Institutional adaptation to climate change - current status and future strategies in the Elbe basin

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Abstract

Climate change is one of the most important challenges of today's and future water management and requires adaptive management strategies in order to cope with its impacts.

This paper deals with the question, in how far institutions for water management in the German Elbe basin adapt to climate change impacts. Based on literature study we identify five main elements of institutional adaptation, which are information, collaboration, flexibility, openness for experimentation, and enabling background conditions. Making use of these elements we investigate, how adaptive the current institutional arrangements in the Elbe basin are, which aspects need improvement and how better adaptation can be achieved.

We will show that adaptation is still at an early stage in the Elbe basin, but both, issue awareness and various strategies to deal with uncertainties on climate change impacts already exist. While the current structures are polycentric in nature, a need for better co-ordination between the different poles of the system prevails, which should be faced by boundary spanners – a position that could be hold by the river basin commission or by the national level. Further, the interview partners expect guidance on institutional adaptation from higher levels, esp. from the EU.[1]

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1. Introduction

Current water management systems are characterised by complexity. For example, water has to be allocated to competing uses and new legal or managerial requirements pose challenges, such as the implementation of European Directives. Moreover, water management needs to adapt to fundamental changes in the physical and human environments. Particularly the impacts of climate change and related uncertainties are a main challenge for current and future water management. Although there is uncertainty about the extent of future climate change, some important trends are relatively certain: for central Europe, a trend towards increasing winter runoff and decreasing spring and summer runoff is expected as well as changes in the timing of runoff and annual water availability. Observations show that in central Europe, the number of flood events increased at the same time as long dry periods in summer (Leipprand and Dworak et al. 2006).

Management systems for water resources must be able to face these challenges and to adapt to changes in the system being managed (Gunderson and Holling 2001). Adaptive management can be considered as a systematic process for improving management policies and practices by learning from the outcomes of implemented management strategies (Walters 1986). Likewise, the integrated concept of social-ecological systems (Berkes and Folke 1998) stresses that social and ecological systems are linked and the delineation between social and natural systems is artificial and arbitrary (Berkes et al. 2003, 1). Social-ecological systems are characterized by complexity and uncertainty, leading to the fact that managers cannot have full knowledge of the system.

Adaptive management explicitly acknowledges both, uncertainties and complexity of a social-ecological system. River basins are a typical example of a complex system, in which social and ecological aspects are closely interlinked. Successful governance in river basin management

depends on adaptive institutions (q.v. Pahl-Wostl 2002, 396) that are able to cope with complexity and uncertainty and to face new challenges such as climate change.

The aim of our study is to investigate, whether river basin management institutions in the Elbe basin are designed to allow for adaptation to climate change impacts. Institutions are considered as a broad "set of rules, decision-making procedures, and programs that define social practices, assign roles to the participants in these practices, and guide interactions among the occupants of individual roles." (Young 2002). Based on literature study, especially taking into account Huitema et al. (in review), we identify five main elements of institutional adaptation which are information, collaboration, flexibility, openness and time for experimentation, and finally enabling background conditions. Making use of these elements, we investigate, in how far experts consider the current institutional arrangements in the Elbe basin to be adaptive and which aspects need improvement. The study focuses on water management and takes into account interlinkages with agriculture. It is exclusively related to the German part of the basin. The study was funded by the EU FP 6 NeWater project. [2]

The paper is organised as follows: in the next section, we provide some background on the Elbe basin and the impacts of climate change. We will then shortly describe our empirical methods and elaborate the mentioned elements of adaptive institutions. The fifth section is based on our empirical analysis and shows that some elements of adaptive institutions can already be found in the Elbe basin. The paper closes with conclusions on the current status of institutional adaptation in the German Elbe basin and some thoughts on the use of the developed framework for further studies.

[2] For more information on the NeWater project: www.newater.info.

2. The Elbe basin – impacts of climate change and general settings

The Elbe basin has a catchment area of 148.268 km^2 and is shared by four states: Germany, the Czech Republic, Austria and Poland; with the latter two encompassing less than 1% of the catchment (see Fig 1). About 25 million people live in the catchment area (FGG Elbe, 2004).

Fig. 1: The Elbe basin

Climate change has been discussed for several years on global and national levels. We will not repeat the state of the art of this discussion here, but aim at giving a short overview for the Elbe basin in order to enable the reader to follow our analysis.

While studies on climate change are quite advanced on global scale, the resolution of the General Circulation Models (GCMs) is currently too rough for a correct representation of the hydrological cycle variations within river basins. This problem can partly be solved by downscaling the GCM outputs onto the regional or river basin scale. Krysanova, Hattermann and Habeck (2005) have modelled the interactions between climate, hydrological, and ecological processes on different scales in the Elbe basin by making use of the eco-hydrological model SWIM (Soil and Water Integrated Model) (cf. Krysanova, Wechsung et al. 2000). We will base our study on this assessment, which we roughly explain in the following.

