> Institutional Requirements for Integrated Water Resource Management in Germany

Insa Theesfeld and Christian Schleyer

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Autoren:
Dr. Insa Theesfeld
Leibniz-Institut für Agrarentwicklung in Mittel- und Osteuropa (IAMO)
Theodor-Lieser-Straße 2
06120 Halle (Saale)
E-Mail: theesfeld@iamo.de

Christian Schleyer
Nachwuchsgruppe „Ökosystemleistungen"
Berlin-Brandenburgische Akademie der Wissenschaften
Jägerstraße 22/23
10117 Berlin
E-Mail: schleyer@bbaw.de

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Geschäftsstelle
Residenz München
Hofgartenstraße 2
80539 München

T +49(0)89/5203090
F +49(0)89/5203099

acatech Hauptstadtbüro
Unter den Linden 14
10117 Berlin

T +49(0)30/206309610
F +49(0)30/206309611

E-Mail: info@acatech.de
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> INHALT

EINFÜHRUNG

Seit den späten 1990er Jahren ist das Integrierte Wasserressourcenmanagement (IWRM) das Hauptkonzept für einen nachhaltigen und umweltverträglichen Umgang mit Wasserressourcen. Auch die Umsetzung der Europäischen Wasserrahmenrichtlinie (WRRL) in Deutschland folgt einigen der Grundideen dieses Konzeptes. Durch die Implementierung der WRRL sehen sich die Verwaltungsbehörden des Wassersektors jedoch mit einer Vielzahl an Innovationen konfrontiert, die ein Umdenken und gegebenenfalls neue Strukturen erfordern. So wurde die Begrenzung der Wasserverschmutzung mit der Festlegung von Umweltqualitätsnormen kombiniert, die Einbeziehung der Öffentlichkeit nicht nur gewünscht sondern gefordert, und eine detaillierte und übergreifende Umweltüberwachung und Berichterstattung eingerichtet. All diese neuen Anforderungen haben erhebliche Auswirkungen auf die verschiedenen institutionellen Aspekte des Wassermanagements (Moss 2004). Schon auf Grund der intrinsischen Eigenschaften der Ressource Wasser (siehe Abschnitt 4) ist die institutionelle Dimension – egal ob bei Grund- oder Oberflächenwassermanagement – entscheidend für deren nachhaltige Bewirtschaftung (Fischhendler 2008; Moss et al. 2009; Theesfeld 2010). Dies trifft insbesondere dann zu, wenn sich der Bezug von einer Grundwasserleiter- oder Oberflächengewässer-Perspektive innerhalb eines einzelnen Verwaltungsgebiets zur Betrachtung ganzer Flusseinzugsgebiete wandelt, die oft grenzüberschreitende, d.h. Verwaltungsgrenzen übergreifende oder gar internationale Kooperationen erfordert (Utton 1982).

Dieser Bericht entstand im Rahmen des Projektes „Georessource Wasser - Herausforderung Globaler Wandel" der Deutschen Akademie der Technikwissenschaften (acatech). Die Arbeitsgruppe „Wassernutzung und Effizienz in Landschaften" hat es sich zum Ziel gesetzt, die Entwicklung von Anpassungsstrategien für ein nachhaltiges Ressourcenmanagement in einer sich global verändernden Welt zu unterstützen. Der vorliegende Bericht dient als Grundlage für eine integrierte Sicht auf eine zunehmende und gleichzeitig konkurrierende Nutzung der Ressource Wasser in Deutschland. Er soll dazu beitragen, neue Management-Konzepte für den landwirtschaftlichen Bereich unter ökologischen, ökonomischen und sozialen Nachhaltigkeitsüberlegungen zu entwickeln. Dies erfolgt in diesem Bericht zunächst mittels einer theoretisch fundierten Darstellung, die die sozio-ökonomischen und ökologischen Eigenschaften von Wasserressourcen mit den damit verbundenen Verfügungs- und Nutzungsrechten sowie Governance-Strukturen zusammenführt. Es wird untersucht, wie man durch eine gemeinsame Betrachtung der ökologischen und sozio-politischen Gegebenheiten zu angemesseneren Formen der Governance und zu einem neuen institutionellen Verständnis für die politische Umsetzung kommen kann. Ausgewählte Beispiele aus deutschen Flusseinzugsgebieten untermauern die Diskussion empirisch.

1. INTRODUCTION

Since the late 1990s, Integrated Water Resource Management (IWRM) has been the main concept for managing water resources. Likewise, the implementation of the European Water Framework Directive (WFD) in Germany follows some of the basic ideas behind this concept. As a result of the implementation of the WFD, water administrations are confronted with a variety of innovations, such as the combination of pollution prevention with economic analyses of water use, the provision of active involvement rights to the public, and a detailed and comprehensive system of monitoring and reporting that needs to be established. All these have a substantial impact on various institutional aspects of water management (Moss 2004: 97). Thus, scholars agree that already due to the resource system characteristics – no matter if groundwater management, surface water management, or conjunctive use is concerned –, the institutional dimension is crucial in handling the resource in a sustainable way[1] (Fischhendler 2008; Moss et al. 2009; Theesfeld 2010). This is particularly true when the perspective switches from an aquifer or surface water system within a single administrative boundary to whole river basins which are usually transboundary water systems (Utton 1982). Therefore, the IWRM concept, and particularly the implementation of the WFD in Germany, is considered here from an institutional economics point of view. The report concentrates on the agricultural water sector.

This report is written in the frame of the project 'Georessource Wasser – Herausforderung Globaler Wandel' of the German Academy of Science and Engineering (acatech). The Working Group 'Water Use and Efficiency in the Landscape' defines as one of its core tasks to support the development of adaptation strategies for the sustainable governance of resources in a globally changing world. This report serves as a basis for an integrated view on an increasing and likewise competing use of the resource water in Germany. It serves to develop new management concepts in the agricultural water sector under ecological, economic, and social sustainability considerations. We will do this by a theoretical debate, bringing together the socio-economic and ecologic characteristics of water resource systems with the related property rights and governance structures in place. This report explores a way to come to more adequate forms of governance and new institutional insights in policy implementation by a joint consideration of ecological and socio-political characteristics[2]. Selected cases of river basin management in Germany that have been established in the course of the implementation of the WFD will empirically substantiate the discussion.

In the following, we first conceptualise the relationship between the WFD and IWRM. Section 3 sketches out the natural system and the social system in which the WFD implementation in Germany takes place. Based on a thorough review of theoretical and empirical literature, important attributes of water-related natural and social systems are discussed using groundwater, surface waters, and agricultural reclamation systems as examples. General procedures for implementing the WFD in Germany help to depict the actual socio-political arrangements in place. In Section 3.4, the empirical part of the report, we highlight selected examples of WFD implementation in Germany. This allows us to show actual promising or critical practices. Based on this socio-ecological system approach, Section 4 provides general institutional requirements for sustainable water management in the agricultural sector. Finally, recommendations for adapted governance structures and property rights in the agricultural water sector are given.

[1] Institutions are defined as the formal and informal rules of a society or of organizations that facilitate coordination among people by helping them form expectations. They also function as constraints that shape human interaction and the enforcement characteristics of these constraints (North 1990). Institutions are made up of formal constraints (e.g., rules, laws, and constitutions), informal constraints (e.g., norms of behaviour, conventions, and self-imposed codes of conduct), and their enforcement characteristics. Here, organisational solutions (governance structures), such as markets, hierarchies, and hybrid forms, are necessary for making institutions effective. They guarantee the rights and duties and their use in coordinating transactions (e.g., Ostrom 1990).

[2] Shah (2008) is doing a comprehensive application of such a joint view in South Asia.

2. INTEGRATED WATER RESOURCE MANAGEMENT AND THE EU WATER FRAMEWORK DIRECTIVE

Since the end of the 1990s, Integrated Water Resource Management (IWRM) has been a well-known and widely-used concept in water management. It is the leading idea for progressive, future-oriented and environmental sound management of water resources. The first question we would like to address here is how the concept of IWRM and the European Water Framework Directive (WFD) are related. As broad as the application of IWRM nowadays is, the manifold are its definitions. The *first* point which is crucial when analysing its implementation is the notion of 'integrated' and 'management/coordination'. Either different (natural) resources can be coordinated with a joint management, or water management by different parallel sectors is coordinated. The awareness of such diverging concepts is necessary if we consider their application for instance as regards the implementation of river basin organisations. It is often the case that such basin organisations are established and take over responsibilities of already existing administrative bodies at different scales and/or in different sectors (in the sense of 'integration'). Without simultaneously changing the responsibilities of the individual administrative bodies at the respective scales and in the concerned sectors (in the sense of 'coordination'), a water management system with parallel uncoordinated authorities will be the result. Butterworth et al. (2010) criticise in that respect the vagueness of the IWRM concept, as there has been rather little agreement on fundamental issues like what aspects should be integrated, how, by whom, or even if such integration in a wider sense is possible.

The *second* point regarding the implementation of IWRM is the question what exactly should be integrated (Butterworth et al. 2010). In this report, we follow Huppert (2005), who describes three different groups of definitions of IWRM with different degrees of inter-sectoral integration as well as integration of administrative levels. The *first group* of definitions is focusing on the joint management of surface and groundwater (intra-sectoral) only, yet across all administrative levels.

In Figure 1 this is represented in the 'Type A'-column. The definition of Jaspers (2003) is prominent for that case:

"IWRM is the management of surface and subsurface water in a qualitative, quantitative and environmental sense from a multi-disciplinary and participatory perspective. There is a focus on the needs and requirements of society at large with regard to water at the present and in the future, thus aiming at maximum sustainability in all senses" (Jaspers 2003: 79).

This definition mentions only implicitly functional aspects of management ("in a quantitative, qualitative and environmental sense"); likewise, coordination with the environmental sector is only implicit ("in an environmental sense"). In addition, the involvement of stakeholder groups ("participatory") and the link to political decision-makers ("needs and requirements of society at large") is also only implied. The question whether IWRM shall be achieved by the actual integration of the management activities of different sectors or simply by coordination between such sectoral units is not answered.

According to Huppert (2005), the *second* group of definitions includes some more substantiated forms of inter-sectoral integration. The aim here is to look at the impact of a certain resource use on the water resources and vice versa. The IWRM definition coined by the International Water Management Institute (IWMI) is characteristic in this context:

"A key focus of the IWMI research theme 'Integrated Water Management for Agriculture' is to look at irrigation management from the perspective of the competing uses of water in river basins, including agriculture, nature, local communities, cities, industry etc." (IWMI 2001).

