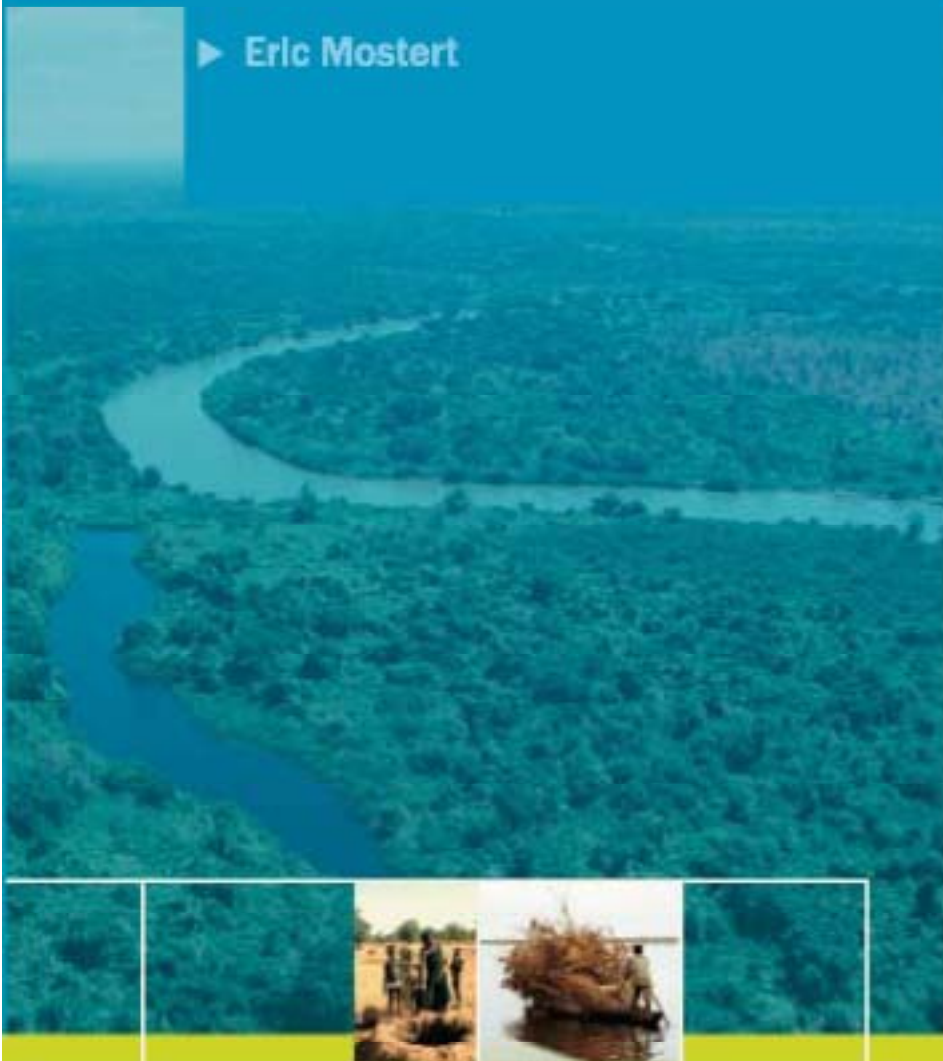


Conflict and Co-operation In the Management of International Freshwater Resources: A Global Review

► Eric Mostert



PCCP Publications 2001-2003

1. Frederick M. Lorenz, *The protection of water facilities under international law*, UNESCO-IHP, 46 p.
2. Sergei Vinogradov, Patricia Wouters and Patricia Jones, *Transforming potential conflict into cooperation potential: The role of international water law*, UNESCO-IHP, 106 p.
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29. William J. Cosgrove (compiled by), *Water security and peace: A synthesis of studies prepared under the PCCP - Water for Peace process*, UNESCO-IHP, 108 p.
30. *A summary of PC->CP publications 2001-2003*, UNESCO-IHP, 34 p.
31. Janos Bogardi and Susida Castelein (eds.), *Selected papers of the International Conference From Conflict to Co-operation in International Water Resources Management: Challenges and Opportunities*, UNESCO-IHE Delft, The Netherlands, 20-22 November 2002, UNESCO-IHP, 600 p.



CONFLICT AND COOPERATION IN THE MANAGEMENT OF INTERNATIONAL FRESHWATER RESOURCES: A GLOBAL REVIEW

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CONFLICT AND COOPERATION IN THE MANAGEMENT OF INTERNATIONAL FRESHWATER RESOURCES

This report contains the results of a desk study on conflict and cooperation in international freshwater management. The study was conducted as part of the UNESCO PCCP project. The PCCP project, which stands for "From Potential Conflict to Cooperation Potential," examines and fosters the potential for international water resources to become a catalyst for regional peace and development through dialogue, cooperation, and participative management of the resource. It tries to find an answer to why with some international freshwater resources conflicts develop, and with others there is cooperation.