Based on the IPCC emission scenario A1, the climate change scenario used here is characterised by an increase in temperature by 1.4°C until 2050 and a moderate decrease in mean annual precipitation in the basin. On average, a -17% decrease in average annual precipitation is expected according to this scenario for the total German part of the Elbe basin in 2046-2055 compared to the reference period 1991-2000. In accordance with this scenario, lower precipitation will be explicitly noticeable in the central and southern parts, whereas some increase in precipitation will be detectable in the northern part of the basin (Krysanova, Hattermann et al. 2005).

Krysanova et al. (2005) have evaluated the impacts of climate change on water quantity as well as on some aspects concerning water quality: Concerning water quantity, different components of the water balance were analysed. Evapotranspiration is expected to decrease on average by 4% in the Elbe basin, with significant sub-regional differences corresponding to the change in precipitation. Runoff and groundwater recharge show a decreasing trend, whereas groundwater recharge corresponded most sensitively to the anticipated climate change (-37% on average). The river flow is becoming significantly lower under the climate change scenario.

Concerning water quality, especially the generation of diffuse pollution was studied. In general, nitrogen losses with water for all soils distinctly

increase with increasing precipitation from climate zone 1 to 5 due to more intensive washing of the soil. Concerning the Elbe basin under climate change, a notable decrease is visible in the northern and south-eastern parts of the basin, whereas they are less pronounced in the central part, so that in conclusion, the impact of climate change on diffuse pollution from agriculture is positive.

The overall result of the study by Krysanova et al. (2005) is that the mean water discharge and the mean groundwater recharge in the Elbe basin will most likely decrease, and diffuse pollution will be diminished, but the uncertainty in hydrological and water quality responses to changing climate is higher than the uncertainty in climate input. The hydrological and water quality responses and the propagation of uncertainty differ in three Elbe sub-regions – the mountainous area, the loess sub-region and the lowland area. In another study, Krysanova et al. (2006) concluded that by now, the changes in socio-economic systems[3] have had a stronger impact on regional water resources than climate change. However, the impacts of climate change on water resources in the Elbe basin are likely to increase in the future (Krysanova, Kundzewicz et al. 2006).

With regard to adaptation needs for climate change impacts, the Elbe basin mainly needs to cope with an increasing frequency of extreme events in form of floods and severe droughts. Also the increasing uncertainties linked to these events require new adaptation strategies (q.v. Becker and Grünewald 2003).

One important and often cited example of an extreme event in the Elbe basin are the disastrous floods in August 2002, which have shifted general attention to the flooding problem.

[3] Human activities in the basin such as industry, agricultural land use and municipal water use have undergone severe structural changes since the political and economic transition from a socialistic and centrally planned system to democratic systems with market economy.

Different organisations are dealing with the management of the Elbe on different levels. The main organisation on river basin scale is the International Commission for the Protection of the Elbe (ICPE), which is composed of Germany and the Czech Republic as main contracting parties and Austria and Poland as well as further organisations, e.g. different NGOs and the ICPR[4], as observers. The ICPE issues recommendations for river basin management; its main goals are to improve the status of the Elbe and its main tributaries, and to increase the ecological value of the Elbe valley (www. ikse-mkol.org). Moreover, the basin states agreed upon the coordination of the WFD implementation under the roof of the ICPE.

On national scale in Germany, the Federal Ministry for Environment, Nature Conservation, and Nuclear Safety (*Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit* - BMU) is the highest authority for water policy and management. Supplementarily, the Federal Environmental Agency (*Umweltbundesamt* - UBA) as the scientific authority for environmental issues reports to the Federal Ministry for the Environment. Due to competencies laid down in the German constitution, mainly the *Länder* (federal states) are in charge of the implementation of water law and water management issues. Ten out of the sixteen German *Länder* are located within the Elbe basin.

Within the *Länder*, the ministries dealing with water management as well as the respective state agencies play a major role in managing the Elbe. The state agencies act as technical and scientific departments for the ministries of environment and/or agriculture in the specific *Land*. In 2004, the ten *Länder* in the basin and the federal government of Germany established the River Basin Community Elbe (*Flussgebietsgemeinschaft* Elbe – FGG Elbe) in order to coordinate the German part of the WFD implementation. The aim of the FGG is to establish a systematic and mutually agreed programme of activities and measures for the German part of the Elbe basin (see www.fgg-elbe.de). Even though the FGG has no formal decision-making power, its technical guidance for the cooperation between the German *Länder* is widely acknowledged (Borowski 2004; Raadgever 2005, 7). Further organisational structures like the ARGE Elbe

[4] International Commission for the Protection of the Rhine.

(Arbeitsgemeinschaft zum Schutz der Elbe) which had a similar standing in the German Elbe basin earlier are decreasing in importance and thus not further taken into account here.

3. Methods and empirical background

The paper draws on empirical data gained from eleven in depth interviews with representatives from different organisations at international, national and sub-national levels. The particular experts were chosen within the German Elbe basin in order to elicit knowledge and obtain opinions of different groups concerned with the question of institutional adaptation.