The *third group* of definitions does not limit integration to one or two resource uses, but advocates the integration of multiple resources, such as water, soil, forest, and aquatic ecosystems. The IWRM definition of the Global Water Partnership (GWP)[3], likewise the most cited one, is representative for this group of definitions:

"Integrated Water Resource Management is a process which promotes the co-ordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems" (GWP 2000).

[3] The Global Water Partnership is an intergovernmental organisation of 13 Regional Water Partnerships, 73 Country Water Partnerships, and more than 2,000 partner organisations in 150 countries (GWP 2000).

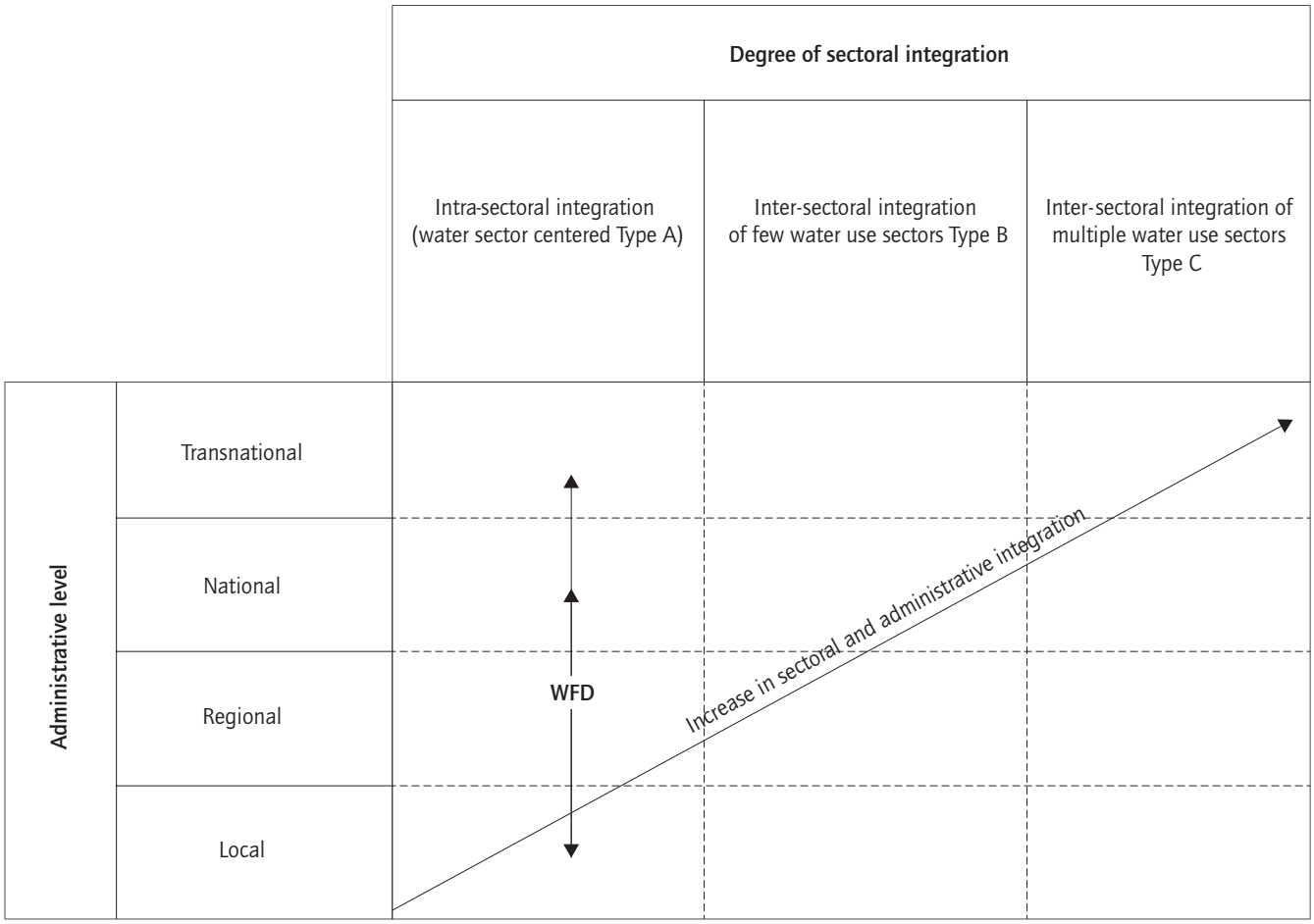
Turning now to the question how the European WFD and the IWRM concept are related, we can manifest that the WFD is a rather broad policy framework. In contrast to many developing and transitional countries – where IWRM is interpreted and implemented as a relatively standard reform package – the WFD in Europe experiments with a diversity of ways to implement IWRM (Butterworth et al. 2010).

Following the above classifications of IWRM concepts, IWRM is like an umbrella structure providing several different categories of integration, whereas the WFD – which focuses on surface water and groundwater using a common management approach (EC 2000) – covers only the 'Type A'-conditions in Figure 1 (Huppert 2005). However, there should be no doubt that water managers pursuing a more integrated approach to water protection will need to cooperate to a far greater extent than in the past with organisations outside the sphere of water management, i.e. their activities will have to move more towards the 'Type B'-column. Yet, such integrative, cross-sectoral governance is not prescribed explicitly by the WFD, although strongly implicit in its requirements (Moss 2004).

The WFD follows the key objectives of:

- Expanding the scope of water protection to all waters, surface waters and groundwater;
- Achieving "good status" for all waters by a set deadline:
- Water management based on river basins;
- Combined approach of emission limit values and quality standards;
- Getting the prices right;
- Getting the citizens involved more closely;
- Streamlining legislation (EC 2000).

Figure 1: Relationship of the WFD with the different stages of IWRM integration. Source: adapted from Huppert (2005: 25).



This listing shows that the focus clearly is on water resources. The management functions are to be focused on the "protection of all waters" and on the limitation of rights of actors to pollute. This means that the coordination with other resource use sectors is only implicitly suggested, but not demanded in terms of management integration of such sectors. The main administrative level is the river basin area. Participation of stakeholders and other citizens at the local level is stressed ("getting the citizens involved more closely") and there is also a link to the political legislative level ("streamlining legislation"). The political dimension of IWRM, however, is not mentioned in the WFD. Instead, technical and economic instruments are stressed as being most promising ("getting the prices right"). Thus, in line with Huppert (2005) we place the WFD in the intra-sectoral/regional box, yet with an outreach to the local, national, and – depending on the river basin – also transnational administrative level. Although other non-water sector related water use aspects are taken into account via the inter-agency consultation processes (for example via steering groups), the decision-making power continues to rest within the water sector administration.

In the following Section, we focus on the implementation requirements of the WFD from an institutional point of view. We thus keep in mind that the WFD is equivalent with the realisation of the IWRM concept according to a narrow understanding of the IWRM concept.

3. SOCIO-ECOLOGICAL SYSTEM APPROACH FOR GERMANY'S WATER SECTOR

The goal of this review is to explore the institutional aspects of policy implementation and governance structures towards sustainable qualitative and quantitative agricultural water use by first taking into account the attributes of the water resources and the related resource systems (Section 3.1). The fact that the resource attributes of groundwater are substantially different from those of surface water already hints at specific requirements in governance system design. Likewise, we present specific characteristics of reclamation systems to emphasise the interdependency between the natural resources water and land and to highlight particularities that are related to the management of technical water infrastructures and which need to be taken care of in a successful governance system.

As such, this report is inspired by the idea of the nested multitier framework by Ostrom (2007), which considers both the attributes of the natural and physical system, i.e. the characteristics of the resource system itself and the resource units generated by that system, and the characteristics of the related social system, i.e. the users and the features of the governance systems. Both affect human interactions within the socio-ecological system and, thus, the outcomes. Given the increasingly complex challenges of making water management more sustainable a critical and detailed understanding of the social organisations of water is essential (Moss et al. 2009). Therefore, we highlight in Section ⁋ 3.3 the socio-political characteristics of the water sector. We do so by explaining core elements of the WFD implementation in Germany and the particular institutional changes taking place in the river basins Warnow-Peene and Ems.[4]

3.1. GROUNDWATER AND SURFACE WATER ATTRIBUTES

Groundwater can be classified as a common-pool resource with both subtractability and low excludability. According to Ostrom (1990: 31f.), subtractability involves the possibility of approaching the upper limit of resource units which can be produced or even overexploitation of the resource. In the context of groundwater, this means that the water level drops with every unit extracted. Theis (1940) comes to the conclusion that in fact all water discharged by wells is balanced by a loss of water somewhere else and that in this respect some groundwater is always mined. Regarding it more local, water pumped and spread on one farmer's field cannot be spread on another farmers' field. In addition, water use may involve the degradation of the quality of the water returned to the aquifer (Brentwood and Robar 2004: xii). Low excludability indicates that it is difficult to hold off water users, in particular landowners, pumping water from aquifers. Aquifers are a source of relatively inexpensive, reliable irrigation that can be implemented by individuals once technology and energy is accessible (Schlager 2007). Both resource characteristics may lead to the so-called 'tragedy of the commons', i.e. the environmental degradation or overexploitation of a resource that occurs whenever a large number of individuals share a subtractable resource. However, it can be shown that it is actually the 'tragedy of open access' that would cause these problems (Feeny et al. 1990; Grafton 2000). In regions where groundwater becomes depleted – no matter if this is due to agricultural or urban usage –, either minimally-enforced rules related to withdrawing resource units lead to a de-facto open access regime, or unrestricted open access has been the general rule (Giordano and Villholth 2007: 2).

Besides subtractability and low excludability, other attributes of groundwater resource systems call for specific governance options. In comparison to surface waters on which an immense body of literature exists, particularly on rivers, the characteristics of aquifer systems are rarely discussed. Yet, Schlager (2007: 135), Puri and El Naser (2003: 417), Jarvis (2006: 409), and also Moench (2004) to some extent, contrast the attributes of both systems; they are displayed in the following:

- *Irreversibility:* Groundwater pumping may lead to aquifers suffering irreversible damage in storage capacities and in hydraulically connected surface-ground water systems. Likewise, once an aquifer is seriously contaminated, it may be difficult, costly, or even technically impossible to reverse this contamination. Therefore, management has to include precautionary measures.
- *Time lag:* In rivers, direct human intervention may immediately emerge downstream. In contrast, in aquifers the effect of pollution or water extraction may become evident – if at all – only after a considerable time lag due to the larger spatial distance between point of intervention and

[4] Fischhendler (2008), for example, shows for the case of water management in Israel that incompatibilities between particular features of the social and ecological system dimensions – here, the fragmentation of the physical and institutional structures – results in inadequate governance and overexploitation.

noticeable effect. Impacts from neighbouring countries in a transboundary aquifer can take decades before being recognized by the Aquifer States (Puri and Aureli 2005). The aquifer replenishment period is long, if at all in non-renewable groundwater situations, and the provenance of groundwater generation is often unclear; difficulties with attributing external effects to particular pumpers or polluters are thus typical. Management and monitoring regimes for aquifers must account for this slow hydraulic response.

