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Institutional design and regime effectiveness in transboundary river management – the Elbe water quality regime

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Abstract

The literature on transboundary river management suggests that institutions play an important role in bringing cooperation about. However, the knowledge on how they should be designed in order to do so remains limited. One way to learn more about adequate institutional design is to assess the effectiveness of existing regimes, and to trace the causal relationships leading to the respective outcomes. In order to gain further insights into the relationship of institutional design and regime effectiveness, this paper presents a study on the water quality regime of the International Commission for the Protection of the Elbe (ICPE). The analysis is based on a review of pertinent documents and ten qualitative interviews with Czech and German Commission members and NGO representatives. Particular emphasis has been put on determining the ICPE's specific contribution and the no-regime counterfactual as well as on the perceived expedience of the institutional arrangements.

The study shows that overall due to external as well as internal institutional factors the ICPE proved relatively successful, and as such it also provides insights into how institutions matter: The commission served as platform for joint problem solving by identifying priorities for action. These international obligations increased the power of national administrations and their access to funds. At the same time, the Commission's reporting to the public served as an enforcement mechanism. However, the ICPE's contribution towards achieving the various goals varied significantly between the different areas of activity. It was high where the main responsibility for action was with the public authorities, such as in the area of wastewater treatment and the establishment of an international alarm plan and model. It was practically non existent in the reduction of non-point pollution from agriculture, where the success depended on the behavior of individual private actors (farmers). From a methodological point of view, the paper shows opportunities and limits of a combined quantitative and qualitative approach in determining regime effectiveness.

1 The problem

In recent years, a discourse on conflict and cooperation in the management of international transboundary rivers has emerged (Gleick, 1993; Rogers, 1993; Barrett, 1994; Waterbury, 1994; Bernauer, 1997; Wolf, 1998; Marty, 2001; Zeitoun and Warner, 2006). In this context Wolf et al. (2003) suggest that institutions are an important explanatory variable for cooperation. But they do not tell us how institutions should be designed in order to bring cooperation about. While some progress has been made on explicating the conditions under which the formation of international water institutions or regimes can be expected (Durth, 1996; Marty, 2001; Lindemann, 2006; Dombrowsky, 2007), little is known about adequate institutional design (Bernauer, 1997). One way to learn more about adequate institutional design is to assess the effectiveness of the respective international regime and to trace the underlying causal effects (e.g. Underdal, 1992; Bernauer, 1995; Helm and Sprinz, 2000).

In general, studies on the effectiveness of international water regimes are rare (Bernauer, 2002). An exception in this context is the 1987 Rhine Action Program of the International Commission for the Protection of the Rhine (ICPR) which has been hailed as a success story of international river cooperation (Bernauer and Moser, 1996; Durth, 1996; Gurtner-Zimmermann, 1998; Holtrup, 1999; Verweij, 2000). However, even in the case of the Rhine the relationship of institutional design and outcome is not entirely clear. For instance, Bernauer and Moser (1996) point at the fact that much of the success can be attributed to national level activities. And Gurtner-Zimmermann (1998), who explicitly studied the effectiveness of the Rhine Action Program, did not relate the outcome to the institutional set up. This indicates that further research on the relationship of institutional design and regime effectiveness is warranted, even for the Rhine, but in particular beyond this river basin.

In order to gain further insights into the relationship of institutional design and regime effectiveness, this paper presents a study of the water quality regime of the International Commission for the Protection of the Elbe (ICPE). The Elbe has been selected,

as the Elbe regime draws heavily on the Rhine model (Holtrup, 1999). However, it can be argued that cooperation takes place under less favorable conditions in the sense that two riparian countries of unequal economic strength cooperate. As such, the Elbe can be considered as a test case whether it was possible to transfer the Rhine model to more asymmetric conditions. Also, the literature on the ICPE remains sparse, and to the knowledge of the author a rigorous study of the effectiveness of the ICPE water quality regime has so far not been carried out. The study looks at the period 1990–2004/5, before the substantive implementation of the European Union Water Framework Directive (WFD) in the Elbe Basin and the reform of ICPE, in order to assess the effects of voluntary cooperation mechanisms (for an assessment of the effects of the WFD on international cooperation in the Rhine and Elbe Basins, see Möllenkamp in the same volume).

Against this background, this study seeks to contribute to the literature on transboundary water management by asking for the expedience of the transboundary institutional arrangements in the Elbe basin based on an effectiveness analysis and the tracing of the causal relationships that led to the respective outcomes. Section 2 will introduce into the underlying theory and methodology. Section 3 will introduce into the Elbe water quality regime. Section 4 will analyze the effectiveness of the Elbe water quality regime. Section 5 will explain the outcome and Sect. 6 will draw conclusions.

2 Theory and methodology

2.1 Measuring and explaining regime effectiveness

One way to determine whether the institutional design of an international regime proves to be adequate is to assess its effectiveness. In this context, institutions can be understood as the formal and informal "rules of the game" (e.g. North, 1990). The term international regime refers to the "implicit and explicit principles, norms, rules, and decision-making procedures around which actor's expectations converge in a given

area of international relations" (Krasner, 1983). Thus, a regime is constituted by institutions.[1]

Generally spoken, a regime can be understood to be effective if it solves the problems it addresses (Haas, Keohane, and Levy, 1993; Young and Levy, 1999). Therefore, in order to assess effectiveness, a first step would be to determine whether the goals of the regime have been met (measuring the outcome) (Underdal, 1992). In the case of transboundary water, this could be done by measuring whether certain water quality targets have been met. However, often it may be difficult to measure the outcome of a regime, for instance because there may be a time lag between certain activities and changes in the environment. In this case, a first approximation towards measuring effectiveness is to measure compliance (e.g. Chayes and Chayes, 1993), i.e. whether the respective actors adhere to the rules they set up and delivered the promised action (measuring output) (Underdal, 1992). However, compliance is not a sufficient condition for effectiveness, as a high level of compliance may not necessarily translate into a high level of effectiveness. As Downs et al. (1996) point out, often it may be easy for states to comply as the respective international agreements do not ask them to make substantial contributions towards the cooperation problem.

