mediating effect of several social and collaborative outcomes. We explore the causal paths through which different dimensions of participation (Fung 2006; Newig et al. 2018) impact differently on environmental outputs and implementation in practice. To that end, we draw on a unique dataset of 305 cases of environmental decision-making with varying degrees of public and stakeholder participation—the "SCAPE" database (Newig et al. 2013). The data was derived from a meta-analysis of published case studies (case survey), in which qualitative case study data was transformed into numeric data through a coding process utilizing a comprehensive, theoretically informed coding scheme. The method thus combines the richness of case study research with the rigor of large-N comparative analysis (Larsson 1993). We employ structural equation modeling (SEM) to test and examine the causal paths by which different dimensions of participation impact on environmental governance outputs and their implementation, mediated through intermediate social outcomes such as learning or trust building.

We expect that insights from this study will be of value for scientists and practitioners alike. Our analysis of pathways linking dimensions of participation with intermediate social and collaborative outcomes, and ultimately with environmental outcomes, provides a broader perspective on the role of participatory and collaborative approaches in the governance of environmental resources. Further, a deeper, evidence-informed understanding of such causal pathways should be of great value for organizers of participatory and collaborative decision-making processes.

The article proceeds as follows: The subsequent section lays out the conceptual foundation of this study, defining participation in public governance, identifying collaborative and intermediate outcomes, and specifying the main pathways through which these are hypothesized to improve the performance of environmental governance. The "Data and Methods" section describes our research design, the method of generating the database through the case-survey methodology, and our statistical approach to data analysis using exploratory factor analysis and SEM. In the following sections, we present and discuss our results. We close by drawing conclusions for further research and policy-making.

Concepts and Theoretical Background

Our analytical focus is on the participation of non-state actors in public environmental decision-making (which we use synonymously with environmental governance) and how these actors exchange and collaborate with governmental actors in order to reach collectively binding decisions on environmental issues. Such decision-making processes include planning, licensing, rule-making, mediation, and other forms of public policy-making. However, we do not assume decision-making processes to be generally participatory or collaborative. In fact, these may range from classical political-administrative decision-making processes to highly inclusive instances of co-governing. We are interested in *what difference* the various degrees and forms of participation and collaboration are making for environmental outcomes.

Decision-makers are often able to design the specific format and setting, including the extent to which a process is designed to be participatory and collaborative. Such design choices on governance modes are understood as strategic interventions that can help to achieve certain goals (Scott and Thomas 2017a). As an umbrella term, we use "participatory governance" to refer to "the processes and structures of public decision-making that engage actors from the private sector, civil society and/or the public at large, with varying degrees of communication, collaboration, and delegation of decision power to participants" (Newig et al. 2018, 273). We use the term "participation" to refer to the specific features and dimensions of—more or less—participatory governance that together form the set of independent variables chosen to explain environmental governance outcomes.

Below we discuss our conceptualization of the relationship between participation and environmental outputs and outcomes, and identify hypothesized causal paths via which participation is expected to improve the effectiveness of public environmental decision-making.

Participation and Collaboration in Environmental Governance Processes

In order to understand precisely how, and by what particular paths, participation influences governance outcomes, we conceptualize participation as comprising three dimensions (Fung 2006; Newig et al. 2018). First, participatory processes vary in terms of the *breadth of involvement* of stakeholders and other actors. Any given process may involve actors from government, the private sector or civil society, or from among the citizenry. These participants may comprise a relatively small group of selected experts, citizens, or representatives of organized groups, or they may comprise a wide cross-section of the general public. Second, processes differ in the nature and intensity of *communication*

among participants (Rowe and Frewer 2005). In terms of communicative dynamics, processes may exhibit one-way flows of information in the case of information provision or consultation processes, or by more intensive two-way exchange of information supporting collaborative dynamics. Third, participation can imply more or less delegation of decision-making power to participants (Arnstein 1969). *Power delegation* here refers to the extent to which participants can influence the decisions to be taken and the outputs produced.

Hypothesized Pathways From Participation to Environmental Outputs and Implementation

Figure 1 represents our conceptual model of the relationships between participation and environmental governance outcomes. The three dimensions of participation outlined above figure as independent variables, which are assumed to produce a number of intermediate social outcomes, and eventually environmental outcomes.

Analytically, we distinguish between the governance output, a set of intermediate social outcomes as well as acceptance and implementation of the governance output. A *governance output* is usually produced at the conclusion of a (participatory) decision-making process, and comprises a collectively-binding decision, program or plan. Depending on the provisions and measures contained in the governance output, this decision can embody a higher or lower *environmental standard*, that is, implying various consequences for the environmental problem at hand, ranging from tolerating severe environmental degradation to strong environmental improvements. Putting this governance output into action is understood as *implementation* (van Meter and van Horn 1974). This involves both the translation of more abstract programs into operational rules and measures, as well as compliance in the sense of "the specific obedience or lack thereof to a law or directive" (van Meter and van Horn 1974, 454). Environmental standard of the output and implementation together form what we broadly term "environmental outcomes" of governance.

Acceptance of the governance output provides an important link between governance outputs and implementation (Newig et al. 2018). On the one hand, acceptance means a reduction in opposition to a decision. Decisions arrived at through participatory processes, especially through successful negotiations, may reduce the risk of noncompliance and open opposition (e.g., through litigation), thereby facilitating implementation (Bulkeley and Mol 2003; Innes and Booher 1999); on the other hand, acceptance, particularly in contexts with high social capital, will increase the likelihood of implementation as stakeholders may be motivated to comply with or even (co-)implement decisions (Layzer 2002). As such, acceptance is understood to play multiple roles, as a component of the quality of the governance output and a means towards swift implementation.

The links between participation and environmental governance outcomes are mediated and shaped by intermediate outcomes on an individual or collective level that are assumed to foster improved decision-making and implementation. These *intermediate social outcomes*, such as social learning (Heikkila and Gerlak 2013) or conflict resolution (Emerson et al. 2009; O'Leary and Bingham 2003), constitute causal steps linking participation to the environmental standard of the output, its acceptance and its implementation. Drawing on the literatures on participatory and collaborative governance, we identified the following intermediate outcomes as relevant to the environmental standard of the output and its implementation: Social learning and individual capacity building; identification of mutual gains for participants and conflict resolution; trust building and development of shared norms; and network formation.

Social Learning and Capacity Building

Scholars of social learning broadly perceive learning to take place both on the individual and the collective level (Gerlak and Heikkila 2011; Reed et al. 2010). On an individual level, participants in a decision-making

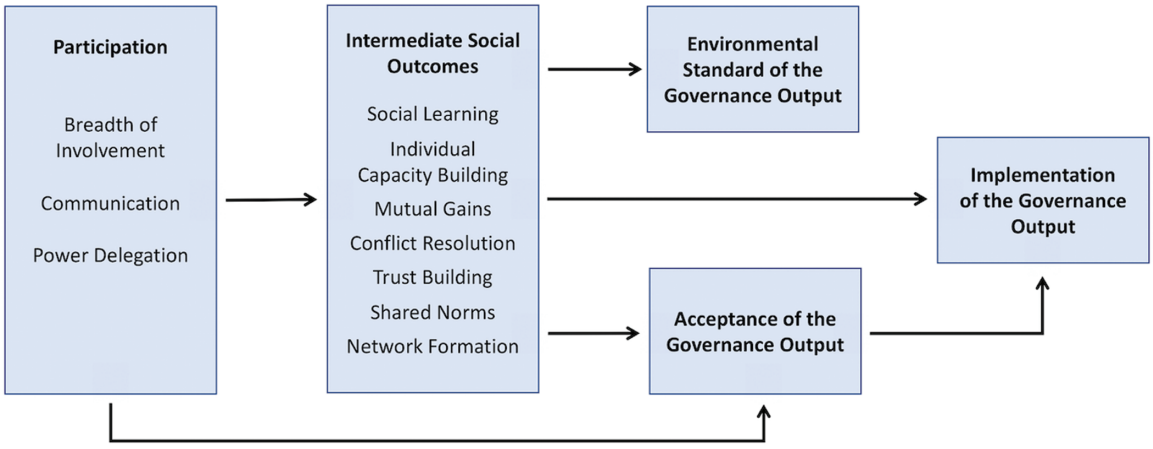

Figure 1. Conceptual Model Linking Participation to Outcomes.

process may acquire new information from within or from outside of the group, and translate this into new knowledge applicable to the issue at hand (Heikkila and Gerlak 2013). Deliberative processes and open dialogue among a broad range of actors play a particular role in this, as individuals are exposed to different kinds of knowledge (Lejano and Ingram 2009), such as lay-local, or context-dependent expert knowledge (Kochskämper et al. 2016). Through the incorporation of this knowledge, which can also relate to new transferrable skills and procedural capacities for participating in public decision-making processes more generally (Emerson and Nabatchi 2015), participants may be empowered in their capabilities to understand the problems at hand, to provide relevant input and "act collectively to implement change" (Beierle and Cayford 2002, 13).