- *Indivisibility:* Hydrological systems are interconnected and no parts can be fenced off and protected from contamination since groundwater dissipates beneath the surface irrespective of boundaries.
- *Fuzzy boundaries:* Defining the exact hydro-geological boundaries of groundwater resources is extremely challenging, even more as with surface water. There are uncertainties with recharge areas, flow and discharge characteristics, and the interrelationships with surface water bodies (Moench 2004). Further, it is complicated to specify the stakeholders involved in the system and to set the social boundaries of the aquifer system, as discussed by Blomquist and Schlager (2005) for watersheds. The acceptance of boundaries may also fade, for instance due to upcoming desires of the society to protect water quality, or natural areas that are related to groundwater (Jarvis 2006).
- *Hydro-geological uncertainty:* Heterogeneity in use situations and uncertainty in the hydro-geology of aquifers makes management and rigid legislative classifications very difficult (Puri 2003; Moench 2004; Puri and Aureli 2005). Knowledge of the interrelationships between human actions and the extent and timescale of groundwater degradation are lacking. The transmission paths by which contaminants enter aquifers are also unknown and the potential health effects, such as arsenic poisoning, are uncertain (Moench 2004: 87).
- *Knowledge needs:* Reliable data are imperative for making knowledge-based and appropriate decisions (van der Gun 2007). In most countries, the data available on both groundwater quantity and quality are poor and not homogeneous compared to the data available for surface water (Biswas 1999: 8).
- *Structure of water withdrawal:* For areas heavily depending on groundwater irrigation, the information on the average extraction per groundwater device and the number of devices provides important details for designing an appropriate governance system. In contrast to Mexico and the United States, where groundwater extraction occurs through wells with high extraction capacity owned and controlled by a small fraction of the population, in India, Pakistan, China or Iran there are numerous small-scale groundwater extractions (Moench 2004: 88; Shah 2008). The structure of water withdrawal has significant implications for decisions about management, such as in terms of monitoring and controlling (Moench 2004: 88).
- *Information asymmetry:* Information is always limited and asymmetrically held by the parties of an exchange (North 1991), here the users and providers of the water resource system and the water units. This must be considered in policy design since the transaction costs for monitoring pollution and abstractions may be prohibitively high. Moreover, knowledge is often used and misused by different stakeholder groups as a tactical resource in the bargaining process (Conca 2006: 378), but also in negotiation processes.

3.2. RECLAMATION SYSTEMS ATTRIBUTES

In this report, reclamation systems are introduced as examples that not only highlight important features of technical water infrastructures, but also the close interdependency between water and other natural resources, in particular land.

In many German regions with naturally high water tables, various forms of drainage or reclamation infrastructure have been applied to provide water tables that allow for (efficient) agricultural land use. These reclamation infrastructures are hydromelioration systems that usually consist of networks of canals, ditches, and subsurface tiles that collect, transport, and dispose of gravitational water from soil. This agricultural land drainage eliminates or mitigates the adverse effects of excess soil moisture on crops and cropping operations. Thus, crop yields are usually higher, and costs and risks of farm management are reduced, on drained soils (Spaling and Smit 1995). In many reclaimed areas, agricultural land use has not been possible before the construction of the drainage works.

Reclamation infrastructures can be conceived of as typical examples of rural infrastructures that provide various forms of public goods (Ostrom et al. 1993). As well as flood protection, they also provide more spatially restricted (i.e. local) public goods:

'appropriate' levels of soil moisture and water tables conducive for agricultural land use. Actors farming outside the reclaimed area are technically excluded from this local public good. Access to the benefits of the reclamation system is only possible if an actor has – at least – use rights on land within the reclaimed area. In turn, it is much more difficult, and often technically not feasible, to exclude actors farming land within the reclaimed area.

Unlike the latter example and most common-pool resource systems, however, consumption by one actor of the flow of services provided by the reclamation system usually does not subtract from the flow of services available to others. The amount of discharge water is largely determined by the size of the ditch or canal and its degree of cleanliness. Still, even if the element of scarcity is 'missing', since exclusion is difficult actors may have incentives to free-ride which can lead to under-investment in the provision and maintenance of reclamation infrastructures (Scheumann and Freisem 2001). Due to the technical interdependence of the reclamation infrastructure, insufficiently cleaned segments of the network of ditches can severely hamper water runoff for larger parts of the reclaimed area. This can result in local spots of land with excessive soil moisture that are not restricted to the land in the immediate vicinity of the poorly cleaned ditch.

Such reclamation systems of tertiary (very small), secondary (small), and primary (large) arterial drains are often equipped with weirs and pumping stations that enable irrigation by flood and even by infiltration. With these facilities, the water table can be regulated, excessive water runoff can be avoided, and the risk of droughts in summer can be reduced. Once the irrigation water is in the network of canals exclusion of particular land users from the benefits of this surplus water is technically hardly possible or would result in very high costs. At the same time, there is subtractability of the resource unit water. This leads back to the characteristics of irrigation systems described in Section ⁋ 3.1. At the same time, as with groundwater, irrigation systems, and other common-pool-resources, there is subtractability in resource use since the same unit of water cannot be used twice (see, for example, Kessides 1993: 56).

In the following, specific attributes of reclamation systems are discussed in more detail:

Similar to other technical infrastructures, such as roads and power networks, some form of collective or state organised provision of the reclamation infrastructure and the services provided by it seems to be necessary due to the attributes of *subtractability* and *low excludability* (Ostrom et al. 1993: 106; Schlager 2007). Here, private enterprise is further limited since reclamation systems can be seen as *natural monopolies*. There are very high fixed costs for planning and building the technical infrastructure, but comparatively low costs for providing an additional unit of drainage or irrigation service, i.e. to discharge or to supply a certain amount of water. Thus, providing more units will reduce the average unit costs of provision (increasing economies of scale). Each private actor who wants to provide reclamation services would have to make high investments for building her own network of ditches and weirs. These high investment costs would in turn increase the average costs for discharging or supplying a resource unit of water; effectively, these costs would have to be paid by the consumers of the reclamation services, i.e. the land users.

Further, reclamation infrastructures are also characterised by *high asset specificity*, in particular site and capital specificity, that would result in high sunk costs for a private actor leaving the market since reuse of single elements of the reclamation infrastructure is hardly possible. Reclamation systems are also very knowledge specific since for an effective regulation of the water table in a reclaimed area profound knowledge of the local hydrological system is needed as well as some familiarity with the operation and maintenance of the technical system. Thus, private investments in providing reclamation infrastructures are rather risky (Kessides 1993: 5ff.; Laslett 1997: 292f.). However, private actors may be contracted for carrying out specific tasks within the provision process, such as operating or maintaining the reclamation system. In turn, state agencies may be the best governance option for planning complex reclamation systems and for taking care that certain technical standards are adhered to (Ostrom et al. 1993: 97-105; Lippert 1999: 421).

Decisions made in reclamation systems may result in a great number of wanted, but also unwanted economic transactions that often cannot be easily separated from another and are, thus, produced jointly. Targeted management of these transactions may be difficult or even – technically – impossible (McGlade and Garnsey 2006: 3). On the one hand, for example, lowering the water table on reclaimed arable land may improve soil conditions for the plants and result in higher yields. On the other hand, the drained soil may now be more prone for wind erosion. Such *jointness of production* is also important when operating the different elements of the reclamation infrastructure in order to achieve a particular aim, such as a concrete water level. Here, a coordinated operation of the weirs in the system

is crucial. Given the *physical indivisibility* in both cases, some form of collective coordination of actors' decisions may be more effective than market solutions (Adger and Luttrell 2000: 87).

The *frequency of respective transactions* for planning, building, operating, and maintaining reclamation systems may differ considerably. While planning and building of the reclamation infrastructure can be seen as a one-time transaction, there are many transactions that are repeated annually (such as flushing subsurface tiles) or even more often (such as operating weirs and monitoring water tables) when it comes to operating and maintaining the system. Here, costs can be distributed over many transactions and it may be worthwhile to invest in particular machinery or governance structures, such as a management plan for operating the weirs or in the establishment of a drainage board or of respective state and municipal authorities.

Processes within reclamation systems are often characterised by *uncertainty* and thus limited predictability of occurrences and effects. Stochastic events like rain fall or floods, for example, can have a substantial impact on the water table in a reclaimed area. Here, not sufficiently large or badly maintained canals may not be able to reduce the soil moisture as fast and effectively as demanded by the farmers. Further, causal relationships in reclamation systems are usually *highly complex*, often non-linear, and, thus, often unclear (McGlade and Garnsey 2006). Establishing sufficient scientific knowledge of these causal relations and implementing technical means for gathering the necessary data may be very time consuming, costly, and site specific. What is more, there may be no consensus, i.e. an interpretative dissent, among scientists or policy makers about how to interpret the available data (Blomquist 2009: 112ff.).

There may also be a *substantial time lag* between a particular activity, or the omission of such an activity, and its results, alike in groundwater systems. For example, neglect of cleaning and maintenance activities in reclamation systems does not necessarily cause flooding problems in the short run. Ditches and subsurface tiles only gradually lose their ability to transport excess water. Thus, the decreasing ability of the ditches to reduce soil moisture may be perceived as a problem only after a substantial time lag (Schleyer 2009; Theesfeld 2008: 310; Thiel 2006: 30).

Management decisions in reclamation systems may have *irreversible effects*, the same as in groundwater systems. For example, some forms of mechanical cleaning of ditches and canals immediately destroy the aquatic ecosystems in the water body. Permanently or frequently low water tables in a reclaimed area may result in the irreversible degradation of the peat soils and their ability to store water (Vogel 2002).