Figure 2 shows the choice of experts reflecting different levels and governmental as well as non-state actors. Besides the international and German national level, also representatives of three German *Länder* were chosen. They either belong to the ministerial level or to state agencies.

Further, three non-governmental actors, namely the German Farmer's Association, the Federal Expert Committee "vital rivers" (BFA "Lebendige Flüsse") and the Munich Re Group (Münchener Rück) were interviewed. The agricultural associations constitute the non-governmental representation of regional or local agricultural interests. The BFA "vital rivers" is an expert group of the German Society for Nature Protection (NABU), an environmental NGO. The Munich Re Group is a German counter insurance company, which has no direct link to the Elbe basin but years of experience on adaptation to climate change in water management. All interviews were conducted during spring 2007, making use of a pre-defined interview guidance. They were conducted in a semi-structured way, leaving open the possibility for closer examination of aspects perceived to be central for the interview partner. The interviews were then evaluated using an analytical framework developed beforehand (see section 4). The Appendix gives more detailed information on the interviewed experts.

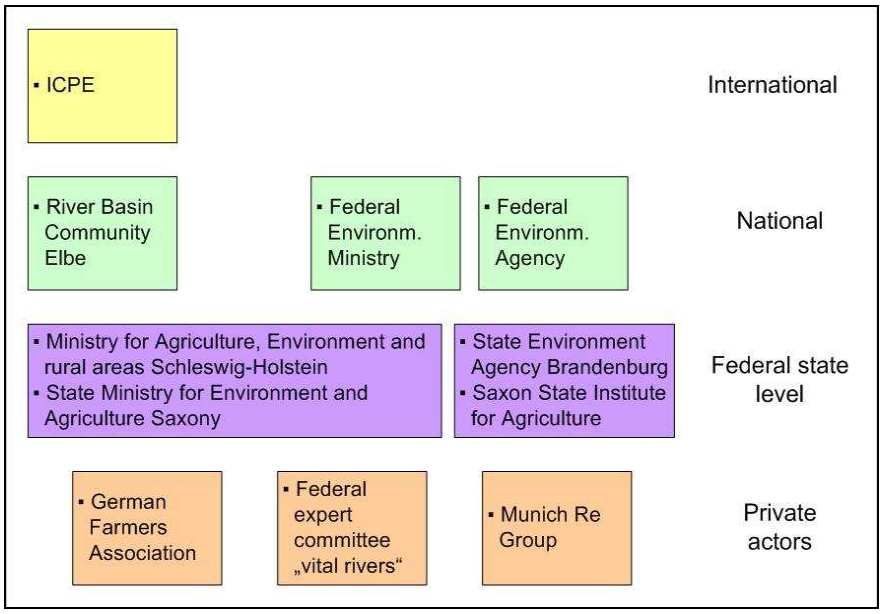

Fig. 2: Organisations from which experts were interviewed for the study

4. Elements of adaptive institutions: an analytical framework

In order to investigate institutional adaptation in river basin management, a framework is needed that provides a guiding structure for the analysis. Based on literature of both, institutional adaptation in general and adaptation research on climate change, we identified five main elements, namely information, collaboration, flexibility, experimentation and enabling background conditions, which form the central part of our analytical framework. Main structuring elements are especially derived from Huitema et al. (in review). We use our framework as a heuristic to analyse the current characteristics of the institutional adaptation in the Elbe

basin and to identify potential needs for improvement. The five elements are closely linked in practice and were separated for the purpose of analysis.

4.1 Information

The first element of adaptive institutions refers to information. Adaptation often has to take place within unknown future developments and the uncertainties involved refer to various issues such as, for example, the precise nature and risks of climate change, the benefits of adaptation, and the impacts on the social and economic system (Adger et al. 2005, 81). As a general definition, uncertainties in adaptation to climate change refer to situations "in which there is not a unique and complete understanding of the system to be managed" (Brugnach et al. 2007, 3). According to Brugnach et al. (2007, 5 et seqs.) uncertainties can occur due to the unpredictability of complex systems and their variable and non-linear behaviour, and/ or due to incomplete knowledge, when information and/ or data about a system are insufficient or unreliable, and/ or finally due to multiple knowledge frames, where understandings about a system are different and sometimes even conflicting.

Concerning the institutional dimension of uncertainties in climate change, Dovers (2001, 217; 2003, 9) points out that richness and sensitivity of information on the issue at stake are vital to keep institutions adaptive. Moreover, Stern (2007, 413) highlights the specific role of governmental actors in encouraging the adaptation of non-state actors by addressing knowledge uncertainties.

4.2 Collaboration – Collective action and social learning

The element of collaboration refers to three aspects: polycentric governance, participation of non-state actors, and sectoral integration.