Conversely, even if the respective goals have been met and the underlying problems been solved, still the question is whether a causal link exists between the international regime and the respective outcome. The reason is that other (external) factors, such as measures taken at the national or sub-national level regardless of the international regime in place or changes in production may have contributed towards the achievement of the respective environmental goals. Therefore, we may distinguish institutional design and external factors in explaining regime outcomes.

Against this background, the so called Oslo-Potsdam solution towards measuring

[1] Furthermore, an analytical distinction is usually drawn between institutions and organizations, where organizations refer to the "players of the game" pursuing a common goal (North, 1990). This notwithstanding, also organizations are constituted by rules. While they are constituted by rules, as a whole they are more than institutions.

effectiveness identifies two benchmarks against which the actual performance (AP) of an international regime can be measured, first the collective optimum (CO) and second the no regime counter-factual (NR) as illustrated in Fig. 1 (Underdal, 1992; Helm and Sprinz, 2000; Hovi, Sprinz, and Underdal, 2003).

The collective optimum (CO) may again be defined in different ways (Young and Levy, 1999). It could be argued that the collective optimum is achieved if the respective goals are met. Furthermore, from an economic perspective, the collective optimum would be achieved if the net gains of cooperation were maximized (cost efficiency) or if certain goals were met at least costs (cost effectiveness). One could also ask if the goals are achieved in a fair manner (Bernauer, 1995; Young and Levy, 1999). From a methodological point of view, it will usually be more demanding to determine whether the respective goals are met in an efficient and fair manner than just asking for goal achievement. In this study, we will assume that the goals set by the actors involved represent the "collective optimum", and for methodological reasons (especially the monetarization of the benefits of an improved state of the environment) we will abstain from a cost-benefit analysis.

The no regime-counterfactual (NR) is the hypothetical state of the world that would have occurred if no regime had been put in place. In the language of game theory, it can be understood as the non-cooperative solution to an international cooperation problem that would follow from the uncoordinated choices of each actor's best reply to the strategies of the other actors (the so called Nash solution). Measuring the no regime counter-factual is particularly challenging. One way is to trace in depth the causal effects that led to actual performance. Another may be to build scenarios, starting with the state of the world that existed before the regime and asking for the consequences that would have flown from the previous "rules of the game". A third strategy would be to study a large number of comparable cases with and without a regime in place. However, in the case of transboundary water management the latter strategy is likely to fail due to the fact that we deal with many explanatory variables and relatively few comparable cases. Therefore, in this study we will mainly follow the first strategy by

tracing the causal relationships and by asking how the international regime contributed towards actual performance. Based on these relationships values for the no-regime counterfactual will be assessed.

On the basis of actual performance (AP), the no-regime counterfactual (NR) and the collective optimum (CO), the effectiveness score E with $0 \leq E \leq 1$ can be defined as indicated in Fig. 1. It allows bringing the regime's actual contribution over and above what would have happened in the absence of the regime (AP-NR) into relationship with its best possible contribution (CO-NR). A value of E close to 0 indicates a low level of effectiveness, whereas values of E close to 1 indicate a high level of effectiveness. One advantage of E is that it allows for the comparison of different international regimes.

2.2 Data bases and approach

The analysis is based on two sources of information, first relevant documents by the ICPE, and second expert interviews. The ICPE does not only publish its action programs, but also regular progress reports on its implementation as well as other environmental and geographical background data. This information was reviewed and evaluated.

In addition, expert interviews were carried out. The interviews were of a semi-structured nature on the basis of a standardized questionnaire. The interview partners were first asked to score the level of overall goal achievement and to explain their scores. In a second step, they were requested to score the achievement of objectives in the different areas of activity, and to outline how the ICPE had contributed towards achieving the objectives in order to assess the no-regime counterfactual. In a third step, they were asked to assess the expedience of the institutional design. As such, the information provided allows approaching the question of institutional design from two angles, from the point of view of regime effectiveness and through a direct evaluation of the institutional design.

In order to get "insider" views from the two riparian states, interviews were conducted with three representatives of each the Czech and the German ICPE delegation: heads

of delegation or working groups and members of the working groups on Action Programs and on Ecology, the main working groups in charge of the action programs. In addition, a representative of the ICPE Secretariat was interviewed. The secretariat can be considered as a "neutral" insider with in depth information on the progress achieved. In addition to these insider perspectives, two German and one Czech NGO representatives were interviewed in order to gain an outsider view, as they had not been involved in the definition of the activities prior to 2004. In the Czech Republic it was only possible to identify one NGO representative dealing with transboundary waters. The person did not feel to be in a position to come up with scores given that she had only recently got involved in the topic. The interviews were fully transcribed and a content analysis was carried out.

Thus, the study combined qualitative and quantitative methods. While a higher number of interviewees would have been desirable for the statistical analysis, the number was consciously restricted in order to be able to carry out in-depth interviews which inter alia allowed for explanations of the scores provided. Also, it appears that the number of individuals who are acquainted with the various components of the Action Programs remains limited and in that sense it is questionable whether a higher number of participants had significantly changed the picture.

3 The Elbe water quality regime

The Elbe River is shared by four countries Germany, the Czech Republic, Austria and Poland; however, more than 99% of the basin area of 148 268 square kilometers (km^2) is located in Germany and the Czech Republic, with shares of 65.5% and 33.7% respectively (IKSE, 2005a) (see Fig. 2). Within Germany, the river basin extends over ten of the sixteen German States (Länder).