3.3. IMPLEMENTATION OF THE WFD IN GERMANY

To give recommendations for a more successful implementation of the WFD in Germany, we not only need to consider the ecological characteristics, but also the socio-political characteristics, particularly the prevailing administrative characteristics.

We focus here on the socio-political attributes of the resource system, which have been modified by the way the WFD is implemented in Germany. This perspective includes relevant actor constellations and their responsibilities, changing duties, and the newly introduced governance structures. This is done, first, by presenting the guiding principles of and general information on the status of the WFD implementation in Germany, and, second, by focussing on two river basin case studies.

On 23 October 2000, the Directive 2000/60/EC establishing a framework for community action in the field of water policy, or, in short, the EU Water Framework Directive (WFD) was finally adopted (EC 2000).

The WFD combines two policy styles: 1) a command-and-control approach, including the specifications on the content and procedures for the river basin management plans, and the strict monitoring and reporting obligations to the European Commission, and 2) an interactive negotiation approach. The latter includes: a) involvement of the public, b) flexibility regarding the timescale for implementation and the concrete environmental objectives for so called "heavily modified water bodies", and c) cost-efficiency in pursuing environmental objectives.

In Germany, with respect to water management, the federal government only enacts framework laws – most importantly the Federal Water Act *(Wasserhaushaltsgesetz, WHG)* – while the federal states (Länder) are free to determine the actual structure and substance of water management as long as it is in line with the provisions of the WHG (the institutional arrangements in the water sector of Berlin and the federal state of Brandenburg are for instance explained in Moss and Hüesker (2010)). With the exception of national waterways, the federal states are primarily responsible for water management and for the execution of water regulations. Thus, when implementing the WFD, not only the national Federal Water Act had to be modified, but also the respective Water Acts and ordinances of all federal states. Since the federal states are responsible for the legal and

organisational implementation of the WFD, there are significant differences in the regional approaches taken by the individual federal states (see Section 3.4.). Yet, the *Bund-Länderarbeitsgemeinschaft Wasser (LAWA)* has developed national guidelines on the WFD to support and – to some extent – harmonise the activities of the individual federal states (Kampa et al. 2003).

The key instrument of the WFD is river basin management, as the unit of water management planning across Europe. The idea is to manage water resources according to the territorial unit of an ecosystem, here the hydrological unit, rather than political-administrative boundaries. This requires water management plans, programmes of measures, and environmental quality objectives to be pursued on the river basin scale. Therefore, the implementation of the WFD centres on the river basin management plans along with competent administrative bodies charged with devising and implementing them (Moss et al. 2009). Following the idea of IWRM the orientation of water management within river basins should enable a territorially more integrated approach. In general, in accordance with the subsidiarity principle, the organisational and institutional implementation of the WFD is the responsibility of the individual EU Member States. Thus, no organisational structures for river basin management are specified or even prescribed. Instead, the "appropriate administrative arrangements, including the identification of the appropriate competent authority" for each river basin district are required (WFD Art. 3).

Apart from the legal and organisational implementation of the WFD, a status review of each river basin and its respective surface and groundwater sub-basins and water bodies had to be carried out by the end of 2004. Here, the main characteristics (inventory) of all water bodies, including their chemical, biological, and morphological status as well as the main impacts of human activities on their status (risk assessment) and an economic analysis of water use were to be reported. Further, if not in place already, measuring networks and programs had to be set up by the end of 2006 to ensure a constant and complete monitoring of relevant parameters in the future.

The recent changes in the organisational structures of water administration are to some extent also a response to one of the key requirements of the WFD (Art. 14): the participation of the general public and all interested parties in the planning process. Article 14 is very open to interpretation. It can range from enrolling a selected number of key players behind a particular decision (usually the specialist public) to opening up the whole decision-making process to multiple tiers of stakeholder interaction (Moss et al. 2009). With respect to the general public, Member States have to make sure that all citizens (including water users) living in a river basin have full access to all information supplied and that they are given opportunity to react to and comment on:

1. the timetable and the work program for the entire planning process (by mid-2007),
2. the interim overview of the significant water management issues in the river basin (by mid-2008), and
3. the draft of the river basin management plans itself and the related programs of measures (by mid-2009).

Beyond this formal consultation process (public hearings), Member States are also supposed to encourage the active involvement of all interested parties (i.e. stakeholders) in the production, review, and updating of the river basin management plans and the related programs of measures. Further, we need to be aware that environmental policies in the federal system of Germany have in the past relied heavily on regulatory instruments, leaving water authorities in-experienced in participatory and co-operative forms of governance beyond formal consultation exercises (Moss 2004). Here, the exchange of information does rely heavily on statutory procedures, such as formal hearings and the submission of written statements (Bruns and Gee 2009).

In Germany, the WFD has been implemented without major alteration to organisational structures or administrative responsibilities. Federal state water authorities retained their legislative and executive powers over water management in accordance with the federal structure of government in Germany. Thus, the required coordination in a river basin district is organised rather loosely in the form of cooperation agreements and coordination bodies (for example, steering groups) between federal state water authorities (Moss 2004). Yet, as the examples of the river basins Warnow-Peene and Ems illustrate, promising institutional changes in the organisational structures can be detected (see Section ↱ 3.4). In line with our definition and debate on the concepts of IWRM this means that there is indeed some form of integration, yet mainly within the water sector itself. Inter-sectoral collaboration, however, is so far rather organised in the form of newly created coordination structures or coordination bodies along river basin boundaries. For the time being, Germany has chosen a path of minimal institutional change, meaning that in the end a successful implementation has to rely even more on non-formalised forms of cooperation. However, this has not been recognized yet as a potential problem as the attention of water authorities had for a long time been focused on conducting analyses of the status of water bodies and reforming the nati-

onal and federal state water acts. Some federal states (Baden-Württemberg, North Rhine-Westphalia, and Saxony), responded to this 'freedom' as a positive challenge and already adopted a pro-active communication policy with affected parties, ranging from official high-ranking advisory boards to information workshops (Moss 2004). Overall, this 'light' implementation of the IWRM concept, i.e. finding a way to address coordination problems rather than replacing existing administrative structures, is seen as a promising practice (Butterworth et al. 2010) as will be discussed in the recommendations.

Until the introduction of the WFD, the main instruments for Water Management Planning foreseen by the Federal Water Act had been the water management framework plan *(Wasserwirtschaftlicher Rahmenplan)* and the water management plan *(Bewirtschaftungsplan)* which had to be drawn up by the federal states for (parts of) river basins and urban areas. Yet, most of those plans that were produced did not consider inter-state issues. Only few of those plans were actually produced by the federal states. Practically more important were so-called water development plans *(Gewässerentwicklungspläne)* and water maintenance plans *(Gewässerunterhaltungspläne)* that primarily served the purpose of restoring river stretches. Other relevant water management planning instruments included the waste water disposal plan *(Abwasserbeseitigungsplan)* and the water quality regulation *(Reinhalteordnung)*. These water planning instruments have been revoked with the implementation of the WFD and are all combined now in the river basin management plan and the programs of measures.

Public participation for water management plans – as for any other major project and plan – has been much formalised and highly structured in the course of approval procedures for public planning *(Planfeststellungsverfahren)*. Basic steps of the process where some form of consultation takes place include a) the project proposal, b) the review by planning authority and other affected authorities, c) the public presentation of proposed activities, d) objections by the general public or affected stakeholders, e) consultation meetings, and f) issuing of planning decision (Kampa et al. 2003). Prominent examples of rather extensive and legally foreseen forms of public participation are regional planning procedures *(Raumordnungsverfahren)* to develop land utilisation and urban building plans *(Flächennutzungs- und Bebauungsplan)*.

Before the introduction of the WFD, provisions for participation during the formulation of the water management plans according to the Federal Water Act were differing substantially among federal states. While some had no relevant provisions for participation, most federal states provided for the involvement of interested parties, including affected state and municipal authorities, public bodies, and organisations representing the various public interests. Further, environmental groups (i.e. registered non-profit organisations) that are approved by the Federal Environment Ministry have to be granted a hearing and access to all relevant documents and materials for all planning processes at national or federal state level (Kampa et al. 2003).

Focussing on administrative structures, water management is not organised along river basins except for a few organisations and policy instruments. Powers for regulation, planning, policy-making, and enforcement are still divided between water authorities representing national, federal state, and municipal governments. Water management is characterised by a strong sectoral and functional division of responsibilities (Moss 2004). From the national to the municipal level, issues of water management, spatial planning, nature conservation, and agriculture are administered by distinct organisational bodies which only recently started to become accustomed to interaction beyond the scope of formalised planning procedures. Still, this is not in line with what is understood by 'integration' in the sense of the broad definitions of IWRM explained above, but in line with the 'cooperation' approach. Thus, implementation of the programs of measures decided on regional forums may be impeded by the insufficient coordination between water management and spatial planning system. Further, the new elements of governance introduced, for example, in Schleswig-Holstein seem to be supplementary to the existing hierarchical formal decision-making structures rather than a substitution (Bruns and Gee 2009).

Above all is the issue of institutional interplay, which refers to boundary problems of a different kind. Assuming the administrative and political boundaries of water management would indeed represent the physical – hydro-geological – territory of a river basin, other sectors, such as land use and tourism, are still organised and administered according to federal political boundaries. Thus, interests and jurisdictions overlap.

However, it should be noted that river basin management is not new in Germany as such. The Ruhr river basin in North Rhine-Westphalia, for example, was promoted as a prime example of integrated water resource management practices in Germany long before the introduction of the WFD. In the early 19th century, the Ruhr River Association for water quality management *(Ruhrverband)* and the Ruhr Reservoirs Association for Water Quantity Management *(Ruhrtalsperrenverein)* that were established as independent organisations have already been successful

in tackling water quality and quantity problems across administrative borders for the Ruhr river basin (Bode, Evers and Albrecht 2003).