4.2.1 Polycentric governance

In contrast to monocentric or hierarchical systems, polycentric governance consists of different centres of management and control (Ostrom 2001, McGinnis 1999). Ostrom (2001, 2) describes polycentric systems as being the "organization of small-, medium-, and large-scale democratic units that each may exercise considerable independence to make and enforce rules within a circumscribed scope of authority for a specific geographical area." These units may be located on different geographical levels and can be either general purpose-authorities or specialised authorities with specific tasks (Hooghe and Marks 2003). Polycentric systems have different advantages. They promote experiments within small-scale units and allow taking advantage of local knowledge, to include trustworthy participants, to rely on disaggregated knowledge, to develop better-adapted rules, and to lower enforcement costs (Ostrom 2005). Further, they have a better capacity to cope with external shocks, are more robust, and possess considerable redundancy due to the capacity of subunits to respond to, and learn from the experiences of other subunits (Ostrom 2001). Externalities can be internalised easier by dealing with issues at the most appropriate geographical level. One level of such a polycentric system can be the river basin as the hydrological scale of water management. Co-ordination and collaboration between the different spheres of authority are essential for polycentric systems to be effective. In this context, boundary spanners (Roberts and King 1996) – individuals or collectives who connect centres, levels, and sectors – are pivotal for the co-ordination of the individual units.

4.2.2 Participation

Participation of non-state actors, either as stakeholders or as civil society in general, has a decisive role in institutional adaptation. There are various reasons for public participation. Crabbé and Robin (2006, 125) point out three important reasons in the context of adaptation to climate change: first, stakeholders in particular can provide information to close data gaps, second, involvement enhances the prospects for consensus, and finally, participation can support the understanding for the significance of climate change, its impacts, and the need for adequate action (see also Ostrom 2005). Likewise, on the one hand, non-state actors on this scale might have stronger incentives to react on climate change impacts (Stern 2007, 431)

and on the other hand, the authorities in charge will be dependent on the compliance of those actors who, ultimately, will be affected by the measures conducted at the local level. As demonstrated in different case studies, some experience in stakeholder involvement linked to adaptation to climate change impacts exists (Shackley and Deanwood 2003; Moser and Dilling 2004; van der Werff 2001). It is of utmost importance that participation takes place at an early stage, involving stakeholders in decision-making processes at different levels and centres of governance (see also Folke et al. 2002, 49).

4.2.3 Sectoral integration

Institutional response to climate change further demands for sectoral integration, for example, by involving the impacts of climate change in planning processes and macro-economic projections (Stern 2007, 432) and by adjusting institutional arrangements of similar policy issues to each other. Actual water resource regimes are characterised by sectoral fragmentation and limited integration, which are seen as a main reason for low adaptive capacity of these regimes (Pahl-Wostl 2007). A prominent example for the need to embed adaptation strategies within existing national policy and institutional frameworks is the claim to integrate climate change adaptation into the implementation processes of the WFD (EEA 2007; Pahl-Wostl 2007, 55). Particularly the six-year-cycle of the river basin management plans offers opportunities for such sectoral integration, where adaptation to climate change issues can – at least in the long term – be tackled. In this respect it is important that different governmental actors, such as representatives of ministries, interact and co-ordinate their efforts.

4.3 Flexibility

Other important elements of adaptive management are flexible and open institutions. Governance systems concerned with the development and preservation of resilience "need to be flexible and open to learning" (Folke et al. 2002, 52). Institutions should be able to change and to adjust to changing external conditions. This means that management procedures and

management structures might need adjustment to new (environmental) conditions or new (scientific) knowledge (Folke et al. 2002, 45). This is closely linked to the earlier mentioned elements of the framework and stresses the idea of learning from past experience. As the natural conditions in ecosystems change frequently, it becomes obvious that the social systems linked to them also need to be flexible and able to change.

"Flexible adaptation options reduce vulnerability to risks of climate change and variability and function in light of a range of climate conditions, not simply a particular projected condition. For example, a management strategy, such as crop choice, that reduces risks under a wide range of moisture and temperature conditions is more flexible than one that would produce exceptionally in a narrow range of conditions, but would be vulnerable to conditions outside that range" (Dolan et al. 2001, 18).

In the following we will especially focus on the capacity of organisational structures to cope with new challenges and their ability to change. We distinguish between structural flexibility, which stands for the creation of new structures, such as working groups, and functional flexibility, which is the ability to include new functions and goals into existing (organisational) structures. [5]

4.4 Openness and time for experimentation

As Folke et al. (2005, 462 et seq.) point out, "adaptive governance focuses on experimentation and learning". Openness for experimentation is hence of utmost importance in order for institutions to successfully adapt to climate change. Experimentation can be seen as a research methodology, but also as a management approach (see also Lee 1999). Experimentation as research methodology is the most commonly known form of experimentation. In water management, this can extend to experimentation

[5] Functional flexibility in the sense of Hempell et al. (2005, 3) means the ability to redeploy employees between activities and tasks by empowering workers with greater decision-making responsibility and assigning them a greater scope of diverse activities.

in icon sites, such as restoration areas along river stretches or in pilot areas, as used for specific questions of WFD implementation (EC/JRC 2005). These experiments aim at achieving knowledge about the system in order to then design optimal policies after testing different hypothesis on ecosystem response to different management interventions. Experimentation as a management approach (as followed in Huitema et al. in review) stresses that policy itself should be considered as a set of experiments (Folke et al. 2002, 52). In consequence, it is acknowledged that action is taken without perfect knowledge but on the basis of scenarios and likelihoods and with close monitoring of results. The important element here is that the management should subsequently be able to adapt to evaluation results and changing background conditions. Learning from the past is the important asset that comes with this approach. Such policy experiments are often discussed in conjunction with the idea of policy or social learning (also Folke et al. 2002, 47), which is also of great interest from the perspective of adaptive management (Huitema et al. in review). The concept of experimentation as a management approach stresses the idea that governance should allow for learning without foreclosing future development options (Folke et al. 2002, 9).