The aim of the desk study was threefold:

- to complement the in-depth case studies prepared in the PCCP project by a more in-breadth coverage of international freshwater management
- to show the wide variety of issues, contexts, and solutions chosen
- to identify general "lessons" on conflict prevention/resolution and cooperation.

First, in order to obtain an overview of the solutions chosen, nineteen institutions for managing international freshwaters were described. The individual descriptions were made by the FAO and are reported in a separate report by Melvin Spreij, titled *Institutions for International Freshwater Management*. Section 4 of this report contains an overview. The overview shows that most institutions studied have a broad scope in terms of water uses covered. Many also have a broad geographical scope and cover complete basins. The organizations set up range from extremely simple to very elaborate. They usually have no broad ranging decision-making powers and decision making in the organizations is usually by unanimity; countries apparently want to keep control. In many cases conflict resolution procedures have been established, but there is not much evidence that they are actually used; often they do not have to be used because cooperation is good. Public participation is with a few significant exceptions still very limited.

Second, a literature study was made of the question of how institutions for international freshwater management actually develop and how effective these institutions are. Some twenty-three freshwater resources or groups of resources were covered. In these cases it usually took ten years or more to develop effective institutions. The main obstacles were conflicting interests, bad international relations and lack of trust, and sometimes controversies over the facts. Several strategies were used to overcome these differences, such as issue linkage. The most common and most effective strategy was to develop and maintain good relations and to compromise on the basis of reciprocity on points that were important for the other countries. In the long run such a strategy benefits all parties concerned (see Section 3).

Relatively little information could be found on the effectiveness of the institutions. Nonetheless, the picture is relatively positive. Some international agreements are not complied with and others are simply not implemented, but many are implemented correctly. In a few cases serious negative side effects occurred because the interests and knowledge of the local population had been ignored when developing the institution concerned. In other cases significant improvements in the basin took place, and the institutions are at least partly responsible for this. It has proved possible to resolve many contentious issues in the framework of international commissions that have been set up, which – if not actually improving international relations – at least prevented deterioration (see Section 5).

It seems that institutions for international freshwater management do matter. The main challenge is to know what an effective institution looks like and how

agreement on such institutions can be reached. The desk study resulted in many suggestions for that. These are listed in Section 6 in the form of fifty-four “lessons” on promoting cooperation and preventing conflicts. They are summarized in the form of seven “key messages” (see Section 7.2 for more detail).

Key messages on promoting cooperation and preventing conflicts in international freshwater management

1. International freshwater management is becoming increasingly important for meeting basic water needs and providing food security.
2. There is no single best way to manage international freshwaters.
3. Commissions or other platforms should be constructed internationally and nationally where the main actors can meet – national governments, lower level governments, water users, local populations, and NGOs.
4. International agreements should have a sufficiently broad scope.
5. The single most effective strategy for reaching agreement is the wish to develop and maintain good relations and reciprocity.
6. Joint or internationally coordinated research can improve the scientific-technical quality of international agreements; unilateral research usually cannot.
7. All stakeholders should participate in institutional development.

During the desk study several limitations in the available data were encountered. These can be overcome by future research describing the management of individual international freshwater resources in detail, using different perspectives and a comparative approach. Additionally, more research is needed on how to organize public participation in large international river or lake basins. As it is, the desk study constitutes the state of the art of international freshwater management as seen by the author. No doubt, our knowledge will continue to develop, as will international freshwater management itself. The author hopes that this report will provide inspiration for all involved in international freshwater management.

1. INTRODUCTION

1.1. The Issue

Water is an essential resource for humankind. It is needed for drinking, personal hygiene, food production, and industrial activities. In addition, it has important non-consumptive uses, such as fishing, shipping, hydropower generation, and recreation. Water also often plays an important role in the cultural identity or the religious beliefs of local people.

Yet, in many parts of the world water availability is severely limited. Due to population growth, per capita water availability in developed countries was 40 percent lower in 1995 than in 1950, while in developing countries with an arid climate availability had fallen by more than 70 percent. It may decrease by a further 5–15 percent by 2025 (Shiklomanov, 1999). Moreover, rainfall and river runoff are often highly variable, leading to water shortages in summer and floods in winter. Pollution often renders the water that is available useless and damages ecosystems. In addition, land use is often inappropriate, resulting in erosion in upstream areas, flooding in downstream areas, and siltation in irrigated areas. Technical remedies for these problems are sometimes worse than the problems themselves. For instance, embanking a river to prevent regular flooding can facilitate more intensive land-use in the former floodplains. However, it can also raise the riverbed and increase the likelihood of catastrophic floods and worsen the damage they cause.