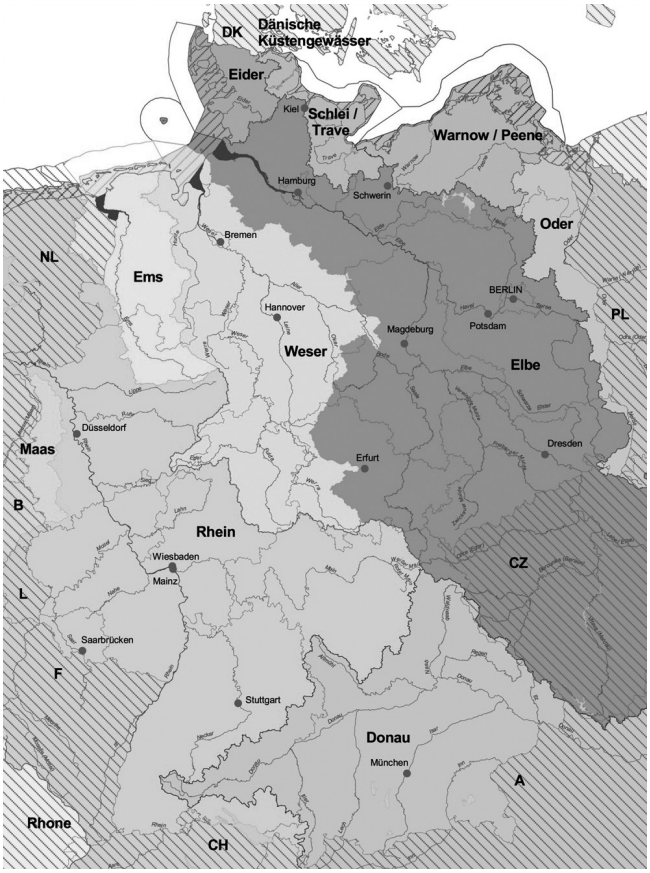
During the 1990s, more and more river basin inter-state committees were set up in Germany which produced action plans and programmes as guidance for the water authorities. Examples include the rivers Elbe *(Arbeitsgemeinschaft ARGE Elbe)*, Rhine, and Weser. For the first two examples, also international commissions were established – for example, the International Commission for the Protection of the Rhine (ICPR) where Luxembourg, France, the Netherlands, Germany, and Switzerland worked together – and the International Commission for the Protection of the Elbe (ICPE), which integrated the activities of Germany and the Czech Republic (Kampa et al. 2003).

Likewise, water management in the German Democratic Republic (GDR) had also been organised along large river basins rather than around political-administrative borders. Here, seven (after 1975, five) Water Management Directorates *(Wasserwirtschaftsdirektionen)* were responsible for water management planning. They were supported by river managers *(Flussmeistereien)* that dealt with all local issues of water management for a river stretch of about 50 km where they had to fulfil administrative, monitoring, and advisory tasks. Yet, rather political concerns than the objective of integrated water resource management were the driving forces for establishing such a water management system (Kampa et al. 2003: 16).

3.4. SELECTED RIVER BASINS IN GERMANY

In the following we present two German river basins, which are now managed in accordance with the provisions of the WFD (see also Figure 2). First, the rivers Warnow and Peene form together a river basin which is situated exclusively in one federal state, Mecklenburg-Vorpommern. This constellation was chosen to study on a relatively simple setting, i.e. where no inter-state coordination is needed, how a federal state fulfils the integration requirements of the WFD (LUNG 2009). The second case is the international river basin Ems. It requires a more differentiated organisational character as a purely national river basin. Likewise, the river runs through two German federal states. Therefore, coordination of activities must be organised between federal states and between Germany and the Netherlands. Moreover, apart from the higher coordination efforts needed due to the transboundary character, management of the river basin Ems is also characterised by a rather sophisticated and elaborated organisational structure that facilitates coordination at small geographical scales. In particular, regional forums *(Gebietsforen)* and round tables allow for taking care of local hydrological and other relevant characteristics (Geschäftsstelle Ems 2009).

Figure 2: Overview of the German river basins according to the WFD. Based on maps by the *‚Länderarbeitsgemeinschaft Wasser' (LAWA)* and the *‚Bundesamt für Kartographie und Geodäsie' (BKG)*. Source: Umweltbundesamt, June 2004, http://gis.uba.de.



3.4.1. WARNOW-PEENE

The river basin Warnow-Peene lies fully within the borders of the federal state of Mecklenburg-Vorpommern (MV), thus no coordination with other federal states or countries was necessary for preparing the respective river basin management plan and the related program of measures. The Ministry of Agriculture, the Environment and Consumer Protection (MLUV) – as the highest water authority – has the main responsibility for the legal, professional, technical, and organisational implementation of the WFD in MV and, thus, also for the river basin Warnow-Peene. For this, a steering group was established in the Ministry's De-

partment for Water and Soil to coordinate activities with other federal state ministries and state-wide agencies, organisations, and initiatives, such as the 'Working Group Diffuse Nutrients', the 'Alliance for Environment and Agriculture', and the 'Moor Protection Advisory Board' (MLUV-LUNG 2009).

However, the practical coordination with lower level agencies and organisations was carried out by the newly created Sub-department Water Framework Directive within the Department of Water and Soil of the State Agency for Environment, Nature Protection and Geology (LUNG) – acting as the higher water authority. In particular, they were responsible for preparing the river basin management plan and the related program of measures. For this, they provided the regional State Agencies for Environment and Nature (StAUN) with the necessary guidelines and available data and information (LUNG 2009).

The river basin Warnow-Peene was subdivided in four so-called water management areas (Bearbeitungsgebiete, up to 5,200 km2), each of which is taken care of by one regional StAUN. These four areas are again sub-divided in 23 sub-river basins *(Teileinzugsgebiete)* which may be situated in the administrative area of more than one StAUN, yet only one of them is taking the lead for a sub-river basin. Together with the Lower Water Authorities at district *(Landkreis)* level the StAUN are responsible for the practical implementation of the WFD, including the participation process. Participation of interested actors takes place in working groups that have been established for each water management area. Here, representatives of the respective StAUN, district administrations, municipalities, water suppliers, associations for sewage treatment, water and soil associations, and agricultural administrations as well as from various environmental, agricultural, and other interest groups have been discussing and preparing the local water-related information for the river basin management plan and developed suggestions for practical measures. At each meeting of the respective working groups a different sub-river basin within the water management area was dealt with and additional local representatives and experts from this very sub-river basin were invited (LUNG 2009).

From an institutional economics perspective it is important to note that here new collaboration organisations have been embedded in and linked up with already existing institutional structures. Rather than being a complete overhaul of the institutional structure of the water sector in MV the organisational changes build upon existing administrative organisations within the current administrative borders. Yet, since sub-river basins in some cases cross administrative StAUN areas the working groups are flexible to accommodate the respective local experts and stakeholders. This approach is more rooted in local realities and will be discussed in the recommendations section.

The general public is involved in all three stages of the consultation process (see Section ↱ 3.3), where every citizen can comment on the respective drafts. In practice, only seven and six statements were received in the first two stages (time table and work program; interim overview of the significant water management issues) respectively, while 49 statements addressing 260 specific issues were handed in when responding to the draft of the river basin management plan and the program of measures. For informing the general public about the implementation of the WFD, several regional and local events were organised by the MLUV and other state agencies. Further, information was made available at various internet platforms and in the form of brochures and reports (LUNG 2009: 137ff.).

In the river basin Warnow-Peene, measures to be implemented within the WFD until 2015 mainly focus on 1) the improvement of the hydro-morphological status of the surface waters (such as transmissibility of water courses for fish), and 2) the reduction of the diffuse pollution of groundwater bodies with nutrients and harmful substances, particularly those stemming from agriculture (LUNG 2009: 147).

Following the provisions of Article 11 of the WFD, in order to reach the water management objectives determined in the river basin management plans, the programs of measures shall at least include so-called basic measures which encompass the minimum requirements from EU regulations with respect to water management; for example, the provisions of the EU Nitrate Directive. Since in most cases the basic measures may not be sufficient to reach the management objectives, so-called supplementary measures can be freely defined in the programs of measures. They may include legal, administrative, economic, and fiscal as well as technical and advisory measures. All measures "shall be made operational" by the end of 2012 (EC 2000).

It is important to note that neither the river basin management plans nor the supplementary measures in the programs of measures as such are legally binding for state administrations and water users with respect to concrete operational decisions and activities. Rather, they can be regarded as the outcome of some kind of management pre-planning process *(Bewirtschaftungsvorplanung)*, i.e. they form the – albeit already prioritised and partly consensual – basis either for the subsequent formal sector planning procedures, such as the regional planning procedure

(Raumordnungsverfahren) or for the design of concrete policies or programs. Further, their implementation depends on the financial means available at federal state or regional and local level. In the case of Warnow-Peene, practical implementation of the respective agreed measures is taken care of by the federal state if first order water courses or water bodies are concerned. In the case of second order waters the municipalities and the respective water and soil associations are primarily responsible. Here, some additional financial support is provided by the federal state. However, the lion share will have to be financed using the already available support programs, such as the Moor Protection Program and Agri-Environmental Programs (MLUV-LUNG 2009).

Thus, it can be concluded that despite the involvement of regional stakeholders and the inter-agency coordination for the design of the program of measures and the river basin management plan, the implementation of the supplementary measures (planning, financing, and carrying out) takes place in the realms of the already established administrative structures.

3.4.2. EMS

The river Ems is an example for a transboundary water body where river basin management in the context of the WFD depends not only on the coordination and cooperation between the German federal states of Lower Saxony and North Rhine-Westphalia but also between Germany and the Netherlands. For national coordination Lower Saxony and North Rhine-Westphalia have negotiated an administrative agreement establishing the River Basin Association Ems *(Flussgebietsgemeinschaft Ems, FGG)* that consists of the Ems Council *(Emsrat)* and its managing office *(Geschäftsstelle)*. The latter is based at the State Agency for Water Management, Coastal and Nature Protection (NLWKN) in Lower Saxony, the federal state that covers most of the territory of the river basin Ems (Geschäftsstelle Ems 2009).

The respective ministries in both federal states and their counterpart in the Netherlands decided to draw up a joint river basin management plan for the whole Ems river basin. To facilitate the process they have introduced an International Steering Committee Ems *(Internationale Steuerungsgruppe Ems, ISE)* where the major decisions regarding the collaboration are made by representatives of the respective ministries at federal state and national level. These decisions are prepared by – and then 'translated' into operational activities – by the International Coordination Group Ems *(Internationale Koordinierungsgruppe Ems, IKE)*. Here, experts from the respective agencies in both countries meet three times per year and are supported by several non-standing working groups that focus on particular WFD-related issues (Geschäftsstelle Ems 2009).

Concrete implementation of the operational activities takes place at the working level where the Ems river basin is subdivided into seven water management areas (between 482 and 4,829 km2) of which one is covered by the Netherlands, five by Germany and one, the river estuary[5], is taken care of by both countries. Further, the German water management areas are organised in so-called coordination areas *(Koordinierungsräume):* while coordination area Ems South is covering territory of both federal states, the coordination area Ems North lies completely in Lower Saxony (Geschäftsstelle Ems 2009).