4.5 Enabling background conditions

The final element refers to background conditions and includes the availability of resources, the priority of adaptation to climate change in current working procedures and the general planning horizon that underlies these procedures. To establish adaptive institutions, sufficient resources in terms of labour, financial means, and time have to be provided (Dovers 2001, 217; Homer-Dixon 1999).

Moreover, if other policy problems have to be tackled more urgently, due to implementation deadlines or current public pressure, adaptation to climate change impacts might take a back seat in day-to-day work. Finally, the planning horizon of current organisational work has to be taken into account. Even though, strategies might also involve measures that are able to achieve success in short-term, climate change is a long-term policy problem that cannot be tackled within one legislative period. Hence,

adaptation also needs to involve long-term planning, which is sufficiently resourced to ensure a comprehensive response strategy to climate change (Dovers 2001, 217; Berkhout 2006, 142).

5. Institutional adaptation in the Elbe basin - Empirical results

For the investigation of current institutional adaptation in the German Elbe basin, interview partners were asked to describe the actual status of adaptation along the five elements explained above. Moreover, the interview partners were asked to suggest strategies for improvement of the current situation and to explain how they deal with uncertainties in some of the cases.

5.1 Information

Even though basic information on climate change impacts and on flood management is perceived as quite good, some interview partners highlighted concrete information gaps. Especially the aspect of droughts was not discussed for a long time [4]. Some interview partners require more precise information resulting from models, also concerning their predictability and their particular applicability for lower scales such as the regional level or local catchments [2, 6, 8, 9]. Other interviewees emphasised the need for more information on the causes of climate change, since it is virtually impossible to separate the impacts of climate change from other anthropogenic impacts [3, 11]. Current information on climate change in the Elbe basin is mainly based on the results of GLOWA-Elbe research, a German funded project conducted in the Elbe basin[6].

[6] See www.glowa-elbe.de

While the ICPE is a platform for data exchange on water management issues, it does not yet have the same function for exchange on climate change adaptation in the water sector [5]. This is also attributed to the fact that some of the *Länder* have only just started to deal with climate change adaptation. The same is true for related research: even though many organisations conduct or commission studies on water management [6, 9, 10, 11], only some interviewees referred to studies dealing with climate change impacts on water resources [10].

For some organisations, however, the work on climate change impacts is already part of their daily work [3, 6, 9]. Their representatives pointed out that both, water management and agriculture are used to that, as they always had to cope with short and long term climate uncertainties.

Concerning data uncertainties, the main approach in the Elbe basin backed up by many interview partners, is to accept the mentioned data uncertainties and to use the known trends of climate change as a basis for further action, rather than using data uncertainties as an excuse to wait for further action. Strategies for decreasing data gaps are mainly seen in a stronger cooperation between administration and science and an improved information exchange within existing networks, for example, by building up a more centralised data processing. Finally, many stakeholders see an important challenge in providing more information on adaptation to climate change to the broad public. Currently, public awareness in both the Elbe basin and in Germany mainly refers to mitigation strategies, while adaptation issues seem to remain a discussion between experts [6, 8, 10].

5.2 Collaboration and Collective Action

5.2.1 Polycentric governance

The interviewees largely agree that the current water management system in the Elbe basin is polycentric in nature, as it comprises different centres of management such as the ICPE or the FGG with a hydrological orientation, the different national and regional ministries and the new level of sub-catchment areas. Current collaboration within these organisational

structures is considered as positive in general: it is not ideal, but pragmatic [5]. The good relations are often attributed to the activities of the ICPE or the FGG Elbe. In order to face new challenges such as climate change adaptation, interview partners do not suggest to fundamentally change this system, but to improve the co-ordination within the existing structures [5], especially on river basin and federal levels [2, 10]. Better co-ordination is also demanded for basic areas such as funding or data exchange. The river basin commissions could act as boundary spanners and connect the different poles of action even more than today. But a need for better co-ordination within the federal structure is also perceived, as there is currently a difficulty to take action on a larger scale [2].

At the same time an encompassing reform of the distribution of competences is not desired, or considered as being unrealistic. Adaptation should only take place within the current system, especially by improving the co-ordination between the different scales. The EU should take a leading role and increase pressure on lower levels to adapt [5, 8]. This corresponds to the EEA 2007 survey, in which a need for EU level action was identified. EU activities could encompass a general framework for adaptation, monitoring and information exchange, as well as coordination between sectors and sectoral policies or educational measures. At the same time, countries reflected in the EEA report, stress the subsidiarity principle and emphasise that the implementation of adaptation measures has to remain the responsibility of the Member States to ensure that they can respond flexibly to the specific challenges in their countries (EEA 2007, 47).