Social learning goes beyond the individual and involves a group process of dissemination where knowledge becomes shared knowledge situated within a wider group (Heikkila and Gerlak 2013; Reed et al. 2010). The exchange of knowledge, ideas, and perspectives within a group can build a shared understanding, allow better diagnosis of the problem at hand, or transform views and beliefs via critical reflection, which in turn might prove beneficial for creating joint purpose and collective action (Emerson and Nabatchi 2015; Muro and Jeffrey 2012; Van Bommel et al. 2009). In this process, again dialogue and information exchange among a wide array of stakeholders usually play an important role.

Collective learning processes may impact positively on the environmental standard of the output through the shared knowledge attained in this way, but also through the emergence of new and innovative solutions (Fazey et al. 2012; Mandarano 2008). On the basis of enriched knowledge and a shared understanding of the ecological and social environment, the competencies of stakeholders and society more widely may be enhanced, along with their ability to contribute to collaborative decision-making, problem solving, and implementation of solutions. In this way, learning and capacity building has the potential to improve the environmental standard of governance outputs and collective action (Beierle and Cayford 2002).

Mutual Gains and Conflict Resolution

Participation may provide an institutional space allowing for intensive communication and negotiation among concerned stakeholders that can help identify *positive-sum solutions* (Delli Carpini, Cook, and Jacobs 2004). Transparent exchange of priorities and interests through intensive dialogue in relation to an issue may result in improved mutual understanding of respective stakes and preferences, and the identification of common ground among participants (Ansell and Gash 2007; Emerson and Nabatchi 2015). "Win-win" solutions, in the sense of Pareto-optimal adjustments that make no party worse off, may emerge and may be reflected in the governance output. Such solutions can include measures providing for compensation to those who would otherwise suffer losses, including side payments with regards to other issues and competing interests that are party to the process or not, as well as to future decisions and options (Wondolleck and Yaffee 2000). Hence, discretion to actually shape the content of resulting agreements is a precondition for mutual gains to be meaningfully negotiated.

Closely related to the identification of mutual gains and win-win solutions are processes of mediation and *conflict resolution* in participatory settings (Emerson et al. 2009; O'Leary and Bingham 2003). Where participation and exchange are supported by professional facilitation or mediation, participants may be enabled to exchange arguments and positions, identify common understandings, values and priorities, to overcome or at least address protracted conflicts (Emerson et al. 2009). This can prove instrumental in breaking stalemates and enabling more constructive, collaborative interaction, and genuine cooperation towards a solution that is acceptable to all parties (Dukes 2004).

Compared to a non-negotiated outcome, a "win-win" solution derived through negotiation or conflict resolution can be regarded as an improved allocation of the resources at stake, with benefits for all or many of the affected parties, including the environment (Brody 2003). Such a solution may also foster acceptance of the negotiated output, as ultimately participating parties will be better off than they would without the agreement (Susskind, McKearnan, and Thomas-Larmer 1999), which is, in turn, likely to have a positive effect on its implementation.

Building Trust and Shared Norms

While learning and win-win solutions may provide an immediate benefit for the environmental standard of governance outputs, the strengthening of trust and development of a shared sense of purpose through participation may rather be seen as a foundation underpinning successful environmental governance (Bryson, Crosby, and Stone 2006; Getha-Taylor et al. 2018).

Many argue that *trust* is a key outcome of collaboration in participatory processes (cf. Emerson, Nabatchi, and Balogh 2012; Siddiki, Kim, and Leach 2017). At the same time, trusting relationships are seen as the "lubricant and the glue—that is, they facilitate the work of collaboration and they hold the collaboration together" (Bryson, Crosby, and Stone 2006, 47). It has even been argued that all factors enabling effective participatory processes can ultimately be reduced to trust (Senecah 2004). Trust is built through repeated interaction and reciprocation, such as through sharing of

information, and underpinned in particular by communication (Albrecht and Travaglione 2003; cited in: Getha-Taylor et al. 2018). Establishing trust may serve to moderate interpersonal behavior, strengthen confidence in partners' competences, and generate mutual understanding and commitment, which in turn facilitate further collaboration and exchange (Chen and Graddy 2010). Ultimately, these benefits may add to the legitimacy of processes and generate collective commitment for action (Emerson, Nabatchi, and Balogh 2012).

On a more fundamental level, sustained interaction and common experiences among those engaged in participatory processes can lead to the development or strengthening of *shared values and norms* conducive to collaboration and reciprocity (Oh and Bush 2014; Thomson and Perry 2006).

The building of trust and shared norms is believed to contribute to solving environmental problems as it creates a shared sense of purpose and provides favorable conditions for effective problem solving (Connick and Innes 2003; Heikkila and Gerlak 2013; Oh and Bush 2014), and acceptance of the final decision (Webler and Tuler 2000), ultimately facilitating collective action among actors (Ostrom 1990).

Building of Networks for Collaboration

Repeated interaction and intensive communication within a participatory process fosters the development of more stable relationships among actors that may lead to the formation or strengthening of *governance networks* (Isett et al. 2011; Klijn and Koppenjan 2016). These networks allow participants and stakeholders to realize common interests and share knowledge (Oh and Bush 2014), and ultimately to engage in collective action and joint problem solving (Innes and Booher 2004; Sayles and Baggio 2017).

In this way, networks may prove instrumental for realizing some of the above-mentioned intermediate outcomes, but they can also spark problem solving and collective action in other ways. They provide the structural means for social learning (Newig, Günther, and Pahl-Wostl 2010), conflict resolution (Klijn, Steijn, and Edelenbos 2010), and trust building (Schneider et al. 2003), and in this way mobilize and exchange resources between dispersed actors, and produce robust solutions to complex problems through collective innovation (Hartley, Sørensen, and Torfing 2013). Networks can further aid implementation and compliance through monitoring, and providing a web of social control to aid collective action and detect noncompliance (Alexander et al. 2018; Leach and Pelkey 2001).

While these intermediate outcomes describe distinct pathways to effective environmental governance, we do not assume that they work in isolation. Instead, it can be assumed that they form a web of interlinkages influencing each other (cf. Newig et al. 2018). Our empirical analysis will address the interrelations and patterns of co-occurrence among these factors.

Data and Methods

Data: Case-Survey Meta-analysis

Data for this analysis is derived from a case-survey meta-analysis of 305 cases of public environmental decision-making, for which published case studies are available.[1] This type of case study meta-analysis (case-survey method) (Larsson 1993; Newig and Fritsch 2009b) entails the interpretation of narrative case studies and the conversion of the rich qualitative information therein into quantitative data. The method is particularly apt for our research aims, as it allows to synthesize emergent findings in a field where existing empirical evidence is mainly restricted to single or small-N case studies.

In line with our conceptual understanding above, we define a "case" as a public environmental decision-making process oriented towards reaching a collectively binding decision. A case can be to a lesser or greater extent participatory, ranging from classical political-administrative decision-making to highly inclusive instances of collaborative co-governing. However, as they provide only formalized choice and limited room for participation, we excluded pure elections and referendums. We also excluded acts of protest and unrest without constructive attempts for collective decision-making.

In order to be able to test specific hypotheses on the links between participation and environmental outcomes, we quantify for each case (1) the "degree" of participation and (2) the environmental standard of the output, each in multiple dimensions and thus via a number of different variables. In addition, we capture a range of intermediate social outcomes, implementation-related aspects.