The river basin Ems was also chosen as a case where different organisational solutions for an active involvement of the public – more precisely, the specialist public – were introduced in both federal states for the preparation of the river basin management plans and the programs of measures. In contrast, the approaches to inform and (formally) consult the general public at the various stages of the implementation process did not vary much among the federal states.

In *North Rhine-Westphalia*, the preparation of the river basin management plans and the related programs of measures – including the participation of the general public and of interest groups – for all river basins and sub-river basins was supervised by the Ministry of Environment and Nature Protection, Agriculture and Consumer Protection (MUNLV). At federal state level, the ministry installed several working groups where represen-

[5] In the Ems-Dollart-estuary, both countries and the organisations established for the implementation of the WFD in the river basin Ems work also together with the Permanent German-Dutch-Border Waters Commission *(Ständige Deutsch-Niederländische Grenzgewässerkommission)*, Subsection G, working group 'Water quality'. Many German and Dutch delegates to this subsection G are also member in the IKE (Geschäftsstelle Ems 2009).

tatives of the environmental state agencies and state-wide interest groups developed state-wide standard procedures for, among others, the preparation of the river basin management plans. Furthermore, these working groups also collaborated with already established forums of cooperation, such as the 'Framework Agreement WFD/Agriculture', the 'Dialogue Economy and Environment', and the 'Waternetwork NRW' (MUNLV 2009).

Those parts of the two water management areas of the Ems river basin that are situated in North Rhine-Westphalia (Obere Ems; Haase) constitute the sub-river basin Ems/NRW[6] which is again subdivided into 10 so-called planning units *(Planungseinheiten)*. Since sub-river basins in North Rhine-Westphalia are not following administrative borders, management offices were installed at the level of the regional governments *(Bezirksregierungen)* to coordinate the activities within the sub-river basins. The regional government Münster, supported by the regional government Detmold, is responsible for the sub-river basin Ems/NRW. Here, regional stakeholders, more precisely the specialist public *(Fachöffentlichkeit)*, i.e. representatives of municipalities, registered associations, related regional state agencies, etc., were involved in the preparation process via so-called core working groups *(Kernarbeitsgruppen)* and regional forums *(Gebietsforen)*. Members of the core working group in the sub-river basin Ems/NRW meet twice a year supporting and advising the management office Ems/NRW with respect to all matters of the implementation of the WFD. Regional forums are organised once or twice a year to exchange information and discuss specific aspects of the implementation of the WFD with a broader spectrum of regional stakeholders, again the specialist public (MUNLV 2009).

Similar organisational structures have been established at the local level. In the sub-river basin Ems/NRW four round tables – each covering two or more planning units – were installed for the systematic and constant involvement of the local specialist public, including, for example, water users, interest groups, and municipalities. So far, each round table took place four times. Here, information on the state of the water bodies in the area and current water uses as well as restrictions and options for improvement and potential conflicts have been exchanged. Further, suggestions for respective measures – as an input into the river basin management plan and the program of measures – were developed.[7] It is intended to continue these organisational structures at regional and local level on a permanent basis also after the first respective river basin management plan and program of measures has been finalised (by the end of 2009) (MUNLV 2009).

While the bulk of information and organised participation at all levels was directed towards the specialist public, the general public was mainly only *informed* about the ongoing processes and discussions via reports and documentations in the print media, with diverse flyers and brochures, via dedicated internet platforms and information events organised by the respective state authorities. Further, in the context of the formal consultation process, respective draft documents were made available to the general public and could be commented on by everybody for six month. In North Rhine-Westphalia as a whole, about 1,200 statements were received from municipalities, interest groups, and private citizens. The comments were then evaluated by the state authorities responsible for the implementation of the WFD, i.e. the MLUV and the regional governments, and – if applicable – taken into account for the revision of the drafts. The final political decision on the river basin management plans and programs of measures in North Rhine-Westphalia was taken by the federal state parliament (MUNLV 2009).

Similar to the case of Warnow-Peene presented above participation of the general and specialised public has been restricted to the stage of giving advice, exchanging and discussing water-related information, and being heard since the final decisions were taken by the already existing water authorities and the federal state parliament. What this means in terms of having the real power in affecting the outcome of a process will be discussed in Section 5 according to the ladder of participation by Arnstein (1969).

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6 In NRW, there are in total twelve sub-river basins that are part of the river basins of the Rhine, Weser, Ems, and Maas.

7 These forms of regional collaboration were facilitated, among others, by the interdisciplinary research project FLUMAGIS that was financed within the research program 'River Basin Management' of the German Federal Ministry of Education and Research (BMBF). Here, a spatial decision-support system was developed and tested in the project study area Upper Ems river basin. More precisely, an interactive computer-based tool was developed that allows decision-makers to design and visualise planning and management scenarios for improving water quantity and quality. The results indicate that in order to achieve the objectives of the WFD substantial and cost-intensive land and water management changes are necessary at all scales. Interesting were the socio-economic models integrated that allowed evaluating the cost-effectiveness of the various measures to tackle water quantity and quality problems. The conflict potential for each potential measure was assessed, for example, with respect to the acceptance of the proposed measure by different stakeholders (Volk et al. 2008; Meyer and Meyer 2003).

Even before the formal implementation of the WFD started in 2001, *Lower Saxony* had taken measures to inform and prepare state and communal water authorities, local water users, and other interested actors for the upcoming changes. Among others, they initiated a pilot project for drawing up a management plan for the Weser sub-river basin. If we compare the two water management areas of the river Ems that are partly on North-Rhine Westphalian territory with the four water management areas of the river Ems located in Lower Saxony – which are here equivalent with the planning units –, we find a slightly different set up of actors groups and organisational structures engaged in participation. Yet, the basic approach and the intra-agency communication are similar. Instead of round tables, Lower Saxony has established so-called regional cooperations *(Gebietskooperationen)* for each water management area.[8] They consist of regional interest groups, water users, state and communal authorities as well as other stakeholders. Permanent members are, more precisely, representatives of the district administrations, municipalities, water associations, agriculture and forestry, water suppliers, industry, environmental associations, and the NLWKN. If necessary, representatives from other organisations, such as fishery, mining, and angling associations, are invited. Their main task is to prepare the programs of measures and to facilitate information exchange and dialogue with respect to the management plan 'Developing measures bottom-up'. They are supposed to continue their work also after 2009. Due to the fact that most representatives come from state or communal authorities and are very knowledgeable, the work of the regional cooperations is perceived as being very professional. Yet, nature interests seem to be underrepresented both with respect to the state authorities for nature protection and the respective non-governmental nature protection organisations. Further, it has been suggested that land owners or leaseholders need to be more actively involved in the planning of concrete measures (NLWKN 2009; NMUK 2009).

Lead by the NLWKN, three thematic working groups (surface water, transitional- and coastal waters, and groundwater) were established that include experts from the NLWKN itself and from the Federal State Ministry for Environment. Their objective was, among others, to provide the professional basis, concepts, and drafts for the implementation of the WFD in Lower Saxony. Further, extended thematic working groups were built with representatives of state authorities, water users, and other interested actors. They cover the thematic areas surface water, groundwater, and economic analysis and are led by the Ministry for Environment. There is also a constant communication and information exchange process of all these thematic working groups with the activities of the regional cooperations at the level of the water management areas (NMUK 2009).

Involvement of the general public, again, follows similar patterns as in the other federal states. Among others, the Ministry for Environment has organised 27 river basin forums at different places in the federal state so far and established an internet-based forum called *'Wasserrahmenrichtlinie-Info-Börse'*. In addition, several model projects were initiated by the Ministry of Environment in Lower Saxony in 2005 to scientifically support and accompany the WFD implementation process (NMUK 2009).

[8] In addition, 11 so-called observation areas for groundwater were installed.

4. INSTITUTIONAL REQUIREMENTS BASED ON THE SOCIO-ECOLOGICAL SYSTEM APPROACH

Plenty of empirical evidence exists demonstrating often substantial discrepancies between the intended effects of a new policy, i.e. usually a set of new or modified institutions, and the outcomes of this policy, i.e. its institutional performance in terms of effectively guiding actors' behaviour (see, for example, Damania et al. 2004; Theesfeld 2008). Thus, the effectiveness and cost-effectiveness of new policies depend on the compatibility between the characteristics of their institutional design and the institutional arrangements already in place at the time of policy implementation, also taking into account the characteristics of actors and transactions targeted by the policy. The same applies to the implementation of the WFD. Given specific attributes of actors and transactions, appropriate institutional arrangements (institutions and governance structures) increase the likelihood of actually achieving the policy objectives. They increase the likelihood of actors' compliance and intended change of behaviour, or they ensure that these policy objectives are achieved at reasonable costs. An adequate understanding of the institutional configuration and the situational logic of the institutional environment in which a policy is to be implemented is a necessary precondition for assessing the balance between the intended and unintended consequences of that policy (Aligica 2005; Esty et al. 2005: 11; Theesfeld et al. 2010). In the same way, institutional ‚fit' is crucial in the water sector, too. Moss (2004) supports this argument by arguing that to reach effective policy implementation, the degree of congruence with the prevailing institutional structures and administrative procedures is crucial.

Comparable to the results of Solanes and Jouravlev (2006), who in their analysis of water institutions in Latin American and Caribbean countries highlight incompatibilities with existing institutional arrangements – for example, counteracting macroeconomic policies, international agreements overriding national laws, a low level of trust in government bodies, imbalanced power of interest groups, preferences of external actors, and the values of ethnic groups –, this report provides new insights into institutional aspects of water management, mainly in the agricultural sector, and into the socio-political and administrative conditions of the implementation of the WFD in Germany.

4.1. VOLUNTARY COMPLIANCE AND PUBLIC AWARENESS

First, due to the resource characteristics of groundwater and surface water described in Section 3.1, there are no effective – or at least no cost-effective – monitoring methods to detect diffuse polluters of water bodies. Thus, many of the supplementary measures concerning non-point diffuse emissions compiled in the programs of measures, such as a change in agricultural cropping patterns at farm level, rely to a large extent on voluntary compliance and public awareness, in this case on part of the farmers.

Second, agri-environmental measures which provide financial incentives for a change in cropping patterns or a reduction in fertiliser or pesticide use might be an alternative here. Yet, the premium levels that need to be offered to farmers for actually taking part in these programs may be lower if there is an increased awareness of the environmental problems on part of the farmers.