Effective freshwater management is imperative for both humankind and nature, but is complicated by the international character of many freshwater resources. Many rivers and lakes, basins, and aquifers extend over more than one state. In these cases international cooperation is called for. Yet national interests often conflict, points of view often differ, and international relations are sometimes bad. Countries may compete for the same scarce water, they may disagree on how much water the other countries concerned are already using, and there may be a lot of misunderstanding and mistrust. The potential for international conflict is therefore large.

Many fear that the wars in the twenty-first century will be about water. In the past, however, there have been very few examples of real water wars. The last "real" water war of which there is any evidence was between the Sumerian city-states of Lagash and Umma in 2500 B.C.E., 4,500 years ago. There are many more examples of international cooperation (Wolf, 1998). Nonetheless, conflicts falling short of a war do occur and cooperation is often ineffective. For many international river basins, lakes, and aquifers no international agreement at all exists, and some institutions that have been set-up are not active. Other institutions have been very successful however, and deliver benefits to all parties involved.

1.2. The PCCP Project

Given the immense importance of international freshwater resources and the potential conflicts, UNESCO has initiated the PCCP project as part of the UN-wide World Water Assessment Programme. PCCP stands for "from Potential Conflict to Cooperation Potential." This project examines and fosters the potential for international water resources to become a catalyst for regional peace and development through dialogue, cooperation, and participative management of the resource. It tries to find an answer to the question of why conflicts develop over some international freshwater resources, whereas with others there is cooperation.

The project consists of a disciplinary track, in which a number of different themes are studied from different disciplinary angles, a case study track, in which a number of river basins are studied in detail, and an educational track, which focuses on

dissemination of the results. In addition, the possibility of water conflict indicators as early warning systems is studied. Box 1 gives an overview of the project.

Box 1: Components of the PCCP project

Disciplinary track

Law

History and the future

Negotiation, mediation, and facilitation

Systems analytical techniques

Case study track

Aral Sea

Columbia

Danube

Jordan

Limpopo-Incomati

Mekong

Nile

Rhine

Upper Lempa

Desk study: comparative overview of many freshwater resources

Water conflict indicators

Educational track

1.3. Purpose of This Report

The present report is the product of the PCCP “desk study” component. It aims to identify the state of the art concerning conflict and cooperation in managing international freshwaters. Its more specific objects are the following:

- to complement the in-depth case studies by more in-breadth coverage
- to show the wide variety of issues, contexts, and solutions chosen
- to identify general lessons on conflict prevention/resolution and cooperation.

The present report does not aim to develop concrete recipes for conflict prevention and cooperation. It is believed that conflict prevention and cooperation is context specific. Each situation will require a different approach. However, the present report does aim to provide insight about which contextual factors are important and how they affect conflict prevention and cooperation. It aims to provide practical guidance and “reflection” for those directly involved in international freshwater management.

1.4. Methodology

The research methodology used for this report is comparative case study research, using a simple theoretical framework (cf. Yin, 1986). The theoretical framework is largely the same as in the other components of the PCCP project. It approaches conflict and cooperation in international freshwater management in terms of institutional development, institutional design, and institutional effectiveness (see Section 2). The framework was made more concrete by a large number of working

hypotheses, derived from the literature and from previous work by the author (Annex I; Mostert, 1998a, 1998b, 1999, and 2000).

Two types of case studies were conducted. Using existing literature, the development and effectiveness of the institutions were analyzed for twenty-three international freshwater resources or groups of resources (Box 2). For each case a "template for analysis" was filled in (Annex II). The main purpose was to test the working hypotheses and reach the third objective of the research: the identification of general "lessons" on conflict prevention/resolution and cooperation. Each new case study gave rise to some modifications or additions to the set of hypotheses. This new set then formed the starting point for the next case study. The end results are the lessons and key messages presented in Section 6 and 7 of this report.

Box 2: Cases and sources

Africa

- Joint Authority for the study and development of the Nubian Sandstone Aquifer² (Regulation NSA, 1992; Agreement NSA, 2000a; Regulation NSA, 2000b; Nubian Sandstone Aquifer System Programme*)
- Kagera basin^{1,2} (Kagera Agreement, 1978; Lwehabura, 1983; Godana, 1985)
- Lake Chad Basin Commission² (Chad Basin Convention, 1964; International Law Commission, 1976; UN, 1983; International Monetary Fund I*, OIEAU*)
- Niger river^{1,2} (Revised convention NBA, 1987; Godana, 1985; UN, 1983; Niger Basin Authority*)
- Nile Basin Initiative² (Nile basin Initiative*, Amare, 1997; Brunnée and Toope, 2002; World Bank*; cf. Howell and Allan, 1994)
- Permanent Okavango River Basin Water Commission² (OKACOM Agreement, 1994; IRN*; SADC*)
- Senegal river^{1,2} (Senegal River Statute, 1972; OMVS Convention, 1972; Godana, 1985; Adams, 2000; Diawara s.d.; Lakh s.d.; World Bank 2001)