In conducting the case-survey, we took the following steps:

1. *Case study identification and selection:* We conducted a thorough search of several online scientific databases and library catalogs[2] for studies published up until 2014 in English, German, French, or Spanish language, which describe binding environmental decision-making processes characterized by varying degrees of

1 Data available upon request from J. Newig (newig@uni.leuphana.de).

2 Sources searched include: BASE; Google Books; Google Scholar; GVK+; Science Direct; SciVerse Hub; Scopus; SpringerLink; SSRN; Web of Science; Wiley Interscience.

public or stakeholder participation, including non-state actor initiated as well as agency-initiated processes. We limited our search to cases from Europe, North America, and Australia and New Zealand. This was done in an attempt to hold the political-cultural context of collaborative governance constant to a certain degree, focusing on western, democratic countries. The assumption behind this was that the scope of participation, and the uptake of governance outputs, would vary considerably across very different political systems and cultures. We utilized multiple combinations of diverse search terms, in several iterations, in order to capture as complete a range of processes studied from a variety of disciplinary perspectives. We searched for environment-related terms (e.g., ecosystem-based; landscape management; wetlands; waste-siting), for participatory governance-related terms (e.g., collaboration, participatory, decision-making, deliberation, stakeholder involvement, controversy, planning) and for concrete process forms (e.g., citizen jury, public hearing, town meeting, task force, consensus conference) in various combinations. We targeted a variety of publication types, including peer-reviewed journal articles, books, edited collections and chapters therein, theses, working papers, conference papers, reports and other forms of gray literature, so long as these were publicly available. This variety of publication sources is recommended as a means to mitigate publication bias and the over-representation of "success stories" (Banks, Kepes, and McDaniel 2015; Mahood, Van Eerd, and Irvin 2014).[3] The search identified over 2,000 cases, described in more than 3,300 texts. Having continued the search to the point of saturation where no new cases were being discovered with any new search effort, we assume that we have covered a nearly complete set of relevant, publicly available, published cases. These were screened for suitability, and those containing insufficient information for our purposes were eliminated. From the resulting database of 639 "codeable" cases we randomly sampled 305 cases for full coding. Figure 2 summarizes the case identification and selection process. Cases in this database range from standard administrative decision-making to highly inclusive and collaborative processes, and cover 22 western democracies, mostly from across North America and Europe. Cases include a wide range of environmental issues, including land use, biodiversity, and freshwater resources, but also particular topics such as waste facility siting, transport infrastructure, and energy planning. Further details and descriptive statistics on the database of 639 cases, as well as the 305 cases of this sample, can be found in the Supplementary Material.

2. *Coding scheme development:* We developed a coding scheme (Newig et al. 2013) on the basis of our conceptualization of participatory decision-making processes (described above), and the hypothesized links between process attributes, environmental outputs, social outcomes, and implementation, as well as relevant contextual variables. These components were broken down into multiple variables—259 quantitative, and additional qualitative variables—each with an accompanying measurement scale and detailed coding instructions. Most variables were coded on a five-point quantitative scale (from 0 to 4). In addition, each variable was assigned a second code capturing the reliability of the information (from 0 to 3) upon which the coding decision was based.
3. *Case coding:* Each case was independently read and coded by three trained raters. Three raters were deemed sufficient to achieve high data quality (Libby and Blashfield 1978). Apart from the actual codings, raters specified for each variable the reliability of the information underpinning their coding decision, using a 3-point scale (with 1 indicating enough information for an informed guess, and 3 indicating explicit, detailed and reliable information) (Newig et al. 2013).[4] After initial coding, raters met to address technical errors and explore divergent interpretations; however, raters were explicitly not asked to force convergence or consensus. In this way, the method accommodates different interpretations of the texts by individual raters (Kumar, Stern, and Anderson 1993). Despite this explicit allowance of divergent codings, data validity is considerably high: interrater reliability,

3 As a robustness check in this respect, we repeated our analysis excluding all cases that solely relied on gray literature. Results remained stable.

4 Variables were also allowed to be coded as "missing data." Through separating variable coding and information reliability, we intentionally aimed to prevent the assessment of the actual variable being influenced by the detail of the underlying case information.

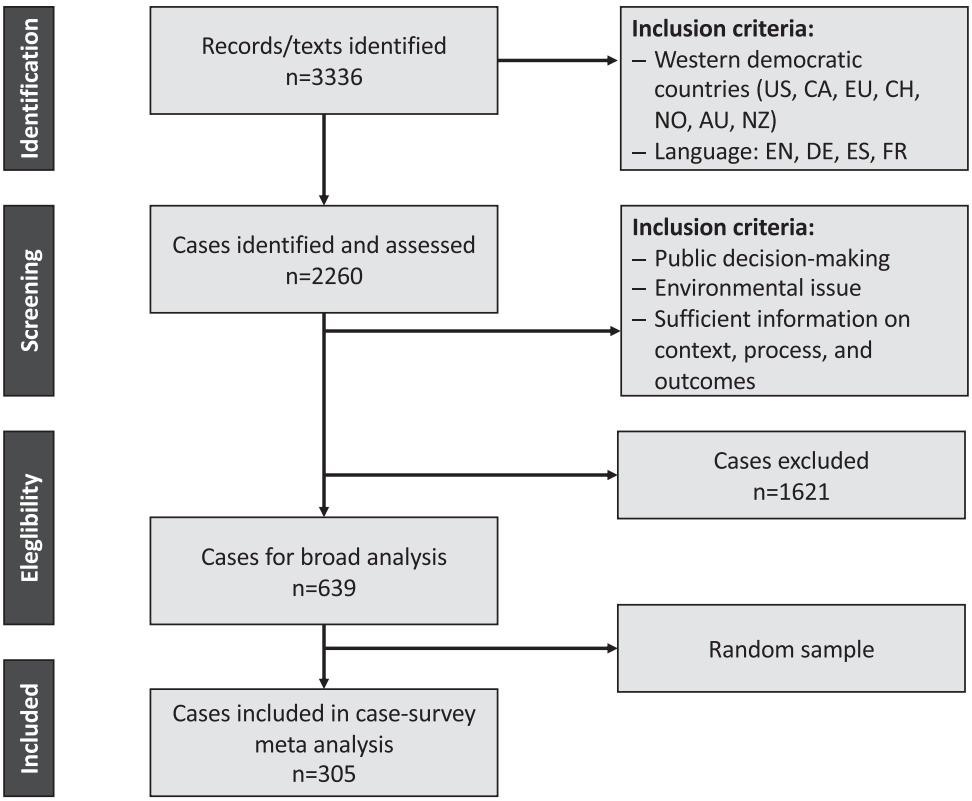

Figure 2. PRISMA Flowchart of Case Identification and Selection (Moher et al. 2009). Country codes: AU = Australia, CA = Canada, CH = Switzerland, EU = European Union member states (including United Kingdom), NO = Norway, NZ = New Zealand, US = United States; Language codes: DE = German, EN = English, ES = Spanish, FR = French.

measured through $G(q,k)$ (Putka et al. 2008) lies at 0.79, whereas interrater agreement (r_{WG}, James, Demaree, and Wolf 1984) was at 0.79.

4. *Data preparation:* Beyond the calculation of interrater reliability, we explored our data for the influence of distorting factors, such as the influence of rater drift or publication type (Jager et al. 2015). As we did not detect any undue distorting effects, we prepared the final dataset by aggregating raters' variable assessments, using information reliability-weighted means (Van Bruggen, Lilien, and Kacker 2002). The resulting dataset forms the basis for the analysis conducted here.

Specification of Variables

Independent Variables

As outlined in section 2, we understand participation as a three-dimensional construct comprising communication, the breadth of public and stakeholder involvement, and power delegation. These dimensions serve as independent variables for our analysis.

We measure the involvement of non-state actors as the average representation of civil society actors, private business actors, and individual citizens in a given case. Detailed definitions of all variables together with some descriptive statistics are given in table 1.

In our measurement of communication, we rely on the distinction between one-way communication flow from and to participants, and two-way dialogue between organizers and participants, and among participants. Each of these variables was measured on a 0 to 4 scale, with 0 meaning no such communication took place, and 4 indicating a maximum degree of communication in this sense. These three variables were then aggregated into a single, composite scale (α = .91) by means of a principal component analysis (PCA, factor loadings were .93, .91, and .91, respectively) to be used in the subsequent analyses.