Historically, the first issue given rise to transboundary cooperation in the Elbe river basin was navigation and maintenance of the river bed, with a first treaty in 1811 (McCaffrey, 2003). After the Second World War, water-related cooperation between West

Germany on the one side, and the German Democratic Republic and the Czechoslovak Socialist Republic on the other, was largely inhibited by the cold war (Durth, 1996). At the same time, rising pollution problems increased the tension between the riparian states. By the end of 1980s, the Elbe was one of the most heavily polluted rivers in Europe (IKSE, 1991b). The situation of non-cooperation changed rapidly after the fall of the Berlin wall, and as early as in October 1990, Czechoslovakia, the freshly reunited German Federal Republic and the European Community founded the International Commission for the Protection of the Elbe (ICPE).[2]

The convention aims at the prevention of the pollution of the Elbe and its drainage area, and at a reduction of the pollution of the North Sea. It is explicitly not concerned with fisheries and navigation. The geographical scope of the ICPE extends over the drainage basin in the Czech Republic and Germany. The detailed objectives of the ICPE are:

1. to enable use to be made of the river, in particular the obtaining of supplies of drinking water from bank-filtered waters and the agricultural use of the waters and sediments;

2. to achieve as natural an ecosystem as possible with a healthy diversity of species;

3. to reduce substantially the pollution of the North Sea from the Elbe area.

In order to achieve these objectives, the ICPE prepared two action programs, the First Action Program (fast-track program) 1992–1995 (IKSE, 1991a) and the Elbe Action

[2]Convention between the Federal Republic of Germany and the Czech and Slovak Federal Republic and the European Economic Community on the International Commission for the Protection of the Elbe, Magdeburg, 8 October 1990. Since the rescission of the Slovak Republic in 1994, the members of ICPE were the Czech Republic, Germany, and the European Community. With the accession of the Czech Republic to the European Union in May 2005, the European Union withdrew from the treaty. Austria and Poland only have observer status. They are however fully involved in ongoing efforts to implement the WFD in the basin.

Program 1996–2010 (IKSE, 1995b). The First Action Program foresaw the construction of 139 sewerage treatment plants in the basin and the reduction of the concentrations of 15 industrial priority substances by 30%. The 1995 Elbe Action Program drew up a comprehensive program of measures in seven areas of activity: (1) municipal wastewater treatment, (2) industrial wastewater treatment, (3) reduction of agricultural non-point pollution, (4) reduction of pollution from contaminated sites and landfills, (5) improvement of fish migration, (6) establishment of protected areas and improvement of morphology, and (7) the prevention of accidental pollution. In addition, in 2003 the ICPE concluded an Action Plan on Flood Control (IKSE, 2003a).

The organizational structure of the ICPE consists of:

- the Commission (3 delegations of up to 5 members each plus experts) and its President;
- a Coordination Group;
- the Secretariat at Magdeburg for the preparation, implementation and support of the commission's work; and
- different, changing Working Groups and Sub-Working Groups, consisting of delegates or experts appointed by each delegation.

The decisions by IPCE are taken by unanimity. They are recommendations to the member states and not legally binding (Epiney and Felder, 2002: 82; Reinhardt and Caßor-Pfeiffer, 2006: 17). Each party bears the costs of representation and investigations in its territory. The contributions to the costs of the secretariat are allocated as follows: Germany pays 65%, the Czech Republic 32.5% and the EU 2.5%. In order to monitor progress, the commission provides the parties with regular progress reports. No formal provisions are made on enforcement and dispute settlement.

4 Measuring the effectiveness of the Elbe qater quality regime

4.1 Achievement of overall goals

4.1.1 Achievement of ICPE target values

In order to monitor the achievement of its goals, the ICPE has developed desirable target values for a list of priority substances. They are not legally binding on member states, and apparently there is no temporal commitment by the member states to achieve these targets. They are used as orientation to evaluate the status quo and, as suggested by an interviewee, were themselves the results of a bargaining process and represented compromise values.

The target values are being measured at the three gauging stations: Schmilka/Hensko at the Czech-German border, Schnackenburg at the previous German-German border and Seemannshöft in the delta area (see Fig. 2). No target values were specified for Goal 3, the protection of the North Sea. Depending on the use, goal achievement is being measured for selected substances in the water or the sediment phase as indicated in Table 1 (IKSE, 1998: 7, Annex 2). It summarizes the goal achievement for the year 2004 and lists problematic substances (IKSE, 2005b: 25 and Annex 1).

With respect to Goal 1a, the use of Elbe water for drinking water production, fisheries and irrigation, the level of achievement is relatively high, as 18 out of 26 priority substances were met at all three gauging stations. In addition, three of the eight substances above target, namely total Nitrogen, total Phosphorus and Hexachlorbenzene, were close to target. Furthermore, Mercury, AOX and EDTA were only significantly above target at Seemannshöft which appears to be a recent development. With respect to Goal 1b, the use of Elbe sediments in agriculture, the level of achievement is low as only two of twelve substances were met at all three measuring stations. Also with respect to Goal 2, the protection of aquatic ecosystems, only a minority of target values, both in the water and the sediment phase, were met at all three gauging

stations. (In the water phase, two of the sixteen substances above target, namely chemical oxygen demand and nitrogen, were close to target.)

Thus, overall, it can be argued that based on the ICPE indicators, the level of goal achievement is relatively high with respect to Goal 1a, but further efforts will be needed to improve the quality of sediments for their use in agriculture (Goal 1b) and to achieve a water and sediment quality that is satisfactory for the maintenance of aquatic ecosystems (Goal 2).

4.1.2 Expert scores

Given the difficulty to capture complex goals by chemical indicators, in a second step, the interview participants were asked to evaluate the achievement of the three goals on a scale of 0 to 10 and to explain their rating. Table 1 lists the average scores given in the interviews and the main explanations provided.

Overall, Goal 1a received the highest scores with an average of 7.3 and Goal 2 the lowest with an average of 6.3. The average score for Goal 3 was 6.5. With respect to the scores, two main observations can be made. First, the scores differed significantly among the experts. The reason can at least partly be found in the explanations which reflect that the participants had at least sometimes different perceptions of what needed to happen in order to meet the different goals.