The co-operation between science and administration is considered as positive by many interviewees [6, 9], the interviewee from the insurance company explicitly considers the insurance as one of the boundary spanners between science and political decision makers [8]. Some interviewees perceive a need to push the current discussion from the scientific and administrative levels towards the political level [1, 2, 6, 11]. Other interview partners urge that scientists working on climate change adaptation should take over the role of a service provider, developing tools and concrete recommendations for policy and administration. Science should not unsettle the general public with their “horror-visions” of climate change scenarios [2, 10].

5.2.2 Participation

While participatory approaches in river basin management and in particular within the implementation process of the WFD were not questioned by the interview partners, there was no consensus, whether the involvement of stakeholders and the broader public is a necessary strategy for climate change adaptation. Critical voices cautioned against overstraining stakeholders and highlighted that a sufficient number of experts are already available to deal with adaptation issues [3, 9, 10]. In contrast, proponents emphasised that a comprehensive adaptation strategy cannot be applied without the backing of stakeholders and the broader public [1, 6, 8, 11]. One should be open to include new stakeholders that emerge with the new issue of climate change adaptation [4]. It can be noticed that the first *Elbeforum* (on 28 and 29 of March 2007 in Usti nad Labem, Czech Republic), which had the aim to inform stakeholders about water management in the Elbe basin, did not include climate change adaptation on its Agenda [4, 5].

Nevertheless, some stakeholders in the Elbe basin are already very proactive and have developed own adaptation strategies [1, 8]. Yet, to achieve successful and broad participation, the dissemination of information on climate change adaptation has to be intensified. In particular the media could take a pivotal role in informing the broader public on adaptation to climate change, just as it already has in informing the public on mitigation strategies [8].

Currently, discussion on climate change adaptation is of special public interest, whenever user's interests are negatively affected (e.g. in terms of navigation, due to droughts or floods) [1, 11]. One important strategy for a better information flow from governmental to non-state actors has been established by the Federal Environment Agency in Germany (UBA). An information and cooperation platform called *KomPASS* was initiated as a new competence centre on climate change adaptation and also serves as an example for stakeholder involvement and information provision for the general public.

5.2.3 Sectoral integration with special emphasis on WFD and floods

Some stakeholders highlighted the current scientific and political discussion on sectoral integration of climate change adaptation and WFD implementation (q.v. EEA 2007; Pahl-Wostl 2007, 55) and urgently recommended a stronger interplay between the two [1, 2, 6, 11]. Particularly the six-year-cycles of the river basin management plans offer opportunities for such an integration, where adaptation to climate change issues can – at least in the long term – be tackled. Further links mentioned referred to a possible change of criteria concerning the status of reference waters, the cross cutting character of climate change in general and the connections between water stress and floods. Since flood management is not in the focus of the WFD, some interview partners expect especially the new European Directive on Floods to close this gap, since it explicitly refers to a combined river basin management plan for the implementation of both water quality and flood management [2, 6, 11]. Moreover, even though low water levels already are an issue in the framework of the WFD, discussions have to be focussed stronger on this issue in terms of climate change impacts and future management strategies [1, 2, 6]. In some areas of the Elbe basin, low water levels and droughts due to climate change are expected to have influence on navigation and agriculture in the long-term. Future discussions on water management need to take these changes into account [2].

Strategies for a better sectoral integration should take into account all relevant aspects of water management, including the WFD and climate change adaptation, as well as flood and drought management. They should also take into account different water uses and stressors, such as navigation and agriculture or thermal pollution, which are seen in close relation with climate change impacts. Possible measures need to integrate existing policies and initiatives respectively (e.g. Common Agricultural Policy or the Flora-Fauna-Habitat Directive) [1, 2, 6, 11]. Yet, it was also emphasised that sectoral integration and particularly the integration of climate change issues into the implementation process of the WFD will only be a first step, but by no means a sufficient adaptation strategy [2].

5.3 Flexibility

Most interview partners perceive the current organisational structures in general as being suitable to tackle climate change adaptation [also 10]. And if there was a need to change the structural setting, such a change would currently be rather difficult, as the current impacts of climate change are not quantifiable enough to reasonably justify encompassing structural changes [4].

Instead, some interview partners express their wish to make better use of existing water management structures for climate change adaptation [2, 5] and to integrate the respective discussions on other aspects such as flood management or agriculture [4]. Currently, there is no co-ordinated discussion on climate change adaptation on the level of the ICPE [2], it only takes place on lower scales, especially on *Länder* and federal levels.