Finally, power delegation to participants was measured through the "*degree to which the process design provided the possibility for participants [...] to develop and determine the output*" (Newig et al. 2013, 37), for which we also employed a 5-point scale as calibrated above.

Dependent Variables

Our main dependent variables are the environmental standard of governance outputs and the implementation of outputs. The output of a governance process refers to the decision made, typically set down in

Table 1. Description of Intermediate Social Outcome Variables

Variable Name	Description	Scale	Mean (SD)
Participation			
Representation	Extent to which the composition of participants in the process mirrors the interest constellation in the public. Full representation is reached when there are a sufficient number of representatives and when those representatives are fully accepted as such by their constituencies.	0–4	1.06 (0.51)
Communication: Information	Degree to which participants [...] received all relevant information (i.e., actual flow of information in the direction of participants), in relation to the amount of information the process organizer had or could easily access.	0–4	2.36 (0.85)
Communication: Consultation	Degree to which participants [...] gave all the input they considered relevant.	0–4	2.45 (0.81)
Communication: Dialogue	Degree to which a two-way dialogue and information flow, and direct interaction among participants and between participants and the process organizers, took place. Dialogue implies more than just extensive communication and/or consultation but requires responsive on-going interaction, so that the relevant information is exchanged (i.e., assumes the possibility to ask questions and respond to comments).	0–4	2.23 (0.96)
Power Delegation	Degree to which the process design provided the possibility for participants [...] to develop and determine the output.	0–4	1.90 (1.11)
Intermediate Social Outcomes			
Social Learning	Degree to which participants, stakeholders or broader society learned about the issue such that they gained new or improved understanding or knowledge of the issue, enabling them potentially to contribute to future joint problem solving efforts ("social learning" in the sense of Reed et al. (2010)).	0–4	1.83 (0.80)
Individual Capacity Building	Degree to which the skills and capabilities of individual participants or stakeholders were enhanced through involvement in or engagement with the decision-making process. These skills and capabilities may be specific to the issue at hand, or incidental and applicable to a range of social situations.	0–4	1.54 (0.82)
Trust Building	Degree to which trust relationships were created or strengthened among participants (and potentially beyond), which can be expected to "facilitate coordination and cooperation for mutual benefit" (Putnam 1995: 67, see also Ansell and Gash 2007). "Trust is the willingness to accept vulnerability based on positive expectations about another's intentions or behaviors" (McEvily, Perrone, and Zaheer 2003).	–4–4	0.59 (1.40)
Network Formation	Degree to which social networks were created or built up (or undermined) among participants and beyond […]. Networks are defined here in the sense of social capital building, which can be expected to "facilitate coordination and cooperation for mutual benefit" (Putnam 1995: 67) regarding capacity to address the problem or similar issues	–4–4	1.11 (0.92)
Building Shared Norms	Degree to which social capital among participants (and potentially beyond) was created or strengthened in the sense of "informal values or norms shared among members of a group that permit cooperation among them".	–4–4	0.59 (0.78)
Conflict Resolution	Degree to which an existing conflict was resolved or worsened or a new conflict developed, considering also the nature of change in any preexisting conflict of values and/or distribution.	–4–4	0.68 (1.42)
Mutual Gains	Degree to which win-win solutions were developed during the decision-making process (i.e., degree to which the output provided mutual gains). Win-win (or Pareto optimal) solutions are those that provide gains (or at least: no losses) to all involved parties. These are always positive-sum solutions compared to the non-collaborative alternative. Win-win solutions include solutions where compensation is provided to those who would otherwise suffer losses. Win-win solutions are not necessarily limited to the environmental issue at hand, but may be linked to alternative issues and competing interests on and off the table, as well as to future decisions (Wondolleck and Yaffee 2000, 50).	0–4	1.46 (0.95)

Table 1. Continued

Variable Name	Description	Scale	Mean (SD)
Outcomes			
Environmental standard of the output	Degree to which the environmental output aimed at an improvement (or tolerated a deterioration) of environmental conditions [...]. This is to be assessed moving from the "business as usual" scenario (projected trend) towards a hypothetical "optimal" (or "worst case") condition.	–4–4	0.85 (1.34)
Acceptance	Did stakeholders oppose, accept or support the decision? 0= opposition, or acceptance with reservations; 1= acceptance and support of decision This variable is an average over all stakeholders identified in the case.	0–1	0.63 (0.28)
Implementation	Degree to which environmental outputs [...] were being (or would most probably be) implemented, taking into account everything we know from the case material. Implementation - as opposed to compliance - means putting a more abstract plan or rule into operation by making it more concrete or developing specific measures (i.e., implementation is a process). This is typically done by government sector actors.	0–4	2.79 (0.85)
Compliance	Degree to which environmental outputs were being (or would most probably be) complied with, taking into account everything we know from the case material. Compliance - as opposed to implementation - means to do what the rule prescribes (rule conformity). This includes more or less simple tasks, including to refrain from doing something. Whereas implementation implies actively (and creatively) designing a solution, compliance simply means adherence to the rule (i.e., compliance is typically a single or repeated action, rather than a process)	0–4	2.67 (0.81)

Note: Definitions are derived from Newig et al. 2013. The right-hand column displays the arithmetic mean overall cases, with SD in parentheses.

writing, in the form of a management plan, a permit, a law, etc. In case of multiple outputs, the "final decision" discussed in the case material is identified as the most legally binding output described, excluding subsequent changes through litigation. In 286 of 305 cases, decision-making produced an output, and in 19 it did not. Only for these 288 cases were output variables coded.

Comparing the environmental standard of governance outputs across a variety of processes and contexts is not straightforward and inevitably requires a degree of abstraction in order to be able to compare across a variety of cases covering different sectors. We treat environmental standard as analogous to "regime effectiveness" as conceptualized by Underdal (2002), who proposes to evaluate regime effectiveness against a hypothetical collective optimum, "one that accomplishes [...] all that can be accomplished—given the state of knowledge at the time" (Underdal 2002, 8). In this vein, we defined the environmental standard of the output as the "*Degree to which the environmental output aimed at an improvement (or tolerated a deterioration) of environmental conditions [...]. This is to be assessed moving from the 'business as usual' scenario (projected trend) towards a hypothetical 'optimal' (or 'worst case') condition*." (Newig et al. 2013, 49). We measured this variable on a scale for –4 to 4, where 0 meant no divergence from a hypothetical business-as-usual scenario, whereas –4 implied that the governance output under consideration corresponded to a "worst-case" scenario, and 4 to a hypothetical optimum. Hence, we do not measure absolute "progress" towards environmental goals—even in a business-as-usual scenario, environmental improvements are possible. We are interested in the effect of governance interventions and the question of what difference they make.

The advantage of this approach, comparing the baseline standard of the business-as-usual scenario with the optimal (or worst) case scenario to assess the degree and direction of change, is that it offers a coherent means to gauge environmental effectiveness across multiple contexts. However, there are several drawbacks (see also Underdal 2004): First, estimating both standards is not trivial, but requires informed extrapolation and a good understanding of the context of the case. We tried to mitigate this challenge and improve reliability and intersubjectivity by requiring raters to discuss and agree on the baseline standard before assessing environmental standards of the output. Further, while it is important to consider both standards, they are not necessarily independent. Using one implicitly means also making assumptions about the other. For example, claiming that something improved implies a

notion of what constitutes positive change. This may also mean that a favorable business-as-usual scenario narrows the space for improvements. However, while it is pertinent to consider these challenges and limitations, the approach appears useful here, as it is explicitly geared towards assessing the environmental effectiveness of specific governance interventions and comparing these across a variety of cases and contexts.

In order to allow for some nuance within what is commonly regarded as "environmental protection," we distinguish two dimensions of environmental output standard: a more eco-centric perspective of *conservation* and a more anthropocentric perspective of *natural resource protection*. The former we define as aiming "to preserve, protect or restore the natural environment and ecosystems [...] largely independently of their instrumental value to humankind" (mean = 0.74). The latter is defined as aiming "to protect, preserve, enhance or restore stocks and flows of natural resources that are of instrumental value to humans, and provide for their sustainable use" (mean = 0.96; Newig et al. 2013, 10). As both dimensions were highly correlated ($r = 0.89$, $p < .001$), they were averaged to form a single scale ($\alpha = .94$). In the following, we will call this variable *Environmental Standard of the Output*; it has an observed range from −3.36 to + 3.25, with a mean value of 0.85.