Second, given the differences in the achievement of ICPE target values between Goal 1a and Goal 2 discussed in Sect. 4.1.1, it is interesting to note that the average scores for Goals 1a and 2 are not far apart from each other with averages of 7.3 and 6.3 respectively. The participants were obviously more optimistic with respect to the level of achievement of Goal 2 as one would have expected on the basis of the objective measurement. A possible explanation is that overall the state of the ecosystems in particular at the Middle Elbe is being considered as quite satisfactory, despite a mediocre sediment quality. Another explanation is that the commission members did not want to score their achievements too badly, however, also one NGO representative gave a score of 7. It is also noteworthy that none of the participants actually referred

to the ICPE target values in their evaluations.

Based on the two assessments, it can be concluded that the level of achievement is fairly high with respect to human uses of the river water, however, that the water and sediment quality still needs to be improved to allow for the reuse of sediments and to protect ecosystems and the North Sea. There is, however, some discrepancy between the indicator-based and the experts' evaluation of the state of the Elbe ecosystems in the sense that experts were more optimistic with respect to the state of the aquatic ecosystems than one would have expected on the basis of the chemical analysis.

While overall the level of goal achievement may be considered as medium to high, this does not yet explain whether the ICPE has actually contributed towards achieving these goals. Therefore, in Sect. 4.2 the compliance with measures will be analyzed.

4.2 Compliance with action program measures

In order to determine compliance with planned activities, it was analyzed whether the measures provided for in the First Action Program and the Elbe Action Program had actually been carried out. This analysis was based on the respective ICPE progress reports (IKSE, 1995a; IKSE, 1998; IKSE, 2000; IKSE, 2003b; IKSE, 2005b). The findings are summarized in Table 2.

In most areas of activity, the member states show high to very high levels of compliance. The only exceptions are fish migration and the delineation of protected areas and the improvement of the river morphology where the 2004 level of compliance can be considered as low to medium. However, it should be noted that activities in these areas are still ongoing until 2010.

Thus, overall the level of compliance can be considered as high. However, this does not yet explain whether this actually contributed towards achieving the overall goals. Therefore, in Sect. 4.3 the actual performance and the no-regime counter-factual will be assessed for each area of activity of the 1995 Elbe Action Program.

4.3 The effectiveness of the Elbe Action Program

In order to assess the current level of effectiveness of the Elbe Action Program (1996–2010), an attempt was made to come up with numerical values for the actual performance (AP) and the no regime counter-factual (NR) in each area of activity; the effectiveness scores were then calculated.

4.3.1 Actual performance

In order to determine actual performance, the participants were asked to score the level of objective achievement in the different areas of activity. The average scores and the main explanations provided are shown in Table 3.

Average scores are high (above 8) with respect to the reduction of pollution from municipal wastewater and the prevention of accidental pollution. This was somewhat expected given the high level of compliance in these areas. But also for most other areas, namely abatement of industrial pollution, delineation of protected areas, improvement of fish migration and abatement of pollution from contaminated sites the average scores are fairly high, notwithstanding lower levels of compliance in some of them. The only area where the level of achievement is being considered as very low is the abatement of agricultural non-point pollution – despite high levels of compliance.

Similar to the scores for the overall goals, the evaluations differed among the participants, although not as much as with respect to overall goal achievement. When analyzing the explanations provided, it becomes clear that the participants again used different reference points for their evaluation. A potential explanation is that the Elbe Action Program only specifies planned activities in each area of activity but does not explicitly state objectives. Hence, when asked to score the achievement of objectives in the various areas some participants referred to the planned measures and others to the perceived overall objectives in the sector.

Despite the relatively low number of experts interviewed, for the sake of illustration, in the following the average scores will be used to reflect the actual performance (AP_P)

of the Elbe Action Program on a scale from 0 to 10.

4.3.2 Specific ICPE contribution and no-regime counterfactual

In order to assess what would have happened if the ICPE had not been in place, the participants were asked to identify what the specific ICPE contribution had been in the different areas of activity. The findings are summarized in Table 4 and discussed below for the different areas of activity as these explanations are important to understand how the ICPE works and how the institutional arrangements come into play.

In the area of the reduction of pollution from municipal wastewater, the main activities were the construction and extension of a list of priority wastewater treatment plants in the Elbe basin. It was argued that by defining an international list of priority action, the ICPE facilitated access to EU and national funds in a situation where different economic sectors competed for structural funds and other financial resources. Furthermore, the regular publication of progress reports by the ICPE created pressure on the respective administrations to report progress and thus to monitor implementation closely.

In order to reduce the discharge of priority substances from industries, lists of the emissions of major emitting industries were regularly published. Furthermore, minimal requirements were defined for the treatment of wastewater in different branches of industry. According to the interviewees, the main contribution by the ICPE was the joint publication of the lists of major emitting industries. The idea was to point out the "bad guys", but to do it jointly, not one state against the other. Furthermore, the monitoring created pressure on administrations to identify and deal with the main dischargers in order to be able to report progress. It is, however, unclear to what extent the ICPE publications had direct impact on these companies. Also, the effect of the definition of minimal requirements remains uncertain. In Germany, these standards applied anyway. Apparently they had some effect on the legislative process in the Czech Republic.

In order to reduce the discharge of nutrients and pesticides from non-point sources in agriculture, the member states compiled recommendations for good practice and for different types of measures. However, they did not commit themselves in the action

program to carry out specific activities on the ground. As such, the ICPE's impact remained negligible or minimal. The interviewees argued that the ICPE (and national governments) had no instruments to influence or control farmers. This notwithstanding, it was argued that it had been correct to include the abatement of agricultural non-point pollution in the Elbe Action Program and that the ICPE had contributed towards putting the topic on the agenda. Those who gave a higher score believed that some improvements had taken place, albeit due to other programs or measures.

The main ICPE activity with respect to the reduction of pollution from contaminated sites and landfills was to identify relevant sites and to monitor planned and ongoing rehabilitation measures. The participants concurred that this was no primary activity area of the ICPE and that its contribution was minimal and limited to prioritize action, but it did not initiate any new activities.