Asia

- Aral Sea Basin¹ (PCCP case study)
- Euphrates¹ (Slim, 1993; Gruen, 2000; Kibaroglu, 2000)
- Ganges–Brahmaputra¹ (Biswas, 1996; Hari Man Shrestha and Lekh Man Singh, 1996; Nishat, 1996; Verghese, 1996; Tanzeema and Faisal, 2001)
- Indus^{1,2} (Keith Pitman, 1998; Biswas, 1992; Caponera, 1987; UN, 1983; Indus Water Treaty 1960)
- Mekong River Commission² (Mekong Cooperation Agreement, 1995; Mekong Commission*; The Water Page*)
- Pancheshwar multipurpose project on the Mahakali River¹ (India–Nepal) (Marty, 2001)
- Salween river¹ (Hashimoto, 1996; Raj Onta et al.,; Moe, 2000; US Department of Labor, 2000)

Australia

- Murray-Darling¹ (Chenoweth and Bird, 2000; Chenoweth and Malano, 2001; Crabb, 2001)

Europe

- Danube River Protection Convention² (Danube Convention, 1994; Danube Commission*)
- Finnish–Norwegian Boundary Waters Commission² (Finnish–Norwegian Agreement, 1980; UN, 1983; Finnish Ministry of Environment*)
- ² (Finnish–Norwegian Boundary Waters Agreement, 1971; International Law Commission, 1976; UN, 1983)
- ² (Frontier Watercourses Agreement, 1964; International Law Commission, 1976; Joint Finnish–Soviet Commission, 1983)
- ² (Frontier Watercourses Agreement, 1964; International Law Commission, 1976; Joint Finnish–Soviet Commission, 1983)
- C, 1996–2001; Roll s.d.)
- Meuse river¹ (Mostert, 2001)
- Regulation of the Alpine Rhine¹ (Marty, 2001)
- International Commission for the Protection of the Rhine^{1,2} (PCCP case study; Mostert, ed. 1999; Dieperink, 1997, 1998; Bernauer and Moser, 1996; Grünfeld, 1999; Verweij, 2000; Rhine Protection Convention, 1999; Chlorides Convention, 1976; Chemicals Convention, 1976; ICPR*)
-
- Spanish-Portuguese rivers¹ (Pires, 1995; Correia, 1999; Lopes, 2000; Maia, 2000)

North America

- Colorado salinity problem¹ (Johnson, 2000; Marty, 2001; Bernal and Solis, 2000)
- ² (Boundary Convention, 1889; Water Utilization Treaty, 1944; UN, 1983; IBWC*)
- ² (Boundary Convention, 1889; Water Utilization Treaty, 1944; UN, 1983; IBWC*)
- ² (Boundary Convention, 1889; Water Utilization Treaty, 1944; UN, 1983; IBWC*)
- ² (Boundary Convention, 1889; Water Utilization Treaty, 1944; UN, 1983; IBWC*)
- Tijuana river¹ (Marty, 2001)

South America

- Amazon basin¹ (Botto, 1999; Braga et al., 1999)
- Columbian Amazon¹ (Torrijos Quintero, 1999)
- Plate basin^{1,2} (Pochat, 1999; Cordeiro, 1999; Del Castillo Laborde, 1999; Joint Declaration, 1967; Plate Committee Statute, 1968; Plate Treaty, 1969; Plate Coordinating Committee*; International Monetary Fund II*; International Law Commission, 1976)
- ² (CTM Agreement, 1946; CTM, 1981; Salto Grande Technical Commission, 1983; Salto Grande*; Concordia*)
- ² (Uruguay River Boundary Treaty, 1961; Uruguay River Statute, 1975; CARU Statute, 1976; CARU*; UN, 1983)

Notes:

1. Political science analysis of the development and effectiveness of institutions (basis for Sections 3 and 5).
 2. ² analysis of the institutions themselves (basis for Section 4).
- * Web site, see at the end of the reference list.

Nineteen case studies described the existing formal institutions for different freshwater resources in some detail. The purpose of the second group of case studies was to show the wide variety of institutional solutions chosen (second objective). However, they also provided important background information for developing the lessons on conflict and cooperation. These case studies were prepared by the Food and Agriculture Organisation (FAO) in Rome and involved close reading of the pertinent treaties, conventions, byelaws, and other official documents. The individual case studies in this group are published in a separate report (Spreij, 2002), but Section 4 of the present report contains a summary and analysis of the results. The cases in both this group and the first group were selected in order to have a wide geographical spread and a wide coverage of hydrological, socioeconomic and political conditions, management issues, and institutional structures.