Implementation, as understood here, includes, on the one hand, the process of putting a more abstract plan or rule into operation by developing concrete measures, and on the other hand, rule conformity on the part of implementing actors. Both dimensions were measured separately and compiled (PCA) into an aggregated scale ($\alpha = .86$).

For the measure of acceptance, we asked whether stakeholders accepted the governance output. This variable represents the average acceptance judged across all stakeholder groups identified within the case.[5]

Intermediate Outcomes

Variable description, measurement scales, and some descriptive statistics on the intermediate outcomes, identified in section 2, are shown in table 1.

Data Analysis

To address our research question of how participation contributes to the environmental performance of governance and through which pathways intermediate outcomes shape this relationship, we combine exploratory factor analysis with SEM (for a similar approach, see Bollen 2000; Thomson, Perry, and Miller 2009).

As outlined above, we assume that intermediate social outcomes do not develop in isolation but form a complex web of mutual support and interlinkages. Our data supports this claim, with correlation coefficients between our seven intermediate social outcomes scoring between 0.29 and 0.78 (mean = 0.55). In order to reduce the dimensionality among these seven variables, we conduct an exploratory factor analysis. To derive an adequate number of factors, we inspected the scree plot of eigenvalues and ran a parallel analysis (Hayton, Allen, and Scarpello 2004), which suggested two factors. As it is reasonable to assume mutual relations among the two resulting factors, we use oblique rotation (*oblimin*), which allows factors to be correlated. The resulting latent variables (factors) were then used for subsequent analysis.

One of the particular methodological challenges of the conceptual model outlined above is that we assume indirect and mediated relationships between variables. Such relations can easily be overlooked in standard regression analysis. Hence, we rely on SEM that explicitly allows for testing such relationships. We employ a piecewise SEM approach (Lefcheck 2016; Shipley 2009), which shifts from a global model estimation, where all equations are solved simultaneously, to local estimation solving each equation separately. This allows for fitting a wide range of distributions and sampling designs, and smaller data sets, and further incorporates an exploratory component as the local estimation helps to identify misspecifications and overlooked paths. In this way, it serves our purpose in combining theoretically informed path analysis with an exploratory component to detect new and unexpected relations.[6] Finally, to test the robustness and assess global fit, we reconstruct the final model, including the factor analysis, using a global estimation approach.[7]

Results

Specifying Intermediate Outcomes

Through the exploratory factor analysis, we derived two factors as adequate representation of the intermediate outcome variables. The results of this analysis, including reliability values, are depicted in table 2.[8]

5 This variable represents a dichotomization of a previously 3-point variable, distinguishing between opposition, acceptance despite some reservation, and full acceptance and support. However, as this more detailed scale has resulted in highly skewed distributions, we considered this scale to be less reliable and opted for a conservative re-coding of our data.

6 One limitation of the approach is that it does not allow for latent variable modeling, hence, we add the latent variables we derived from the exploratory factor analysis separately as such.

7 This global model may be found in the Supplementary Material.

8 The Kaiser-Mayer-Olkin index verified the sampling adequacy (KMO = 0.86, i.e., "meritorious"). Bartlett's test for sphericity also indicated that correlations were sufficiently large ($\chi^2(21) = 1{,}322$, $p < .001$).

Table 2. Intermediate Social Outcomes—Results of the Exploratory Factor Analysis, Oblique Rotation (Oblimin), Factor Loadings >.4 or <–.4 in Bold

	Factor 1	Factor 2
Variable	"Convergence of Stakeholder Perspectives"	"Stakeholder Capacity Building"
Conflict Resolution	**0.93**	–0.11
Trust Building	**0.84**	0.14
Mutual Gains	**0.73**	–0.03
Building Shared Norms	**0.58**	0.29
Individual Capacity Building	–0.04	**0.92**
Social Learning	0.08	**0.77**
Network Formation	0.12	**0.58**
Eigenvalues	2.63	2.06
Per cent of variance	0.38	0.29
Reliability (Cronbach's alpha)	0.89	0.83

The analysis revealed two distinct but correlated factors (table 2). Factor 1 mainly includes the variables Conflict Resolution, Trust Building, Identification of Mutual Gains, and Building Shared Norms, whereas Social Learning, Individual Capacity Building and Network Formation score high on Factor 2. Factor 1 underlies those variables that express the degree to which actors' viewpoints, values and mutual understanding in a decision-making process converge or diverge. We label this latent variable "*Convergence of Stakeholder Perspectives*." The second factor underlies the variables which relate to the extent to which participants learn and build capacities during the process, and the extent to which networks conducive to resolving the issues at hand are built (or deteriorated). All of these variables are strongly associated with the concept of individual social capital (Portes 2000). Social capital supposedly enables actors to more meaningfully participate in decision-making processes, to defend their own interests, but also to contribute to joint problem solving and implementation of agreed outputs. We, therefore, term this variable "*Stakeholder Capacity Building*."

With these newly derived factors, we refine our conceptual model for specification in the subsequent SEM analysis (figure 3). We assume that the factors serve as intermediate variables, mediating the effects that the three dimensions of participation will have on governance outputs, their acceptance and implementation.[9]

9 A graphical representation of the model equations can be found in the Supplementary Material.

SEM Analysis

On the basis of this revised conceptual model, we ran a piecewise SEM, also exploring plausible alternative pathways between participation and governance performance beyond the ones identified in this conceptual model. This exploratory phase, relying on local estimation, suggested only one additional path to the model, namely the direct link between Power Delegation and the Environmental Standard of the Output.

The structural model (N = 204)[10] demonstrates a good fit. The robust root mean square error of approximation (RMSEA) was 0.02, which is below the cutoff value of 0.06 (Hu and Bentler 1999). Robust comparative fit index (CFI) of 0.997, Tucker-Lewis index (TLI) of 0.992 and a χ^2 value of 9.621 (p = .38) indicate a satisfactory fit. Overall, the model explains between 8 and 37% of the variance in the intermediate and substantive outcomes.[11] The final result is displayed in figure 4.

Results highlight that the three dimensions of participation show varying effects on intermediate outcomes and environmental performance overall. Strong effects can be observed for communication on both convergence of stakeholder perspectives (β = .32, p < .001), and stakeholder capacity building (β = .34, p < .001). The representation of non-state stakeholders and power delegated to participants, on the other hand, only show a moderate significant effect on stakeholder capacities (β = .21, p = .003), whereas power delegation shows a slightly higher effect on the convergence of perspectives (β = .29, p < .001).

The environmental standard of the output is, in turn, only significantly positively influenced by convergence of stakeholder perspectives (β = .21, p = .02), but not by the stakeholder capacities built up within the process. Also, the indirect effect of stakeholder capacity building through the highly correlated convergence of perspectives is rather weak (indirect effect = .11, p = .04).[12] The highest values were identified for the direct, unmediated effect of power delegation

10 Smaller N results from missing data, especially for the implementation variable. We checked the results for robustness in this respect, by running the model without implementation. Results remained stable.

11 The reported fit measures were derived through global, robust estimation in R with the package *lavaan* using the same data as in the piecewise SEM. Additionally, as a robustness check, we re-ran the model through global estimation, also replicating the results of our exploratory factor analysis through a confirmatory factor analysis approach. The resulting model had an RMSEA of 0.06, a CFI of 0.96, and a TLI of 0.95, indicating an overall satisfactory model fit. χ^2 was at 87.56 (p = .001) though, suggesting a poor model fit, but this is less important in larger samples. Also, beta coefficients and R^2 in the resulting model were very similar to those derived through our initial approach, which together support the robustness of our results. This model is added to this article in the Supplementary Material.