In order to improve fish migration, the ICPE identified several measures in Germany and the Czech Republic until 2010. The first priorities were to realize fish passes at Geesthacht in Germany and at the weir Stekov at Ústí n.L. in the Czech Republic. While these and a few others have been realized, other measures in tributaries still need to be addressed. Overall, the ICPE contribution is seen as intermediate. While several respondents believed that the ICPE contributed towards the realization of the fish pass in Geesthacht, another interviewee argued that it was mainly promoted by the ARGE Elbe, the working group of the German Länder on the Elbe. The completion of Geesthacht did, however, increase the pressure on the Czech Republic to move ahead with its program, and according to one interviewee the first fish pass in the Czech Republic was built with "direct and indirect" support by the ICPE.

The ICPE also identified the potential for the creation of a number of protected areas as well as several measures to improve the morphology of the river and its tributaries in the two countries. The accounting for these measures in the ICPE progress reports remains a bit opaque. While major protected areas such as the UNESCO biotope reserve "River Landscape Elbe" which extends over 400 river kilometers and the Czech national park Bohemian Switzerland were realized, other activities still need

to be addressed. Also, there is not much progress on morphology. According to the interviewees, activities were mainly driven by the states, but compiled and coordinated by the ICPE (such as the preparation of maps). They argued that the ICPE was the only institutions taking a basin-wide perspective, thus "putting local egoism into larger perspective". Again this is believed to have accelerated the process. It was pointed out that in the Czech Republic, the opportunities were limited and it remained difficult to attribute activities to the ICPE or other forces.

In order to prevent accidental pollution, the ICPE developed an international warning and alarm plan and model, developed recommendations on accident prevention at company level and in flood-prone areas and published a list of potentially hazardous plants. In general the interviewees agreed that this is an original activity area of transboundary water cooperation and that the contribution of the ICPE was high. However, some respondents pointed out the fact that there might still be a certain gap between theory and practice. A cyanide accident at a company in the Czech Republic in January 2006 demonstrated problems in the application of the respective instruments by the company and within the Czech administration. On the other hand, there was a successful prevention of an oil spill in the Czech Republic in March 2006.

On the basis of this analysis, the author carried out a qualitative assessment of the level of ICPE contribution in the different areas of activity and came up with quantitative estimates on a scale of 0 to 10 for the no-regime counterfactual (NR_{ID}) in each area as indicated in Table 4. While the author arguably became an "expert" during the course of interviews which allowed her to come up with these quantifications, they have mainly been derived for illustration purposes and their role should not be over-estimated.

4.3.3 Effectiveness scores

For the sake of illustration, the effectiveness scores E_i for the different areas of activity within the 1995 Elbe Action Program were calculated as of the year 2005 using the average scores by the participants as actual performance (AP_P) and the author's estimated no-regime counterfactual (NR_{ID}) as a basis. In order to determine an overall

effectiveness score $E_{average}$ the arithmetic average was built on the basis of the individual effectiveness scores.[3]

Table 5 shows that the values of E_i differ significantly among the different areas of activity, ranging between values of 0 and 0.82. The effectiveness was high for the development of the international alarm plan and model (E=0.82) and the construction of municipal wastewater treatment plants (E=0.70). The areas of the reduction of industrial pollution (E=0.44), the improvement of fish patency (E=0.42) and the set up of protected areas (E=0.36) show intermediate levels of effectiveness. The effectiveness of the ICPE was very low (E=0) in the agricultural sector. The overall average effectiveness score of 0.42 indicates that the ICPE regime had some impact, but that the outcome can by no means only be attributed to the ICPE. The interviewees argued that the ICPE mainly "speeded up" processes that would have happened at the national and sub-national levels anyway, albeit at slower speed. This applies in particular to the Czech Republic, where the process would have been significantly slower in the absence of the ICPE and where the ICPE contributed significantly towards undertaking active measures. But also the water administrations in the East German Länder benefited from the ICPE process.

However, still the question is how the differences in effectiveness can be explained. A frequent explanation is that it is easy for international water protection commissions to address point sources of pollution, but more difficult to address non-point sources of pollution (e.g. Gurtner-Zimmermann, 1998). But the question is why this is so. Also, the activities of the ICPE went beyond point and non-point sources of pollution. At a more general level, it can instead be argued that the effectiveness of the ICPE was particularly high, when the main actors responsible for implementation were located within

[3] Alternatively, given that the interviewees themselves emphasized that the different areas of activity played different roles, a weighted average could be considered too. Given that at least some of the areas with lower effectiveness scores, such as the rehabilitation of contaminated sites and landfills, were not a priority area of activity, a weighted average would increase the effectiveness score.

the public sector, such as in the case of the construction of municipal wastewater treatment plants or the development of the international alarm plan and model, and when specific visible infrastructure measures or projects were involved. In contrast, it appears that the effectiveness was relatively low where the behavior of non-state actors needed to be influenced. This applies in particular to the agricultural sector, a general problem of international river protection commissions in Europe (see for instance Gurtner-Zimmermann, 1998 for the Rhine). In contrast, industry appears to represent an intermediary case, where public administration has some influence through standard-setting and the publication of data on emissions. In the areas of improvement of fish patency and the set up of protected areas the ICPE also promoted "visible" projects, but it can be assumed that the ICPE was somewhat less influential in these areas, as the decision-making process on these measures tends to involve more stakeholders and to be more complex than in the area of municipal wastewater treatment.

While the precise numbers remain somewhat questionable, overall the effectiveness analysis on the basis of the Oslo-Potsdam solution reveals very clearly that (1) the level of influence of the ICPE and its contribution was lower than one would maybe have assumed on the basis of the analysis of overall goal achievement alone, and (2) – and even more importantly – that the effectiveness varied significantly among the different areas of activities. While this was implicit in the qualitative analysis of ICPE's specific contribution, the effectiveness score allowed bringing ICPE's actual contribution (AP-NR) into relationship with its assumed best possible contribution (CO-NR).