At the same time it is suggested to bring about structural changes within the general system boundaries, for example, not to change the system structures themselves, but to create new structures in a flexible way, for example, in form of working groups. An example for this approach can be found in Saxony, where an integration of different water management aspects has taken place within one unit of the regional ministry. After an internal structural reform, the work on WFD implementation, floods and draughts as well as climate change adaptation are brought together in a single unit. This structural change was driven by an external auditor, who aimed at minimizing interfaces and at improving the workflow [10]. In this case, the general culture of the organisation seems to be an important factor. While some organisations aim for constant quality improvement and thus are used to changes, others have a more stabilised tradition. Other interviewees also reported to have created new working groups dealing with water management and climate change adaptation [for example 1, 7, 9]. The already mentioned initative of KomPASS serves as a link between decision makers in companies and administrations. To sum it up, we can say that structural flexibility exists within the general system boundaries, but a general structural reform is not suggested by the interviewees.

Functional flexibility, for example, the inclusion of the discussion on climate change in existing structures was also mentioned. Some interviewees reported a broadening of tasks in their water unit in order to

include climate change related questions [6,11] or linking it to existing foci, such as the discussion on biodiversity [1].

However, some interview partners indicated that they did not (yet) include climate change adaptation into their work, neither into existing, nor into new structural arrangements [3,5].

5.4 Openness and time for Experimentation

As to experimentation, interview partners report a large variety of experiments in the classical sense, for example, pilot projects or research related activities. This is especially true for the Eastern part of the German Elbe basin. For example, projects were initiated to get insights into the use of drought resisting plants and new irrigation technologies. Most of these experiments were conducted by federal state agencies and accompanied by scientists. In general, most interview partners perceive a need for more experimentation by allowing more labour and time resources for co-operation with science. There also still seems to be a need for scientific consultancy on climate change adaptation. Many interview partners stated that science should provide relevant guidance for water management practice. This request is by no means a new one. In a project conducted on the science/policy interface for climate change in the Netherlands in the beginning of the 1990s, policy makers clearly demanded that scientists should get more actively involved in the public debate by disseminating their knowledge in form of demonstration projects (Klabbers et al. 1996, 81 et seq.).

Besides the projects, which are accompanied by science, various pilot projects are finalised or on their way in the Elbe basin. These projects usually refer to the implementation of the WFD. One main institutional advantage is their co-operative setting. Being conducted within hydromorphological units of river catchments and basin districts, the projects usually involve governmental, as well as non-governmental actors from different federal states. Some of the projects explicitly focus on policy issues. Even though, these projects don´t have any reference to climate change adaptation by now, their experiences concerning other questions of water management can be drawn upon and partly transferred to climate change adaptation.

Interview partners differ in their support for more pilot projects. Some consider that the results of these projects, which usually refer to the implementation of the WFD, can be transferred to other *Länder* [7] or topics, but still the funding of such projects is not secured [7]. There are currently no pilot projects on climate change adaptation which would though be very useful [2]. Other interviewees hold the opinion, that there are already many pilot projects and that new ones might be less effective [4].

Contrarily to experiments in the classical format, management experiments are not as common. In general, management decisions are not considered as experiments by many decision makers, who instead perceive that structures and personal are not suitable for experiments. Instead, change in structures is often considered as optimisation [10]. Nevertheless, management experiments take place, for example, by launching a project group for a specific task as long as that task is of pivotal interest [10]. Though in practice, this is rather a reactive optimisation of structures than experimentation.

5.5 Enabling background conditions

Many interview partners highlighted the need for stronger political commitment to adaptation to climate change, for example, by showing more willingness to scrutinise current economic and land/water use structures. Currently, thinking in legislative periods and in WFD reporting time scales dominates political decisions and day-to-day work of the authorities in charge [5, 6, 7, 10, 11]. Though, also the WFD implementation can take into account climate change adaptation, especially in the management plans, which would then require a more long-term oriented planning [10].

Interview partners characterised the current situation of climate change adaptation in the Elbe basin as a short-term reaction and planning that mainly takes place in form of reacting to external drivers such as floods [1, 6, 11]. In consequence, the need for long-term planning horizons towards climate change adaptation and continuous action, which is not only linked

to strong external pressures, is claimed [1, 6, 7, 9]. The precautionary principle and no-regret measures are suggested as important elements for future developments [11].

Moreover, many interviewees found fault with financial, personal, and time resources to adequately tackle the challenges of climate change adaptation. In this context also more flexibility is needed in funding mechanisms [6, 7, 9]. Particularly actions towards tighter collaboration with both science and administrative actors at state and national scales demand more time and personal resources [6, 7]. Other studies on the Elbe basin also emphasised that implementation of measures towards climate change adaptation is slow due to lack of finances (Borowski 2004; Kliot et al. 2001). Only some organisations have managed to provide budget for future or less prioritised environmental issues [11]. Currently, resources are in particular concentrated on the WFD implementation. It is suggested to more clearly prioritise climate change on the Agenda which would also make available more funding opportunities for corresponding measures.

6. Conclusions and outlook

The work at hand pursued the aim to study the current institutional adaptation in the Elbe basin from the perspective of interviewed experts. While the framework used for the study is rather encompassing in its categories, we did not aim for a full picture of the situation in the basin but rather for a general overview. We only interviewed eleven experts and did not analyse the situation in the Czech part of the basin. Therefore, follow-up studies are needed that analyse the whole basin, take a broader empirical basis, and dig deeper into details.