12 Indirect effects were assessed using the recommended bootstrapping approach (Zhao, Lynch, and Chen 2010).

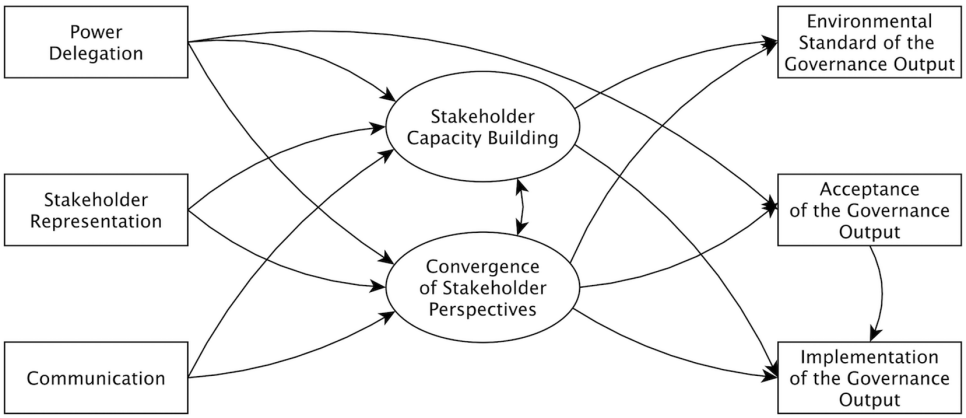

Figure 3. Conceptual Model Linking the Three Independent Variables (Dimensions of Participation, on the Left-Hand Side) to the Intermediate Social Outcomes (Derived From the Exploratory Factor Analysis), and both to the Three Dependent Variables (Right-Hand Side).

on the environmental standard of the output (β = .32, $p < .001$), indicating that there are more ways in which empowering participants improves the environmental output beyond the particular pathways we tested here. In this vein, we also tested the indirect effects for the other dimensions of communication and stakeholder representation through both our intermediate factors. Both cumulated indirect effects are very small (indirect effect of communication = .10, $p = .01$; indirect effect of stakeholder representation = .04, $p = .06$).

The acceptance of the environmental output proves to be strongly connected to the convergence of stakeholder perspectives (β = .51, $p < .001$) attained during the process, indicating that collaborative outcomes affect both the content and the political fate of environmental governance outputs.

Finally, the only factor with a significant effect on implementation is the degree of acceptance of the governance output (β = .22, $p = .01$). Convergence of stakeholder perspectives shows only an indirect effect, which is small but significant (indirect effect through acceptance = .10, $p = .03$). However, with an R^2 of 0.08, the explanatory power of our model is rather low in this respect, suggesting that there may be different factors at work when it comes to translating political plans and programs into action.

Discussion

With this analysis, we set out to shed light on underexplored links in the study of participation and environmental governance, namely on the question of *how* participation may enhance the performance of environmental governance and which role intermediate social outcomes play in this relationship.

First, we assessed the interlinkages among intermediate outcomes, resulting in two aggregate factors, one underlying stakeholder capacities built up during a decision-making process (including capacity building, social learning and network formation), and one indicating the convergence of stakeholder perspectives developed among participants and beyond (conflict resolution, trust building, mutual gains, building shared norms). This analysis highlights, as expected, that intermediate outcomes are interlinked and clustered. Yet, the way these variables clustered was not fully expected. Network formation, that is, establishing structural ties among actors, appears to co-vary strongly with learning outcomes, rather than with factors of social convergence such as trust or shared norms. This emphasizes the important role of structural aspects of connectivity in the process of collective learning, but also is in line with the notion of learning as an increase in the number and density of connections in an actor network (Newig, Günther, and Pahl-Wostl 2010). At the same time, more tangible benefits of conflict resolution and mutual gains appear in the same factor with cognitive aspects of social capital, building of trust and social norms. This result is in line with much of the literature on conflict mediation, which maintains that trust and capacity for collaboration are an essential component and result of conflict resolution (Emerson et al. 2009; Innes and Booher 1999).

Using SEM, we traced the pathways between participation and environmental effectiveness, using the two intermediate social outcomes as mediating variables. Overall, results support the general hypothesis that participation positively influences the environmental standard of governance outputs, both directly and mediated through intermediate outcomes. On closer inspection, it becomes apparent that only specific aspects of participation appear as strong predictors for specific outcomes, whereas for others no evidence could be found. In line with our conceptual assumptions, communication proves to be a strong influencing factor for both intermediate outcome factors, highlighting the central role of exchange among stakeholders for arriving at negotiated outcomes,

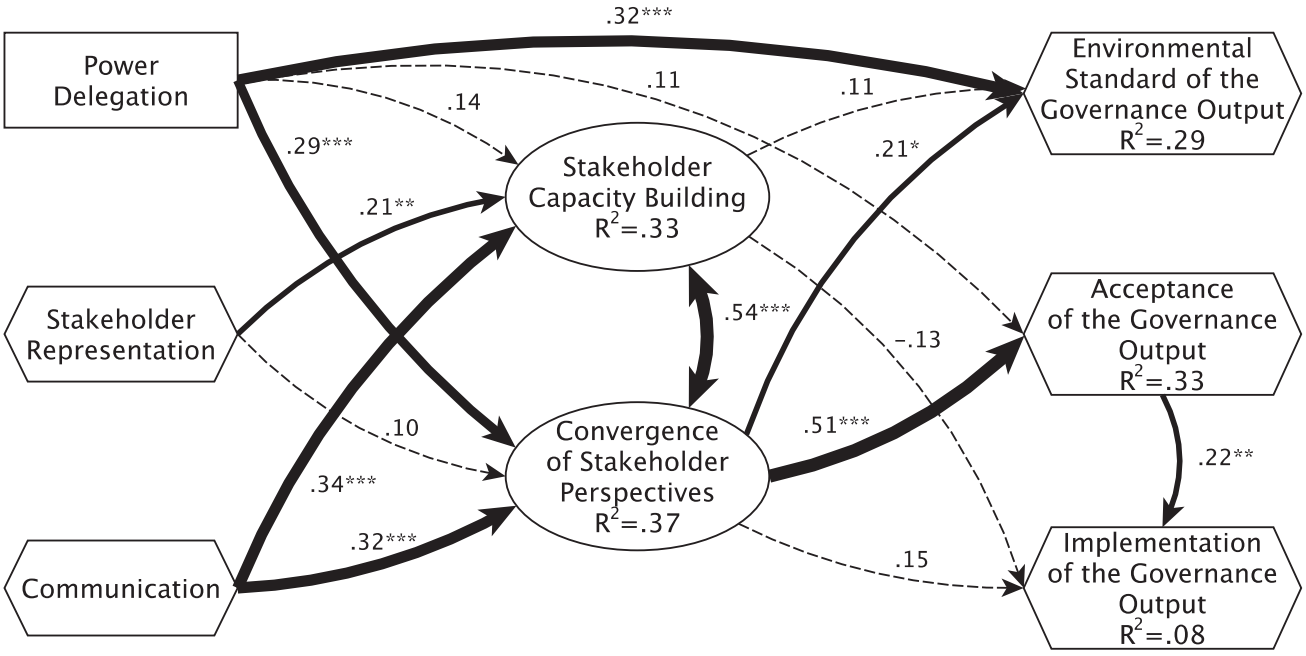

Figure 4. Structural Equation Model Results. *Note*: Rectangles Represent Measured Variables, Ellipses are Latent Variables, and Hexagons Represent Composite Variables. Arrows Depict (Standardized) Beta Values, Arrows are Weighted by the Size of Beta Values. Dashed Lines Represent Insignificant Effects. Significance Thresholds: $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$.

learning, and social capital building. In our model, the breadth of stakeholder involvement, only significantly impacts on stakeholder capacity building, but not on the convergence of stakeholder perspectives. This highlights the importance of broad stakeholder representation for learning processes, potentially acting as multiple and diverse sources of information and knowledge, but also as knowledge producers throughout the process (Bodin and Crona 2009; Siddiki, Kim, and Leach 2017). A complementary pattern emerges with regards to power delegation, which shows no significant effect for stakeholder capacity building, but only for the convergence of stakeholder perspectives. This suggests that stakeholder capacity building is fostered by broad representation or communication-intensive processes, whereas the development of shared understanding and win-win situations depends rather on participants having space to interact and being able to make decisions.