5 Explaining the outcome of the Elbe water quality regime

In the following, an attempt will be made to explain the outcome described in Sect. 4. This section builds upon the material presented in Sect. 4 and additional information obtained in the interviews, including the experts' evaluation of the expedience of the institutional arrangements.

5.1 ICPE approach and role of the institutional set up

The general working mechanism of the ICPE can be summarized as follows:

1. The ICPE provided a platform for the identification of priority action from a "basin" perspective (given that Austria and Poland did not participate, only about 99% of entire basin area was considered). In doing so, a step-by-step approach was pursued which started with the main priorities (hot spots), and sought to refine the targets once the primary objectives had been achieved. The prioritization process was carried out by the ICPE working groups where representatives and experts of the respective governments met. This ensured that the recommendations were developed by those who were responsible for their implementation. The secretariat supported the working groups in the preparation of documents. As such, the secretariat played an important editorial function, and in this process it had also the opportunity to insert ideas into the process. Furthermore, the work of the working groups was backed up by high level political commitment towards the international objectives. This was important for the working groups in order to be able to move forward.

2. The national administrations used the international obligations to promote their interests within the administration and to increase their access to funds, both national and different EU funds. Typically, for these funds different sectors compete, and the international obligations helped the parties to increase their share.

3. The fact that the ICPE regularly published progress reports created pressure on the national administration to follow up in order to be able to report on progress. As such, the progress reports not only provided a monitoring, but arguably also an enforcement mechanism.

Hence, the work approach and the institutional structure have to be seen as closely interrelated. In general, the interviewees believed that the institutional structure "stood

the test". Upon the question what could have been improved with respect to the institutional set up two aspects were mentioned. First, some argued that some working groups such as the ones on Monography and Law and Procedures had not necessarily been needed. The main activity of the working group on Law had been to prepare the observer status for Poland and Austria. Furthermore, the working group on Research was by and large limited to work in Germany. Thus, the structure could have been leaner and as such more efficient.

Second, there appears to have been an issue with the so called coordination group. It consisted of the President and the chairpersons of the various working groups. It usually met once a year in between plenary sessions. While some thought that this was actually needed, others argued that it only existed on paper. Instead, according to this fraction, a group was lacking that coordinated the activities of the different working groups at a working level. In the absence of such a group, this gap was by and large filled by the working group on Action Programs. However, this also led to some tensions with other working groups as they did not want to be coordinated by a peer group, but to report directly to the Commission. Some argued that the working group on Action Programs did not necessarily have a steering function, but it had the last say, as it took up the results of the other working groups in order to present them in a way that could be sold to the public.

In terms of the functions of the ICPE it is interesting to note that while there was no explicit enforcement in the form of a sanctioning mechanism in place, it can be argued that the reporting mechanism effectively served as an enforcement mechanism. The fact that publicly available progress reports were regularly published increased the pressure on the national administrations to be able to report on progress. The interviewees believed that at least at the international level a sanctioning mechanism had not been necessary and could even have been counter-productive as it could have undermined the building of trust between the two countries – this is of interest, given that from a game-theoretic perspective, a sanctioning mechanism is necessary to sustain cooperation in Prisoner's Dilemma-like situations (e.g. Dombrowsky, 2007). This

notwithstanding, the national administration might have sometimes wished to have had stronger enforcement mechanisms at the national level, in particular vis-à-vis industry and agriculture.

At the level of informal institutions, apparently a conscious attempt was made to build good relationships and trust. In general the working atmosphere was considered as good to excellent, and in particular at the working group level even friendships emerged over time. Two factors were mentioned that promoted the building of trust. First, both a Czech and a German representative mentioned that an attempt was made by the German side not to dominate the process. The Czech representative remarked that "the German colleagues very sensitively and in harmony with our effort agreed on the steps how to increase" (Czech interview partner 2). The German representative emphasized that demonstrating that the other side is not put down played a role (German interview partner 1). Second, NGOs were only granted observer status in 2004 in the context of the implementation of the EU Water Framework Directive. Two German interview partners argued that the fact that NGOs did not participate from the beginning had also contributed towards building trust among the representatives of the two countries.

Thus, apart from the fact that the efficiency of the institutional arrangements could maybe have been slightly increased, in general it can be argued that the ICPE work approach and institutional structure was adequate and allowed the ICPE to promote ongoing and planned national activities effectively, at least with respect to point sources of pollution and large visible projects.

5.2 Additional explanatory variables

5.2.1 Upstream and downstream had incentives to cooperate

In an upstream-downstream setting the question is whether the upstream country has any incentive to cooperate (e.g. Dombrowsky, 2007 and Möllenkamp in this volume). In the case of the Elbe, it can be argued that both the Czech Republic as the upstream country and Germany as the downstream country had sufficient incentives to cooper-

ate, and that this was an important precondition for achieving the outcome that has been reached. In the interviews, the following reasons were mentioned for the Czech cooperation: an interest in broader good relationships and access to Western markets from which environmental matters could not be excluded; the perceived international pressure to improve the quality of the Elbe water; and after 1994 the aspired EU accession. Thus the Czech aspiration for greater integration towards the West can be seen as a main motivation to cooperate on environmental matters. Or to put it the other way around, water quality was not to stay in the way of broader good relations. Furthermore, in 1994 the Czech Republic started official negotiations with the European Union on its accession, and in May 2005 it formally joined the EU. Thus, from 1994 on it was clear that activities in the framework of the ICPE would also contribute towards the fulfilling the EU requirements in the water sector. While according to the Czech interviewees EU accession did not play a role from the beginning, it did so at least since 1994.