The methodology and the validity of the resulting lessons and key messages are reviewed in Section 7.2.

1.5. Reading Guide

This report consists of seven sections, including the introduction. Section 2 contains the theoretical framework used for this report.

Section 3 gives an overview of the development of international cooperation in freshwater management, based on the different case studies in the first group.

Section 4 describes the wide variety of institutions for international freshwater management, based primarily on the case studies in the second group (cf. Spreij, 2002). It describes the scope of the institutions, the organizational frameworks that have been set up, the applicable procedures, and the financing of the institutions. Separate attention is paid to the issue of public participation.

Section 5 describes the effectiveness of the different institutions. It discusses whether the formal institutions function effectively in practice, whether they promote further cooperation, and what the overall effect is.

Section 6 contains fifty-four lessons that could be drawn on promoting cooperation and preventing conflict in international freshwater management, based on the case studies and partly on other literature.

Section 7 forms the conclusion of the report. It contains seven key messages, evaluates the research, and gives several recommendations for further research.

The Annexes contain the list of working hypotheses (Annex I) and the template that was used for analyzing the case studies in the first group.

2. CONFLICT AND COOPERATION IN INTERNATIONAL FRESHWATER MANAGEMENT

Studying and comparing different examples of conflict and cooperation in international freshwater management requires a common theoretical framework. This framework should be general enough to apply to many different cases, specific enough to ensure that all cases are analyzed in the same way, and open enough to allow surprises and not to exclude or overemphasize particular aspects of international freshwater management.

This section tries to develop such a framework. Section 2.1 gives some more background information on the different types of international freshwater management issues. Section 2.2 discusses the different types of international water conflicts, the different forms of cooperation, their causes, and their motivations. Section 2.3 gives an overview of the conflict prevention and cooperation process. The issue of how to determine and evaluate the effects of institutions receives separate attention in Section 2.4. Section 2.5 discusses the different levels that are involved in

international freshwater management and argues that it is often misleading to treat states as unitary actors and focus solely on national governments. The section closes with a short summary of the theoretical framework (Section 2.6).

2.1. International Freshwater Issues

In March 2000, the World Water Vision was presented at the Second World Water Forum and Ministerial Conference in The Hague. The Vision is based on the assumption that there is a water crisis, which is going to get worse if no action is taken. Presently, about 20 percent of the world population does not have access to safe and affordable drinking water. More than 800 million people – 15 percent of the world's population – are chronically undernourished. Unregulated access and subsidized energy have led to overpumping of groundwater and falls in groundwater tables of several meters per year. Many valuable wetlands have disappeared, and many rivers are heavily polluted. Moreover, because of population growth, average annual per capita water availability is projected to fall from 6,000 cubic meters today to 4,800 cubic meters per day by 2025. Some 3–4 billion people – nearly half the world's population – will live in moderately or heavily water-stressed countries (Cosgrove and Rijsberman, 2000).

Immediate action is needed. However, a complicating factor is the fact that many freshwater resources are located in more than one country. There are more than 250 international river and lake basins in the world, covering more than 45 percent of the land surface (Wolf et al., 1999). In addition, many groundwater aquifers extend beyond national boundaries. Unilateral action by any one of the countries concerned is often ineffective, inefficient, or outright impossible. For instance, downstream countries often lack good sites for water storage dams. These can often be built at lower financial and environmental costs in an upstream country. Unilateral action can also significantly harm other countries and lead to a serious conflict. The main examples are upstream pollution and upstream water diversions. International cooperation is therefore needed, but the problem is how to achieve this.

To get a clearer view on the possibilities for international conflict and cooperation, it may be useful to distinguish between three types of issues: collective problems, negative externality problems, and positive externality problems (Marty, 2001). In the case of collective problems, all states concerned can benefit from finding a solution. Many issues concerning international lakes and boundary stretches of rivers are of this type: reducing pollution of these common waters, ecological restoration, joint development, and so on can benefit all countries concerned. The potential for cooperation is therefore large, yet achieving it is not necessarily easy.

In the case of externality problems, the interests of the countries concerned are fundamentally different. A negative externality problem occurs when (ongoing or planned) activities in one country have negative effects in another. Prime examples are pollution and water diversions in an upstream country. A positive externality occurs when (ongoing or planned) activities in one country have positive effects in another country. An example is a dam that would reduce flooding problems downstream. In the case of negative externalities the affected country A would like country B to stop or not start with a specific activity, whereas in the case of positive externalities country A would like country B to start or continue with an activity. Particularly in the case of negative externalities the potential for conflicts is large. Yet, as we will see, even in such cases cooperation has developed.

2.2. Water: Conflicts and Cooperation

Water can play different roles in conflicts. In "real" water conflicts, water is the *object* of the conflict; for example, states quarrel over scarce resources or water pollution.