Considering how intermediate social outcomes affect the environmental standard of governance outputs, we see—in line with contributions to the literature on consensus building and collaborative governance (Ansell and Gash 2007; Innes and Booher 1999)—that convergent perspectives attained within the process make an output of a high environmental standard more likely. Stakeholder capacity building, however, does not show a significant effect. This can be interpreted as evidence that win-win solutions, trust and a shared understanding generated within participatory processes also contribute to environmentally beneficial outputs. At the same time, these results indicate that learning and cognitive changes among participants are not necessarily sufficient for changing decisions or behavior (Heikkila and Gerlak 2013; Newig et al. 2019; Wood 2006), which does not mean that these effects are without societal and collaborative value (Ansell and Gash 2018; Scott and Thomas 2017b). Despite these benefits in stakeholder capacities, other factors may shape participants' behavior, for example, strategic considerations or institutional ground rules (Koebele 2019; Ostrom 2011), that may be better moderated in situations with higher mutual understanding (Siddiki, Kim, and Leach 2017).

The strongest effect on the environmental standard of governance outputs was observed for the degree of power delegated to participants to shape the output. Communication and the representation of non-state stakeholders in turn only show smaller, indirect effects. The surprisingly strong role of power delegation suggests that taking participants seriously as agents over their environment is an important factor in realizing, among other things, strong environmental outputs (Biddle 2017; Emerson, Nabatchi, and Balogh 2012; Kochskämper et al. 2018). From the perspective of public administrators who organize decision-making processes, this implies that if strong environmental outputs are sought, participatory formats that leave room for participants to explore alternatives and take decisions should be utilized. In our sample of cases, such formats included processes of collaborative negotiation, round tables, work groups, councils or steering

groups, whereas processes with little power delegation included formats such as pure administrative decision-making, public hearings or consultation fora, with process formats such as advisory groups falling somewhat in between.

Turning to the implementation of governance outputs, we find support in our analysis for the assumption that converging stakeholder perspectives, including win-win situations, trust and shared norms, make the acceptance of those outputs more likely. Indeed, we see one of the single strongest effect in our model between these variables. This highlights that where decisions are taken under circumstances where mutual benefits are realized and trustful relationships are established, we find significantly higher acceptance among stakeholders, leading potentially to increased social legitimacy of these decisions (cf. Birnbaum 2016). However, when inspecting the effect of "decision ownership" (here measured through power delegation) fostering acceptance, we do not find conclusive evidence.

While we found that our model has considerable explanatory power for intermediate outcomes, the environmental standard of governance outputs, and their acceptance, it accounts for much less variance when it comes to implementation of decisions. Acceptance proves here to be a significant predictor, as was expected conceptually. Yet, we do not find evidence for a direct effect of either stakeholder capacity building or convergence of stakeholder perspectives on implementation and collective action, but merely a small, but significant indirect effect of convergence through acceptance. This resonates with findings from earlier studies, both qualitative and quantitative (Beierle and Cayford 2002; Kochskämper et al. 2018), which warn that a link between participation and implementation may not be taken for granted.

The present analysis is not without limitations. First, while we put considerable effort into an exhaustive case search and screening process, the generalizability of findings based on the resulting sample is, of course, contingent on the representativeness of the wider field of literature. A majority of cases in this sample takes place in North America (United States and Canada), with the rest coming from across Europe, Australia, and New Zealand. Generalizations beyond this western-democratic context could only be done with great care. Thematically, the included cases cover a variety of environmental issues, with land use, biodiversity and freshwater management being the most prevalent topics. We, therefore, expect that our findings display a strong external validity as concerns variation in environmental topics. While one might suspect that geographical and sectoral context matters with respect to both prevalence of variable values and to covariance relations between variables, initial tests for this, however, found very few significant effects. Processes of information elicitation and data coding through raters may be a further source for bias, given that case coding can be seen as a numeric interpretation of the case material. In a comprehensive analysis of these biases we did not find significant distorting effects in our data (Jager et al. 2015), but these limitations may nonetheless be important to note. Second, some of the constructs we employed are not without problems. Generally, measuring and quantifying complex social process characteristics is not straightforward, as they often consist of multiple conceptually and empirically interdependent dimensions. We encountered these difficulties especially with the variables for representation and acceptance. For others, such as implementation, the information basis in the underlying case studies was often imperfect, adding to the low explanatory power of our model for this variable.

Ultimately, the results of a meta-analysis such as this one are highly dependent on the richness and quality of the available case study data. We mitigated these challenges by employing three raters for each case, by controlling for biases and reliability, by making conservative choices in cases where data appeared less reliable, and by making our approach transparent. Third, in the analysis presented here, we were particularly interested in the pathways through which participation impacts the environmental standard of outputs and their implementation. However, our approach did not allow us to test for the influence of control variables or contextual conditions, which likely will also be of importance.

Conclusions

With this research, we seek to improve the evidence base on how participation impacts the environmental standard of governance outputs, their acceptance, and their implementation, as well as which intermediate outcomes mediate this relationship.

The empirical results from our case-survey meta-analysis of published case studies suggest that participation overall has a positive effect for the environmental standard of governance outputs, in particular in cases where participants were granted considerable influence over decisions and outputs. Aspects of intensive communication, on the other hand, are seen to be highly influential in the realization of social and collaborative intermediate outcomes. Notably, of the two intermediate social outcomes, only the factor "Convergence of Stakeholder Perspectives" (comprising social aspects of conflict resolution, trust building, mutual gains and the building of shared norms) has a measurable effect on environmental output standard and, much more strongly, on acceptance, and thus indirectly on

implementation. "Stakeholder Capacity Building" (including aspects of societal learning, individual capacity building and network creation), by contrast, while of value in and of itself, was not found to significantly impact on environmental outcomes.

More generally, this analysis demonstrates the insights to be gained by treating a complex and multifaceted phenomenon such as public and stakeholder participation in a nuanced manner, exploring the mechanisms through which its different facets may advance various social and collaborative outcomes and potentially improve the environmental outcomes of public decision-making processes. This opens up avenues for further research in multiple directions. First, data employed in this analysis covers a wide spectrum of environmental and institutional contexts. Future studies might disentangle these contextual conditions in order to gain deeper insight into "what works how and when" in participatory and collaborative governance. Second, this study yielded several unanticipated findings, such as the strong direct effect of power delegation on the environmental standard of the output. Follow-up research may examine this relationship more closely in order to explore the mechanisms that are at work here, and develop further hypotheses regarding these links. Third, this research may be extended by incorporating additional outcome categories. Our model yielded the least strong results when it came to implementation. Future research will need to tackle the challenging task of providing better explanations for on the ground implementation of and compliance with agreed outputs, and the role of participatory and collaborative governance processes therein. One first step to do so may be complementing our analysis through follow-up data gathering such as media analysis or interviews, allowing more informed analysis of implementation.

Supplementary material

Supplementary material is available at the *Journal of Public Administration Research and Theory* online.

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Overview of articles included in this cumulative Ph.D. thesis

(in accordance with the guideline for cumulative dissertations in Sustainability Science [January 2012], in the following termed "the guideline")

Title of Ph.D. thesis: Understanding Learning in Water Governance: The Process and Products of Learning through Participatory Decision Making, Adaptive Management, and Governance Learning.

Papers included:

[1] Newig, Jens; Challies, Edward; Jager, Nicolas W.; Kochskämper, Elisa; Adzersen, Anna. (2018) The Environmental Performance of Participatory and Collaborative Governance: A Framework of Causal Mechanisms. Policy Studies Journal, 46 (2), 269-297. doi.org/10.1111/psj.12209.

[2] Kochskämper, Elisa; Challies, Edward; Newig, Jens; Jager, Nicolas W (2016) Participation for effective environmental governance? Evidence from Water Framework Directive implementation in Germany, Spain and the United Kingdom. Journal of Environmental Management, 181, 737-748. doi: 10.1016/j.jenvman.2016.08.007.

[3] Kochskämper, Elisa; Jager, Nicolas W., Newig, Jens; Challies, Edward (2018) Impact of participation on sustainable water management planning: Comparative analysis of eight cases. In E. Kochskämper, E. Challies, N. W. Jager, & J. Newig (Eds.), Participation for Effective Environmental Governance: Evidence from European Water Framework Directive Implementation. Oxon [u.a.]: Routledge. 117-148. ISBN:978-1-138-71329-1 (hbk), ISBN: 978-1-315-19364-9 (ebk).