Third, the success of command-and-control measures – which form a substantial part of the basic measures in the programs of measures – depends to a large extent on the monitoring and control efforts needed to enforce them. They may become prohibitively high, due to characteristics of the resource system and the sometimes high number of water and land users. Thus, resource users sometimes ignore or violate restrictions imposed on them. Therefore, voluntary compliance is a key issue (Pistor 2002; Burchi and Nanni 2003). Voluntary compliance implicitly assumes a certain level of common understanding and knowledge about the resource at stake. Otherwise, users will continue to ignore the new governance structures and policies and may seek other solutions to their problems. The primary challenge for agricultural and water agencies in this regard is in communicating with a wide spectrum of water users of different sectors to encourage sustainable use of the resource. Taking California's groundwater management as an example, Blomquist (1992: 302) shows that compliance with formal rules can be extraordinarily high. This is due to two factors: 1) management programs were generally developed by the water users themselves, and 2) they included some form of monitoring which made the actions of each user known to all fellow users. Each user's compliance

thus depends on the compliance of the others. This feature is often discussed in combination with a system of graduated sanctions in which the participants themselves undertake monitoring and sanctioning and where the initial sanctions are surprisingly low (Ostrom 1992: 69).

4.2. ADMINISTRATIVE RESPONSIBILITY

The *'problem of fit'* occurs if the boundaries of a biophysical system, such as a river basin, an aquifer, or a reclamation area, do not match the jurisdictional areas of political and administrative structures responsible for managing this resource (Young 2002). In order to implement decentralised water resource management successfully, the institutional arrangements have to be clearly-defined and reasonably well-matched with the hydrogeological system. Poorly-defined boundaries may impair collective decision-making by including actors or communities who are not actually stakeholders in the particular resource system, or excluding others who have a legitimate stake (Ostrom 1990); both may lead to prohibitively high coordination costs in terms of time and funds. Studies on the implementation of river basin management in Europe in the context of the WFD implementation find that historically deep-rooted structures, such as the federal administrative and political systems in Germany, are likely to make basin management more difficult (Moss 2003). Blomquist and Schlager (2005) add to the discussion on water basin management the observation that the selection of boundaries is always a political act and even integrated watershed management has therefore many trade-offs. Likewise, there are no ultimate boundaries.

The *'problem of interplay'* occurs when resource management requires the interaction of different levels of the political and administrative hierarchy (for example, national, federal, and regional) and/or horizontal interaction across different sectoral units and the related organisations (for example, spatial planning, agriculture, and water protection) (Young 2002; Moss 2003). If different authorities need to work together, ambiguity often exists in the definition of their respective central and local responsibilities and the related decision-making power. Often the central level basically tries to retain control over local decisions. This is particularly the case with the implementation of the WFD where the administrative bodies of the German federal states will be held legally responsible by the European Commission for failure to reach the objectives formulated in the river basin management plans; that is, if they are not able to provide evidence that these objectives can only be reached at disproportionate costs or if this would endanger other crucial societal needs. Therefore, they may not be in favour that objectives and measures are decided on by local actors alone.

4.3. BUREAUCRATIC INERTIA

Any administration that needs to implement new formal rules and to adopt new organisational structures will show some reluctance when substantial changes in procedures are foreseen. This is understood as political and bureaucratic inertia, which is due, among other things, to the high transaction costs faced by civil servants (for example, in terms of time, meetings, and memos) for becoming acquainted with new policies and establishing new procedures for their implementation (Theesfeld et al. 2010). For instance, as described earlier, the German administrative bodies are rather accustomed to command-and-control approaches as well as standardised and formal forms of stakeholder involvement and coordination. Including more elaborated and flexible participatory methods would, *first,* slow down the decision-making process and, *second,* imply to get accustomed to new working procedures. *Third,* the required coordination across administrative borders (vertically and horizontally) is often seen as troublesome. Following Moss and Hüesker (2010: 6), the institutional arrangements of the German water sector are traditional and have proven itself in the past, leading to inertia and reluctance towards necessary changes.

What is more, while the prospect of an agrarian boom due to the introduction of IWRM is often the focus of many developing countries, water management policies are mainly directed towards new challenges: water management must address overexploitation, adaptation towards climate change, and water quality issues. Further, conflict resolution mechanisms are important elements of water governance, too. All these aspects are likely to bring about adaptation in daily working routines; and in fact demand it.

4.4. POLITICAL ECONOMY

When new water legislation that restricts the actions of water users is introduced, difficulties may arise due to the social pressure placed by water users and their political associates

to grant exceptions. This may have a negative impact on policy implementation if resource management is controlled by rent-seeking stakeholders. In such cases, well-organised special interests promote self-serving policies in the absence of a transparent governmental and information system that would allow other stakeholders to counterbalance their influence (Burke et al. 1999: 52). Individuals or communities, who perceive they will suffer from a policy change, are likely to defend the status quo, just as any change in power relationships where a loss of decision-making rights and rights to allocate funds are involved. Hamann (2005) refers to these issues as the problem of how to overcome the reluctance to alter the status quo. The latter may be intensified if additional funds are provided to encourage local initiatives and self-organisation, as this takes away even more power from the previously exclusive decision-makers.

Petersen et al. (2009) argue that the new conception of integrative water protection that is inherent in the WFD will eventually not only lead to a fundamental change in European water protection policy, but also in environmental policy as such. According to the WFD, EU Member States not only have to prevent environmental damage but have to guarantee a good status of the environment – here the good status of water – or even to achieve it if this status has not been reached yet. Given the complexities of the physical and social systems that need to be addressed for fulfilling this strong obligation, governmental organisations in its current form may be overburdened by this task. In consequence, the authors find, state authorities must build up additional capacities for management, communication, and evaluation in order to organise and monitor complementary and supportive forms of governance and participation processes. Yet, this would "not result in a reduction of governmental activity, but in its extension and augmentation" (Petersen et al. 2009: 2064).

All countries with a parliamentary democracy share the politicians' inability to enforce measures which affect the livelihood of actor groups that constitute a powerful voting base. The agricultural producer lobby and farmers associations are a group which political leaders cannot ignore when discussing financial support or a restriction on private entitlements to land or water.

Other issues are the democratic legitimisation and the factors influencing the selection of actors being invited to participative forums. *First,* in a study on participation and collaboration procedures in the water sector management in the federal state of Schleswig-Holstein, Bruns and Gee (2009) point to the fact that members of the regional working groups established there to support the implementation of the WFD are not democratically legitimised. Thus, providing them with 'real' decision power next to the existing political and administrative structures may be risky. Moss and Hüesker (2010) also point to the risk of providing individual powerful actors, which are not democratically legitimised, with too much power. *Second,* the selection of actors participating in these forums and their influence does also depend on the method of participation chosen, which experts are invited, which questions are discussed, and which methods and data are accepted as representing the state of the art in science. That is a common way of influencing the outcome of a compulsory participatory process. In addition, the lack of objective data, for example, on aquifer pollution, enables these data to be used politically and provides grounds for manipulation of different parties in a negotiation approach (Moench 2004: 95).

In this respect, Wright (2007) also criticises the strong reliance on neo-classical economic methods, such as contingent valuation and benefit transfer, in the decision-making processes in the context of the WFD implementation. These methods are central in the guidelines produced by WATECO[9] for EU Member States for the economic evaluation of measures and to determine whether the costs for reaching a particular environmental objective are proportionate, or not. In case of the latter, EU Member States are allowed to derogate. Thus, the effectiveness of the WFD will be limited and less stringent environmental objectives adopted. Most importantly, basing decisions for water management on these models alone would be totally at odds with the claim to involve stakeholders actively in the decision-making process. Instead, to ensure acceptability, transparency, and effectiveness of the WFD implementation elaborated forms of stakeholder participation and deliberative approaches to decision-making are needed. In this regard, Jessel and Jacobs (2005) successfully applied scenario analysis to investigate the impacts of land use changes. Here, they used stakeholder interviews to determine the initial conditions for the scenarios as well as to evaluate the results of the scenarios in the Havel river basin in northeast Germany. This approach helped to identify the priorities of stakeholders.

[9] The Water Economics Working Group WATECO was set up under the Common Implementation Strategy of the WFD with the aim to provide guidelines for the economic analysis in the context of the WFD implementation (WATECO 2002).

4.5. INFORMATION AND DATA

The WFD requirements to ensure a 'good' status of surface water and to establish a tight and reliable monitoring system demands from the Member States a systematic collection of data on the ecological and morphological quality of all water bodies. This will lead in the future to a monitoring network allowing for continuous collection of data with a full coverage. In the process, gaps of required data are becoming obvious.

As described above, compared to surface water, groundwater data are even more patchy, outdated, or inaccessible. Often there is scientific uncertainty, for example, with respect to the extraction recharge estimates needed for policies based on the sustained yield approach, or the impact of human actions on the resource (Moench 2004). Without understanding the complexity of the groundwater system, the irreversibility of groundwater depletion, and the necessity of precautionary protection, cooperation will be ineffective. Thus, the prevalent data gaps have to be closed since those data are a prerequisite to decide on the 'best' measures to be incorporated in the programs of measures. As regards the development of new groundwater management approaches, Moench (2004: 97) calls for more direct measurements of groundwater conditions, such as primary data collected by water authorities, instead of relying on modelling attempts.

In general, information deficits have three implications for water governance: *First,* a common understanding of the operation and interrelationships of a management system is required for public involvement (Ostrom 2000; Bruch 2005). *Second,* a prerequisite for voluntary compliance with water regulations is public awareness. If knowledge about the danger of pollutants for personal health, or the irreversibility of falling groundwater levels and loss of storage are inadequate, it is difficult to motivate people to change their behaviour and refrain from otherwise profitable actions. *Third,* information-sharing and high quality data are required for a valuable public consultation. Similarly, participation of interested parties and the broader public can be an important instrument to manage or even reduce 'informational' uncertainties on part of the decision-makers. These knowledge deficits may include the lack of knowledge about the present and future conditions of the water bodies, about the causal relationships regarding the origins of pollution, and the effects of proposed measures (Newig et al. 2005).[10]

Further, standardised socio-economic data, for example, for the valuation of environmental goods, are missing on a broader scale, i.e. going beyond case study level. Such data are best gathered using discourse-based or deliberate methods. Such methods are very valuable when it comes to making assumptions on the degree of likely voluntary compliance to a rule change; yet, they are also more time consuming and costly. Further research in institutional analysis has to encompass the question of how to capture not only the incentive structure faced by individuals in different decision-making contexts, but also bounded rational behaviour and informal institutions that form an important part of the institutional environment (Hagedorn 2008).