Water can also be an *instrument* in a conflict. This occurs for instance when states are in conflict on some other issue and an upstream state threatens to divert an international river, not because it needs the water, but to harm or exert pressure on the downstream state. An extreme example is the pollution of drinking water sources. Finally, water can act as a *catalyst* for international conflicts. Water shortages within a country can create internal political instability, which in turn can increase international instability (cf. Libiszewski, 1995).

The intensity of water conflicts can range from minor disagreement to serious tension, open dispute, and even armed conflict. Described in this way, some degree of conflict is inevitable in international freshwater management. The main task of those involved is to manage the conflict, prevent escalation, and promote mutually beneficial cooperation.

Cooperation can mean different things. It could mean that different parties join forces in order to reach common goals. This description of cooperation is applicable in the case of collective problems. However, cooperation does not require common goals. Cooperation can also mean that the cooperating partners reach a compromise to prevent escalation, or that they jointly formulate a package deal that serves their (different) objectives as much as possible. (Compare the distinction in negotiations theory between distributive and integrative bargaining: dividing the pie and increasing the size of the pie, respectively.)

The main aim of the PCCP project is to enhance conflict prevention rather than conflict resolution and to “tip the balance in favor of cooperation potential away from potential conflict.” The potential for conflicts can be measured in terms of three possible sources or aspects of conflicts (Mostert, 1998b):

- conflicting goals (interests and/or fundamental values; cf. the distinction between collective, positive and negative externality problems)
- bad relations
- different perceptions of the relevant facts.

Conflicting goals can lead to conflicts in which water is the object, whereas bad relations are more likely to lead to conflicts in which water is an instrument. Different perceptions can lead to all types of conflicts. The three causes are, however, related. For instance, bad relations and lack of trust can result in communication problems, less understanding of different perceptions, and less concern for the interests of other parties. This in turn may worsen relations, and so on. It is important to pay attention to all three aspects of conflicts and not focus only on conflicting interests or perception issues, as some approaches in political science and psychology do.

The potential for cooperation can be approached from the positive side or from the negative side. Positively, the potential for cooperation lies in the potential benefits it brings, such as better water quality, less overpumping, more hydropower, more water for irrigation, and restoration of wetlands. Negatively, the impetus for cooperation consists of the costs of conflict, including both direct costs such as the suffering caused by war, and indirect costs: the foregone benefits of cooperation in other sectors.

2.3. The Conflict Prevention and Cooperation Process

The conflict prevention and cooperation process can be modeled as a cyclic process (Figure 1). It starts with a potential for conflict and cooperation. This potential is determined by the hydrological, institutional, socio-political, and economic context. Next, cooperation can develop. Cooperation usually takes the form of an “agreement.” This agreement can be implicit or explicit, written or unwritten, and legally binding or not. Examples include formal treaties, private law contracts, customary law, shared

understandings, and even a shared culture and cultural practices. Most agreements need to be implemented next. This may change the context, create a new potential for conflict or cooperation, and start a new cycle.

The process can also take a different course. Sometimes the potential for conflict and cooperation does not result in an agreement, but in an escalating conflict (not included in the figure). Moreover, sometimes an agreement is reached but not implemented. This can necessitate the negotiation of a new agreement, but it can also result in an escalating conflict. Finally, agreements can also be reached if there is an actual conflict and not just a potential, as many peace treaties have shown. Conflicts can de-escalate as well as escalate.

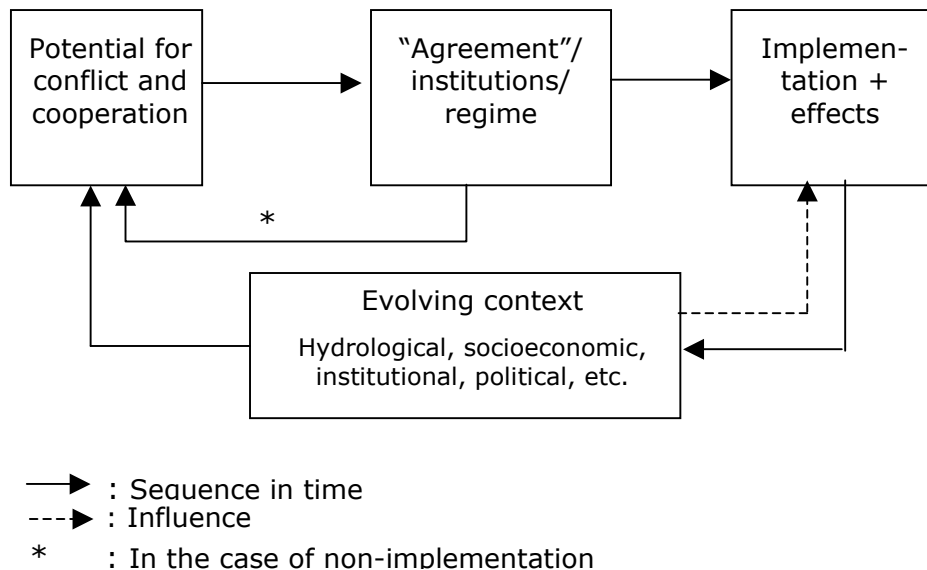


Figure 1. Schematic overview of the conflict prevention and cooperation process (excluding serious escalation)