Despite these restrictions, there are some general insights that can be drawn from the study. We were able to show that adaptation is still at an early stage in the German Elbe basin, while relatively high issue awareness already exists. This goes along with the analysis by Stern (2007), who states that in developed countries in general, progress on adaptation is still at an early stage, even though market structures are well developed and the capacity to adapt is relatively high (ibid., 418).

Remarkably, the information on and discussion about adaptation is behind discussions concerning climate change mitigation. However, at the

same time, adaptation strategies already exist on lower organisational scales of water management. The current co-operation structures for water management in the Elbe basin are polycentric, but there is a perceived need for better co-ordination of the different existing poles, corresponding to the concept of boundary spanners. The role of such boundary spanners could be taken over by the river basin commissions (ICPE or FGG) or on national level. More generally, guidance on adaptation is expected from higher levels, especially from the EU.

State actors consider adaptation mainly as an administrative or political task and see the state less often in the role of developing an enabling framework to encourage autonomous action by private actors. However, according to Stern, this would be a role that governments should take over. Stern emphasises the specific role of governments in establishing policy frameworks to encourage adaptation by private individuals and firms – in particular to address information uncertainties, ensure transparency of transactions, and tackle constraints that will reduce the capacity for autonomous adaptation (Stern 2007, 430 et seq.). While first steps in this direction are of course the information provided by governments, government could make further steps in that direction. It is remarkable in this context that the interviewed private actors are already proactively tackling the issue and aim at contributing to climate change adaptation on their own.

Sectoral integration is one of the central prerequisites for adaptation to climate change. It becomes obvious that many interviewees perceive the need to include further water uses and to diversify the topics of discussion in the Elbe basin. This was especially mentioned for aspects such as navigation, agriculture or thermal pollution.

Currently, the Water Framework Directive takes a major place in daily water management practice and in many cases priority is given to the implementation of the directive. The stringent deadlines set by the WFD are certainly one of the reasons for this. At the same time, the WFD implementation itself offers good opportunities to include measures for climate change adaptation, for example, by making use of the river basin management plans. Climate change aspects can be integrated if political will is sufficient.

Currently, thinking in legislative periods and thus short term oriented planning inhibits more action on institutional adaptation and can restrict options for an early integration of climate change adaptation into policies. Smit et al. (2000, 246) also mention that more urgent problems are posed by current weather variability and extreme events and that the rather short term deadlines of the WFD lead to rather short term planning.

Our study in the Elbe basin was elaborated on the basis of existing conceptual works on adaptation, which were combined and further developed to a new and individual analytical framework in order to study institutional adaptation. The proposed analytical framework is meant to facilitate the investigation of different cases. It is based on various approaches and studies on adaptation. Yet, within these studies, the categories and the terminology are by no means consistent. We aimed at providing a more consistent approach of classification that is particularly suitable in the institutional context of adaptation.

When applying the framework, some aspects for possible improvement already became clear. Partly it became apparent that the identified elements of adaptive institutions are not separated clearly enough and overlap. This is especially true for the elements of experimentation and flexible institutions. They intertwine widely in practice and the artificial separation in our framework could be reconsidered. At the same time other elements could be divided into smaller sections, as, for example, the element of collaboration, which encompasses three central sub-categories: polycentric governance, participation, and sectoral integration.

Depending on the setting, further aspects of adaptation might become new elements to investigate. One possible element would be leadership, which is currently being mentioned in close connection with political willingness and personal intentions.

From a practical perspective,, the framework at hand sometimes appeared to be relatively abstract. For example, it was not possible to communicate it fully to the interviewed experts.

The study at hand proved that the framework is applicable to the Elbe basin. In order to further improve the framework, its application to further case studies is necessary. In future research, the elements should also be better defined and broken down to measurable categories, which would of course go far beyond the study at hand.

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Appendix

Table 1: List of interview partners

The interviewees remain anonymous. The interview does not necessarily reflect the view of the respective organisation.

Cited number	Organisation	Day of interview
[1]	Bundesfachausschuss Lebendige/ Naturschutzbund Deutschland (BFA)	15.02.2007
[2]	Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (BMU)	13.03.2007
[3]	Deutscher Bauernverband	27.02.2007
[4]	Flussgebietsgemeinschaft Elbe (FGG Elbe)	26.02.2007
[5]	Internationale Kommission zum Schutz der Elbe (IKSE)	26.02.2007
[6]	Landesumweltamt Brandenburg	27.02.2007
[7]	Ministerium für Landwirtschaft, Umwelt und ländliche Räume Schleswig-Holstein	30.03.2007
[8]	Münchener Rückversicherung	15.03.2007
[9]	Sächsische Landesanstalt für Landwirtschaft Leipzig	22.02.2007
[10]	Staatsministerium für Umwelt und Landwirtschaft, Sachsen	13.03.2007
[11]	Umweltbundesamt (UBA)	01.03.2007