While German interviewees presumed that there was also internal pressure to improve the water quality, the Czech representatives had not really perceived a public demand. However, they all emphasized that there had been a tradition of river basin planning in the Czech Republic, and thus it was the logical next step to extend the river basin approach to the international level. Hence, going beyond direct incentives, ideas or convictions apparently also played a role, at least at the level of the Czech delegation members. In addition, German interviewees argued that the Czech commission members were also able to use the international obligations to promote their own administration's interests internally and to increase their standing within the administration. Overall, one German interview partner concluded that "the Czech Republic cooperated because it was in its own interest, not because it wanted to do something good for Germany. Otherwise there would have been more calls for financial contributions" (German interview partner 2).

Germany of course had an inherent interest in cooperation as it benefited from pollution control upstream, but it also contributed its part: "Hamburg of course also did

what it demanded to be done upstream" (German interview partner 2). Furthermore, it was argued that German defection would have undermined its credibility. In addition, as one Czech interviewee mentioned, the goal to protect the North Sea provided direct incentives for Germany. Internal pressure within Germany to clean up the river was not explicitly mentioned as an argument, but it can be expected to have played a role too. There was also a commitment to the polluter-pays principle, and Germany was, of course, also obliged to fulfill EU regulations.

5.2.2 Cooperation took place under favorable framework conditions

The second external explanation why the countries were relatively successful is that cooperation took place under favorable framework conditions. First, the interviewees emphasized that once the cooperation was possible after the fall of the Iron Curtain, there was real enthusiasm and the political will to move quickly. The high political will to address the problems was reflected by the fact that the ICPE treaty was negotiated within nine months, and signed five days after the German reunification. As such, the fall of the Berlin wall provided a "window of opportunity".

Second, the partial breakdown of the industrial production in the former German Democratic Republic, and partly also in the Czech Republic, contributed significantly towards the improvement of the quality of the Elbe water. This is an important external factor explaining the relatively high level of goal achievement for goal 1a.

Third, an important prerequisite for the implementation of measures was the availability of funds. In this context also different types of EU funds played a role. One interview partner argued: "Both countries were able to use the ICPE to direct EU funds into the water sector. In the absence of such EU funds, cooperation might be difficult to achieve" (German interview partner 2).

Fourth, given that the middle stretch of the Elbe is much less regulated than other European rivers, in this river section the achievement of comparatively healthy ecosystems was much less challenging than for instance in the Czech Republic or on the Rhine.

Fifth, a Czech interview partner also pointed at the fact that the officials and experts working with each other all had a high and balanced level of professionalism. Thus, overall the technical capacity was high on both sides, which facilitated the dialogue.

5.2.3 Factors inhibiting cooperation

Upon the question which factors inhibited success, the limited ability to control industry and agriculture and complexities at the national level were mentioned (see above).

In other contexts it was mentioned that there were also sometimes cultural differences, e.g. to address conflicts directly or to deal with information flows, but this was also perceived as a generation problem. Furthermore, the absence of a common working language was perceived by some as a problem. Others thought that they had managed quite well with evenly poor English, and apparently the situation is changing as younger people join the process. The fact that all staff members of the secretariat need to be bilingual was perceived as very helpful in facilitating communication.

Overall, it can be concluded that despite a certain language barrier there were no major factors inhibiting international cooperation. Instead, factors hampering effectiveness lie in the limited ability to of the commission members to influence complex domestic policy processes.

6 Conclusions

In order to learn more about the design of adequate institutions for transboundary water management, this paper analyzed the role of institutional design for the outcomes of the water quality and ecology-related work of the International Commission for the Protection of the Elbe.

The study pursued a mixed methodological approach using qualitative and quantitative elements. In general, it can be argued that the quantitative approach of the Oslo-Potsdam solution for measuring effectiveness provided analytical clarity and con-

tributed towards showing the different levels of effectiveness in the different areas of activity. At the same time, the qualitative approach contributed towards a better understanding of the causal relationships. The disadvantage of this combined approach was that the number of interviews remained comparatively small so that the numbers generated are indicative only.

Overall, the paper shows that the countries were relatively successful in achieving their overall goals. While the ICPE generally showed a high level of compliance, a main finding is that the ICPE's contribution towards achieving the goals varied significantly among the different areas of activity. It was high where the main responsibility for action was with the public authorities, such as in the area of wastewater treatment and the establishment of an international alarm plan and model. It was practically zero in the reduction of non-point pollution from agriculture, where the success depended on the behavior of individual private actors (farmers). It was intermediate where multiple parties were involved in the decision-making process, such as in the area of fish migration or the establishment of protected areas.

The commission supported the countries' activities by serving as a platform for the identification of priority action from a basin perspective. The resulting international obligations increased the power of involved national administrations and their access to funds. At the same time, the Commission's reporting to the public served as an enforcement mechanism. As such, the ICPE speeded up implementation, in particular in the Czech Republic. At the informal level, cooperation was fostered by the fact that the stronger party made a conscious effort not to dominate the process.

The relatively positive outcome was also supported by favorable framework conditions in the sense that not only downstream, but because of broader economic interests, also upstream had an interest to cooperate. Furthermore, the fall of the Berlin wall generated a high level of political will to improve the situation. In addition, both countries benefited from access to external EU funds.

Overall, it can be argued that the Rhine model of transboundary cooperation was successfully replicated in the Elbe basin. However, against the initial assumption that

the Elbe allows for testing the hypotheses generated for the International Commission of the Protection of the Rhine under more asymmetric conditions, in this case, the relative weakness of the Czech Republic as upstream party and its desire towards greater integration towards Western Europe apparently increased its incentive to cooperate so that the asymmetry rather promoted than inhibited cooperation.

The question is under which conditions the ICPE model may be transferable. This is certainly the case when local or national measures are to be prioritized at a basin scale, in particular when the protection of downstream lakes or regional seas plays a role. Furthermore, the approach is most powerful when the responsibility for such activities is with actors in the public sector. In that sense, the transferability of the approach may remain limited. But still, the idea of a platform for problem-solving and the apparent attempts to build trust might be of wider applicability.

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Table 1. Achievement of overall goals.