2.3.1. Context

To understand the conflict resolution and prevention and cooperation, one first needs to understand the major management issues, the players involved and the freshwater resource involved. This requires a basic understanding of the context or rather contexts. Below a "typology of contexts" is given, with different aspects that may be important in specific cases (not limitative).

- *Hydrological context.* Precipitation, evaporation, discharge, recharge, abstractions, water pollution, actual water quality, and the water quality needed for different uses and ecosystems, morphological aspects such as erosion and sedimentation, hydropower potential, and so on.
- *Socioeconomic context.* Uses and users of the freshwater resource, in-stream uses, economic circumstances of the different users, social position, degree of organization and power, regional and other disparities, need and potential for economic development, the different national cultures (Box 3), and the like.
- *Institutional context.* National and international water managers and commissions, decision-making rules, existing operational rules, water use and provision rules (Section 2.3.4).
- *Political context.* National, subnational, and international political dynamics, international relations and mutual trust (or mistrust), power, and similar factors.

The context is not stable. Conflicts and cooperation lead to changes in the hydrology, to new infrastructure, more or less water abstraction and water pollution, more or less poverty, worse or better international relations, and so on. Consequently, the context should not be analyzed only at the start of the process: its evolution should ideally be followed.

Information on the context is often scarce and difficult to obtain and the reliability of the information is often low or unknown. Many abstractions and emissions are not registered, water quality is often not monitored or the results are kept confidential, groundwater data are often lacking, and so on. Besides, the data can often be interpreted in different ways. Consequently, the "objective facts" of the case are often very controversial. Uncovering such controversies is part of understanding the context.

As argued in Section 2.5, the context explicitly includes the national context. Moreover, the context can include issues that have nothing to do with freshwater management if these issues involve the same or partially the same parties (issue linkage).

Box 3: Culture, conflict, and cooperation

The term "culture" refers to the patterns of feeling, thinking, and acting that members of a specific group (for instance, a nation) have in common. It consists of fundamental values, rituals, "heroes," and symbols, and colors the ideas of its members. It predisposes them towards certain types of behavior, and gives meaning to these behaviors (Hofstede, 1991; Faure and Rubin, 1993). These culture-specific types of behavior in turn reinforce the culture concerned (Thompson et al., 1990).

Using ample survey material from fifty-three countries, Hofstede (1991) has identified five cultural dimensions that differ significantly from country to country:

- masculinity
- individualism–collectivism
- uncertainty avoidance
- power distance
- time frame: short-term versus long-term orientation.

In "masculine cultures" (for example, the United States and Great Britain), assertiveness and competition have a positive value. In such cultures conflicts tend to be solved by a "good fight" (Hofstede, 1991; Avruch and Black, 1993). In more "feminine" cultures (for example, the Netherlands and the Scandinavian countries), conflicts tend to be solved through negotiations and compromise.

In "collectivist cultures" (for instance, Indonesia), individuals are first and foremost members of a group that offers lifelong protection in return for unconditional loyalty. They derive their identity from the group. Harmony within the group is a prime concern and conflicts have to be prevented, or at least formulated so that no one "loses face." Mediation may work better than unassisted negotiations because it is easier to make concessions without losing face to a mediator than to the parties with whom there is a conflict (Cohen, 1993). Conflicts between groups are often not solved but suppressed and may result in an armed struggle, at least when the cultures concerned are also uncertainty averse. "Uncertainty averse" means that members of these cultures

feel threatened by uncertain or unfamiliar situations (as in the case of Israel and the Arab countries; Hofstede, 1991).

“Power distance” refers to the degree to which the less-powerful members of a group expect that power is divided unequally and accept this (or, conversely, totally reject it). In cultures with a small power distance and little uncertainty aversion (such as Great Britain), the preferred conflict resolution methods are informal, flexible methods. If the power distance is small but uncertainty aversion high (as in Germany), the preferred methods are formal, impersonal procedures. If the power distance is large and uncertainty aversion high (for example in France), the preferred methods are bureaucracy and hierarchy. Finally, if the power distance is large but uncertainty aversion low (as in Indonesia), the preferred method is also hierarchical, but without the structuring of activities characteristic of bureaucracies (Hofstede, 1991). Hierarchical resolution of conflicts between countries is often not possible, so international conflict resolution could be especially difficult in the case of hierarchical cultures (cf. Verweij, 2000).