[4] Newig, Jens; Jager, Nicolas W., Kochskämper, Elisa; Challies, Edward (2019) Learning in participatory environmental governance – its antecedents and effects. Findings from a case survey meta-analysis. Journal of Environmental Policy & Planning, *21*(3), 213-227. doi.org/10.1080/1523908X.2019.1623663.

[5] Kochskämper, Elisa; Koontz, Thomas M.; Newig, Jens (2021) Systematic Learning in Water Governance: Insights from Five Local Adaptive Management Projects for Water Quality Innovation. Ecology & Society 26 (1): 22. doi.org/10.5751/ES-12080-260122.

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Authors' contributions to the articles and articles publication status (according to §16 of the guideline):

Article #	Short title	Specific contributions of all authors	Author status	Weighting factor	Publication status	Conference contributions
1	The Environmental Performance of Participatory and Collaborative Governance: A Framework of Causal Mechanisms	JN: Development of conceptual and methodological approach; JN, EC, NJ, EK, AA: Participation in literature review and analysis, participation in the development of the manuscript	Co-author with important contribution	0.5	Published in *Policy Studies Journal* (IF=3.917)	3-Länder-Tagung Politikwissenschaft 2013†, ICPP 2015†
2	Participation for effective environmental governance? Evidence from Water Framework Directive implementation in Germany, Spain and the United Kingdom	EK, JN, EC, NJ: development of conceptual and methodological approach; EK, EC: conduction of interviews; EC: literature review; EK, EC, NJ, JN: data analysis; EK, EC, NJ, JN: development of the manuscript	Co-author with equal contribution	1.0	Published in *Journal of Environmental Management* (IF=4.865)	ECPR General Conference 2014, Wesley Conference 2015, ICPP 2015
3	Impact of participation on sustainable water management planning: Comparative analysis of eight cases	EK, JN, EC, NJ: development of conceptual and methodological approach; EK, EC: conduction of interviews; EK, EC, NJ, JN: data analysis; EK, EC, NJ, JN: development of the manuscript	Co-author with predominant contribution	1.0	Published by *Routledge*	
4	Learning in participatory environmental	JN, NJ, EK, EC: development of conceptual and methodological approach;	Co-author with important	0.5	Published in *Journal of Environmental*	ECPR General Conference 2018†

	governance – its antecedents and effects. Findings from a case survey meta-analysis	NJ, JN: data analysis; JN, NJ, EK, EC: development of the manuscript	contribution		*Policy & Planning* (IF=4.195)	
5	Systematic Learning in Water Governance: Insights from Five Local Adaptive Management Projects for Water Quality Innovation	EK, TM, JN: development of conceptual and methodological approach; EK: conduction of interviews; EK, TM, JN: data analysis; EK, TM, JN: development of the manuscript	Co-author with predominant contribution	1.0	Submitted to *Ecology and Society* (IF=3.310)	Conference Rethinking the governance of European water protection 2019, Conference on Earth System Governance 2018
6	Exploring Governance Learning: How Policymakers Draw on Evidence, Experience and Intuition in Designing Participatory Flood Risk Planning	JN, EK, EC, NJ: development of conceptual and methodological approach; JN: conduction of interviews; EK, EC, JN, NJ: data analysis, drafting of the manuscript	Co-author with important contribution	0.5	Published in *Environmental Science & Policy* (IF=4.816)	ICPP 2015†
7	Pathways to implementation: Evidence on how participation in environmental governance impacts on environmental outcomes	NJ, JN, EC, EK: development of conceptual and methodological approach; NJ, JN: data analysis; NJ, JN, EC, EK: development of the manuscript	Co-author with important contribution	0.5	Conditionally accepted for publication in *Journal of Public Administration Research and Theory* (IF=3.407)	

Explanations

Specific contributions of all authors
EC = Edward Challies, NJ = Nicolas W. Jager, EK = Elisa Kochskämper, JN = Jens Newig, TM = Tomas M. Koontz

Author status
according to §12b of the guideline:
Single author [Allein-Autorenschaft] = Own contribution amounts to 100%.
Co-author with predominant contribution [Überwiegender Anteil] = Own contribution is greater than the individual share of all other co-authors and is at least 35%.
Co-author with equal contribution [Gleicher Anteil] = (1) own contribution is as high as the share of other co-authors, (2) no other co-author has a contribution higher than the own contribution, and (3) the own contribution is at least 25%.
Co-author with important contribution [Wichtiger Anteil] = own contribution is at least 25%, but is insufficient to qualify as single authorship, predominant or equal contribution.
Co-author with small contribution [Geringer Anteil] = own contribution is less than 20%.

Weighting factor
according to §14 of the guideline:

Single author [Allein-Autorenschaft]	1.0
Co-author with predominant contribution [Überwiegender Anteil]	1.0
Co-author with equal contribution [Gleicher Anteil]	1.0
Co-author with important contribution [Wichtiger Anteil]	0.5
Co-author with small contribution [Geringer Anteil]	0

Publication status

IF = ISI Web of Science - Impact Factor 2018

Conference contributions (acronym, society, date, venue, website)

3-Länder Tagung Politikwissenschaft 2013: Austrian Society for Political Science, Innsbruck, Austria, September 19 – 21, 2013, http://www.oegpw.at/de/innsbruck-2013/startseite/

Conference on Earth System Governance 2018, Earth System Governance Project and Utrecht University, Utrecht, Netherlands, November 5 – 8, 2018, http://www.earthsystemgovernance.net/utrecht2018/

Conference Rethinking the governance of European water protection, Helmholtz Center for Environmental Research, Leipzig, Germany, January, 8 – 9, 2019, https://www.ufz.de/index.php?en=45173

ICPP 2015: International Conference on Public Policy, Milan, Italy, July 1 – 4, 2015, http://www.icpublicpolicy.org/-Milan-2015-

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Wesley Conference on Environmental Politics and Governance, Bainbridge Island, USA, May 14 – 16, 2015, http://depts.washington.edu/envirpol/?page_id=280

* Paper accepted for presentation but not actually presented
† Paper presented by co-author

Declaration (according to §16 of the guideline)

I avouch that all information given in this appendix is true in each instance and overall.

Publication list

Edited volumes/ Special issues

Kochskämper, E., Challies, E., Newig, J., Jager, N. W. (2018): Participation for Effective Environmental Governance? Evidence from Implementing the European Water Framework Directive. *London and New York: Routledge*

Challies, E., Newig, J., **Kochskämper, E.,** Thaler, Th., Levin-Keitel, M. (eds.) (2016): Contributions of Participatory and Collaborative Governance to Sustainable Flood Risk Management. *Environmental Science and Policy*, Special Issue.

COLMEX-CONAGUA-IMTA-ANEAS. (2012): *Hacia un posicionamiento de gobernanza del Agua en México*, El Colegio de México, Comisión Nacional del Agua, Instituto Mexicano de Tecnología del Agua, Asociación Nacional de Empresas de Saneamiento: México, D.F.

Monograph chapters

Kochskämper, E. and Newig, N. (2021). Water Governance and Policy in Transition: The EU Water Framework Directive; In Baird, J. and Plummer, R. (Eds.): Water Resilience: Management and Governance in Times of Change. Cham: Springer, pp. 23-40.

Newig, J., **Kochskämper, E.,** Challies, E., & Jager, N. W. (2018). Researching participation in environmental governance through the implementation of the European Water Framework Directive. In E. Kochskämper, E. Challies, N. W. Jager, & J. Newig (Eds.), Participation for Effective Environmental Governance: Evidence from European Water Framework Directive Implementation. Oxon [u.a.]: Routledge, pp. 3-10.

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Peer-reviewed journal contributions

Kochskämper, E., Koontz T., Newig, J. (2021). Systematic Learning in Water Governance? Insights from Five Local Adaptive Management Projects for Water Quality Innovation. *Ecology & Society,* 26 (1): 22.

Gollata, J. A.M., **Kochskämper, E.,** Newig, J., Jager, N.W. (2021). Participation in multi-level policy implementation: Assessing the impact of different governance cultures; *Journal of Environmental Planning and Management,* https://doi.org/10.1080/09640568.2021.1876002

Witting, A., Brandenstein, F., & Kochskämper, E. (2021). Evaluating Learning Spaces in Flood Risk Management in Germany: Lessons for Governance Research. *Journal of Flood Risk Management*, *14*(2), [e12682].

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