4.6. LINKED USE SECTORS

As already indicated in the discussion on the ecological characteristics of reclamation systems there is a close interdependency between water and other natural resources use, in particular land use decisions. Further, interactive governance not only between water managers, but also between them and those responsible for regulating land use, which are mostly the agricultural authorities is necessary to meet the spirit of the WFD (Moss 2004). Land use has a tremendous impact on the availability and quality of both surface and groundwater. In principle, this is implicitly addressed by the focus of the WFD on 1) river basin management, 2) the combined approach to pollution prevention (including environmental quality standards addressing land use as contributing to diffuse-source pollution (Art. 10)), and 3) the inclusion of hydro-morphological parameters for achieving a 'good' status of surface waters.

Note that in contrast to water use decision, land use decisions are predominantly made locally. In order to integrate the land and water sector, participatory forums have to ensure the involvement of actors at local geographical scales, and inter-sectoral collaboration has to go down to the lowest administrative level.

[10] Newig, Pahl-Wostl and Sigel (2005) also argue that participation can be seen as a way to reduce the 'normative' uncertainties related to the WFD since the concrete water management objectives and measures are not prescribed by the Directive itself but need to be specified for each part of the water bodies. Here, local knowledge is essential.

5. RECOMMENDATIONS

Referring back to Section 2 where we discussed the general concepts of IWRM we can conclude for the WFD implementation in Germany that the integration of surface water and groundwater can be considered as satisfactory. The effective link to other water use sectors, however, is only conceptually depicted. Some forms of interaction and coordination with sectors outside the water sector have been established in all federal states and at various spatial and administrative levels. This includes inter-agency coordination groups as well as regional forums with participants from many other sectors that affect or are affected by the water sector. As one result, some of the final supplementary measures in the programs of measures take other resource uses explicitly into account, and range from "constructing a fish pass at location xy" to "establishing protection stripes between agricultural land and river yz". Some of these measures are technically very water specific, others more integrated. In how far this integration only exists on paper is beyond the scope of this report, as the timeline of the WFD has not reached the measure implementation and the subsequent evaluation phase yet. Thus, we can only evaluate here the institutional change at administrative and organisational scale.

Butterworth et al. (2010) suggest a pragmatic approach to implement the IWRM concept that is 'light' and locally rooted. It should allow taking local realities (i.e. structures and interests) more seriously and would thus be in line with the socio-ecological approach and the idea of institutional fit (Section 4.2) used in this report. Following Butterworth et al. (2010), IWRM implementation does not mean that all actions and actors have to be fully integrated and handled by a super-agency that replaces the many actors in the water sector; rather it is about finding ways to interact and to address coordination problems. This is very much the spirit in which the IWRM principles are realised in Germany in the context of the WFD implementation. The cases of the river basins Warnow-Peene and Ems illustrate this nicely.

In line with the socio-ecological-system approach (Ostrom 2007), we suggest to structure institutions, i.e. the new rules necessary due to the implementation of the WFD, in ways that maximise compatibility not only between prevailing and new institutional attributes, but also between new institutional attributes and the hydro-geological properties of the respective resource systems (Young 1999: 48), as described in Section 3.

In general, German water governance and other related sectors have to accomplish a generic shift from mainly imposing central policies and regulations towards voluntary and flexible agreements negotiated with regional stakeholders and water users. In line with Knill and Lenschow (2000), Germany is predestined for a misfit between the state-centred, regulatory philosophy and administrative traditions of water management, and the partnership-oriented, cross-sectoral features of the WFD. Here, bureaucratic inertia may play a leading role in hampering the needed transformation (Moss and Hüesker 2010; Theesfeld et al. 2010).

According to Moss et al. (2009), and in line with the concept of socio-ecological systems where social actor groups play a significant role, more attention should be paid to individuals and organisations outside the traditional categories of water users, managers, and regulators. Here, the integration between water service providers, users, and regulators – one important requirement of the WFD – could also be realised by organisations fulfilling intermediary functions, such as facilitating dialogue, providing guidance, bridging gaps, advocating reforms, and pioneering novel forms of interaction. On the one hand, – and in contrast to governmental authorities –, such newly established or already existing intermediaries have a higher degree of adaptation capacities and can be beneficial when it comes to translating IWRM principles into everyday practices. Yet, on the other hand, it should not be overlooked that they may have their own agendas, not necessarily acting as neutral bodies (Moss et al. 2009).

Following Green and Penning-Rowsell (1999), resource management concepts like IWRM that simultaneously aim at integration and participation seem to pull in opposite directions. Integrated management often necessitates some kind of centralisation by bundling and coordinating the activities of different functional and spatial administrations, with the intention to achieve a more complete understanding of the sectoral and spatial interdependencies. At the same time, achieving effective public participation beyond simply informing and consulting stakeholders is likely to require the decentralisation of decision-making and the shifting of the respective decision-making powers down to geographical and functional units at lower scales (Green and

Penning-Rowsell 1999). Such effective local participation mechanisms are necessary to account adequately for the diversity of uses and corresponding needs in a river basin which cannot be dealt with successfully when relying only on centralised decision-making procedures (Butterworth et al. 2010). Likewise, participation and information sharing is a prerequisite for public awareness and voluntary compliance.

Borowski et al. (2008) argue that the introduction of participatory structures that are not following the administrative borders of existing decision-making structures may result in parallel structures and spatial misfits within the institutional settings of river basin governance and, thus, is likely to impede social learning. At least, the plain introduction of advisory boards or forums at hydro-geological scales needs to be effectively linked up with the relevant water-related administrations and decision-making structures. The authors refer to the example of the federal state of Thuringia, where the participatory structures introduced in the course of the WFD implementation explicitly follow the administrative borders.[11] Participants of such forums were very confident that the results of their discussions would be taken seriously and finally influence the content of the river basin management plans and programs of measures. This shows that in some respect it is necessary to organise participation along hydro-geological boundaries of river (sub-)basins, but when it comes to the relevance of the regional decisions taken at such cross-border forums for the actual political decision-making process those structures may not be adequate if the de-facto decision making structure still follows the existing administrative borders only.

When assessing the current implementation of WFD's Article 14 on participation with the ladder of participation by Arnstein (1969), where each rung corresponds to the extent of citizens' power in determining the end product, the reviewed participation attempts score poorly.[12] There is a critical difference between going through the empty ritual of participation and having the real power needed to affect the outcome of the process. Participation without redistribution of power is an empty and frustrating process for the so far powerless. Rather than power sharing and more empowering forms of participation, most state activities in the frame of the WFD implementation are limited to informing and consulting people. The citizens lack the power to ensure that their views will be well received by the powerful, there is no assurance of changing the status quo (Arnstein 1969). In that respect, also Neef (2008) investigates critically the WFD-induced shift towards more participatory approaches in the Jagst watershed in the German federal state of Baden-Württemberg. He concludes that participatory processes initiated by the federal state are episodic and rather ceremonial, and thus remain on the informative and consultative stage. Further, the strict adherence to vertical lines of decision-making and the claimed superiority of experts' judgment seems to restrict the real influence of stakeholders and other citizens taking part in the collaborative processes at different levels and stages of WFD implementation.

After analysing the level of participation in the evaluation processes for river basin planning in other European countries, Antunes et al. (2009) conclude that in most cases decision-making procedures do not sufficiently include the interests, perceptions, and values of affected parties. Only in very few cases participation went beyond the level of information and consultation of stakeholders and resulted in a real influence with respect to the design of project alternatives and programs of measures. These authors, too, suggest putting more emphasis on the integration of deliberative methods, such as participatory modelling, deliberative visioning, and social multi-criteria evaluation, in the participation and decision-making process.

Investing in decentralised governance structures, such as regional forums, and providing the participants with some real decision-making powers – that could be checked by democratically legitimised political actors – could be particularly worthwhile in the context of the WFD implementation. This is because these forums and the knowledge that has been accumulated there can be (re-)used for every scheduled revision and update of the river basin management plans and programs of measures which are determined by the WFD. Further, in particular at local level, trust between participants and also vis-à-vis the water authorities and political actors could thus be developed by continuous communication, collaboration, evaluation, and feedback. In addition, if organised as permanent bodies, these forums could also be used for adapting measures and respond to current developments quickly; not the least since the WFD requires periodic updates to the river basin management plans and associated programs of measures only on a six-yearly basis.

[11] One of the stakeholder forums established at the district level, the Unstrut-Leine Forum, covered two sub-basins from two different river basin districts. Here, the same representative of the federal state Ministry of Environment – that has the overall responsibility for the implementation of the WFD in Thuringia – chaired both the participatory process and the political decision-making process and thus functioned as an interface (Borowski et al. 2008).

[12] The rung of the ladder are: 1) manipulation, 2) therapy, 3) informing, 4) consultation, 5) placation, 6) partnership, 7) delegated power, and 8) citizen control. Only the last two stages of the ladder lead to actual political participation (Arnstein 1969).

Summing up, the following applied suggestions can be derived:

- Continue the German way of 'light' implementation of IWRM with its focus on horizontal and vertical coordination between administrations and stakeholders instead of setting up completely new, highly integrated organisational structures for water management.
- Reward state employees adequately for the additional upcoming tasks of coordination and train them properly for the new required procedures. This would help to mitigate the inertia within the bureaucracies.
- Design and establish conflict resolution arenas, including administrative staff training in intermediation, to mitigate conflicts which are likely to emerge once the implementation of the programs of measures has started.
- Set up an accessible data basis that relies on transparent methods aiming at a frequent data exchange between natural scientists and water authorities, both collecting and processing data to address the quality status of water bodies. Both sides often use different methods for gathering, processing, and analysing their data. Yet, win-win situations should be accomplished by planning and designing from early on methods and procedures that allow for an easy data transfer from science to policy and vice versa.
- Strengthen the role of participatory elements by actually implementing as many measures which were developed in the regional discourses as possible.
- Perpetuate and intensify the consultation processes with the general public. This can be facilitated by evaluation procedures of the implementation of the measures that involve the general public.
- Strengthen the integrating elements. The additional value and expertise generated by, for example, regional forums has to become more relevant and effective for the decisions taken by the administrative and political decision-making structures which have not changed.
- Stick to the democratically legitimised decision-makers for final political and financial decisions, or organise a system of checks-and-balances when delegating real decision-making powers to regional forums.

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