Goals	1a. Use of water for water supply, fisheries & irrigation	1b. Use of sediments in agriculture	2. Protection of aquatic eco-systems	3. Protection of North Sea
ICPE target values met in 2004	18 of 26 in water phase (69%)	2 of 12 in sediment phase (17%)	10 of 26 in water phase (38%) 2 of 9 in sediment phase (22%)	Not specified
Problematic substances	CSB, (TOC), Hg, AOX, EDTA	Hg, Cd, Zn, Tributyl-tin-compounds, Hexachlorbenzen & AOX	Hg, Cd, Zn, Cu, As, Tributyl-tin-compounds Hexachlorbenzene, AOX, EDTA	Not specified
Avg. score	7.3	-	6.3	6.5
Explanations by Interviewees	Significant improvement of the water quality has taken place. Consumption of larger quantities of Elbe fish still not advisable. Drinking water rarely produced from Elbe water = symbolic goal.	Some improvements, but sediments can only be used in the long run. Old contaminants are (only) remobilized and washed out during floods. Sediment use is not of practical relevance = symbolic goal.	Good starting conditions at Middle Elbe, due to low regulation. Ecosystems have benefited from improved water quality vs. fish diversity has not increased as expected and only few fish species reproduce naturally.	Priority substances have decreased, but nutrient loads are still too high for North Sea. North Sea was only added for political reasons.

Table 2. Compliance with measures.

Area of Activity	Summary of Progress Reports	Level of Compliance (Author's evaluation based on reports)
1. Municipal wastewater	Virtually all planned WWTP completed or under way, even before target.	Very high
2. Industrial point sources	Proposed measures carried out: discharges of large industries regularly published; minimal requirements for different branches of industry defined.	Very high
3. Agricultural non-point sources	Recommendations on good practices made and monitoring of ongoing activities as planned. (Specific measures were not foreseen.)	High
4. Contaminated sites and landfills	Relevant sites listed and rehabilitation measures monitored: 90% of planned measures under way and 55% realized by end of 2002.	High
5. Fish migration	Initial key measures realized. Ongoing; 25% of planned measures realized by 2004.	Low to medium (ongoing)
6. Protected areas and morphology	Ongoing; 25% of planned measures implemented by end of 2002. Changing targets.	Low to medium (ongoing)
7. Accidental pollution	Proposed measures carried out: International Warning and Alarm Plan agreed and updated; Elbe Alarm Model operational; hazardous plants published; recommendations on accident prevention made.	Very high

Table 3. Areas of activity – experts' assessment and explanation of actual performance.

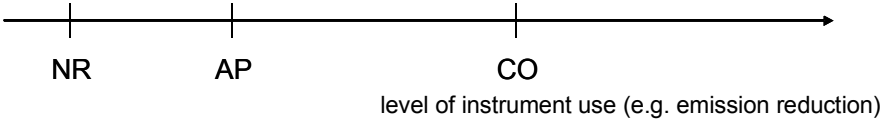
Area of Activity	AP_P	Explanations by Interviewees
1. Municipal wastewater	8.5	All planned WWTPs have been constructed vs. EU Urban Wastewater Directive not yet met vs. oversized infrastructure in East Germany (NGO statement).
2. Industrial point sources	7.2	Main polluters targeted vs. smaller companies not yet addressed vs. impact of minimal requirements unclear.
3. Agricultural non-point sources	2.7	No improvement vs. some improvement due to decline in agricultural production and EU directives/agricultural policy.
4. Contaminated sites and landfills	6.8	Progress with respect to sites listed vs. contamination in tributaries remains high.
5. Fish migration	6.8	Many priorities were implemented vs. progress in Czech Republic limited to border area only; more to be done in tributaries; morphology of main stem remains a problem.
6. Protected areas and morphology	7.4	Good progress under given framework conditions vs. limited progress in Czech Republic.
7. Accidental pollution	8.4	Very advanced alarm system and prediction model vs. deficits in its application.

Table 4. Areas of activity – specific ICPE contribution and no-regime counterfactual.

Area of Activity	AP_P	Specific ICPE Contribution Explanations by experts	Author's assessment	NR_{ID}
1. Municipal wastewater	8.5	Priority lists => access to funds Monitoring => stick to targets	Medium	5.0
2. Industrial point sources	7.2	List of discharges of large emitters => follow up by administrations Minimal requirements => some influence on CZ legislation	Low to medium	5.0
3. Agricultural non-point sources	2.7	Practically no contribution. (Agenda-setting)	Zero	2.7
4. Contaminated sites & landfills	6.8	Priority lists, but little contribution, no priority area	Low	6.0
5. Fish migration	6.8	Promoted ongoing activities, priority lists => access to Czech funds	Low to medium	4.5
6. Protected areas & morphology	7.4	Promoted ongoing activities, but no new proposals	Low	6.0
7. Accidental pollution	8.4	Original ICPE contribution	High	1.0

Table 5. Calculating an effectiveness score for the Elbe action program.

Area of Activity	AP_P	CO	NR_{ID}	E_i
1. Municipal wastewater	8.5	10	5.0	0.70
2. Industrial point sources	7.2	10	5.0	0.44
3. Agricultural non-point sources	2.7	10	2.7	0.00
4. Contaminated sites & landfills	6.8	10	6.0	0.20
5. Fish migration	6.8	10	4.5	0.42
6. Protected areas & morphology	7.4	10	6.0	0.36
7. Accidental pollution	8.4	10	1.0	0.82
Average	6.8	10	4.3	0.42



NR: no regime counter-factual

AP: actual performance

CO: collective optimum

Effectiveness score E = (AP - NR)/(CO - NR)

Fig. 1. Measuring regime effectiveness (after Helm and Sprinz, 2000: 637).

Fig. 2. Elbe river basin with main gauging stations (triangles) and fish passes (squares) (based on http://www.grid.unep.ch/product/publication/freshwater_europe/images/map9.jpg (24 April 2007)).