Complications can occur when the parties in a conflict come from different cultures. Culture influences the perceptions of the parties and the values to which they adhere, so different cultures can mean different perceptions and values. Misunderstandings can occur easily when the same actions and words may have different meanings. Problems may also occur if one party sees the other party, whether correctly or not, as culturally arrogant and dominant. Relations can improve if one of the parties shows an interest in the culture of the other and common cultural elements are discovered (Salacuse, 1993). Whenever there are large cultural differences, it may be useful to have experienced diplomats undertake the negotiations rather than high government officials with little international experience. One could also use a mediator as a kind of “cultural interpreter” (Avruch and Black, 1993; Cohen, 1993).

A few limitations of Hofstede’s theory need to be mentioned. First, subcultures – national and international ones – can be at least as important as national cultures. For instance, environmentalists and bureaucrats in one country may have more in common with their foreign counterparts than with each other (cf. the “cultural theory” of Thompson et al., 1990; Verweij, 2000). Different subcultures may prevail at different times. For example, in Japan two types of negotiation exist that are prevalent in different periods: the consensus (“feminine”) type of negotiation and the warrior (“masculine”) type (Faure, 2001). Behavior is therefore less predictable than Hofstede’s typology suggests. For subcultures, moreover, other dimensions rather than the five listed may be important. Finally, most concepts of culture generally can be misused. Culture may be used to stereotype people or as an excuse for failing negotiations. If the concept is not specified, it can be misused to “explain” everything that cannot be explained otherwise.

2.3.2. The Potential for Conflict and Cooperation

The analysis of the context should make it possible to identify the main issues and players and the potential for conflict and cooperation. It should be possible to characterize the main issues as collective problems, positive externalities, or negative externality problems (Section 2.2). As argued, the cooperation potential is highest in the case of collective problems and conflict potential is highest in the case of negative externality problems. Yet one should also pay attention to subjective perceptions and to relational aspects, including the degree of trust or mistrust and the balance of power.

2.3.3. Development of Agreement (or of a Serious Conflict)

The potential for conflict and cooperation gives the background for the negotiation process. Negotiation processes can be analyzed in terms of five elements (cf. Faure, 2001):

- the actors involved
- the context
- the strategies employed
- the process itself
- the outcome.

The *actors* in negotiations can be individuals, groups, organizations, and states. They include not only those at the negotiation table, but also influential audiences, such as the media, parliaments, and public opinion. The local population and other groups that may be affected by the outcome may be excluded if they are not listened to and lack the resources to make themselves heard.

The actors are determined largely by the *context*. For instance, in a democracy the media and public opinion can be influential, while in a dictatorship they usually are not. Yet, the context does not determine everything. Actors themselves decide whether to enter into negotiations or not and whom to consult or not. Key actors may have the power to invite other actors to the negotiation table or reject them. This may be part of their strategy.

Strategy can be defined as "the general orientation of the action which each negotiator adopts to achieve his/her goals" (Faure, 2001, p. 18). One possible strategy is to make the solution of an issue that is of concern for another actor dependent on the solution of an issue that is important to oneself. This is called "issue linkage." Other possible strategies include threatening, advocating more research to take the heat out of the conflicts or to delay, and offering financial compensation or contributions to the costs of works. Another strategy is to foster good relations, give in on less important points, and create a "reservoir of goodwill" (LeMarquand, 1977) to use when issues arise that are important for you. Strategies can be characterized as more or less cooperative, more or less flexible, and so on. One can hypothesize that in masculine cultures the less cooperative strategies are more popular, and in feminine cultures the more cooperative ones (cf. Hofstede, 1991; Box 3).

The *process* describes the interactions of the actors within the evolving context, employing strategies and negotiation tactics. It focuses on the dynamics of negotiation and on the developments in time. It is often useful to distinguish several rounds of negotiation. If in any phase the interactions become more cooperative, we may expect to see an improvement in the relations, more agreement on the facts, and more consideration of the interests of the other parties. If relations become more conflictual, we may expect the opposite.

The *outcome* of the process is what the actors are ultimately interested in. The immediate output of cooperation is an explicit or implicit agreement. This usually still needs to be implemented to obtain the outcome. Often further agreements are needed, especially in the case of a framework agreement. Negotiations often continue right into the implementation phase, as agreements can never be specific and flexible enough to cope with every eventuality. However, the earlier agreements set the framework for the later negotiations.

2.3.4. The Agreement

The agreements that are reached can be analyzed in terms of the institutions established. Institutions can be described as:

Rules of the game or codes of conduct that define social practices, assign roles to the participants in those practices, and guide interactions between the occupants of these roles.

(Young, 1995: 33)

Three types of institutions can be distinguished (Ostrom, 1992). *Operational rules* determine who can make which use of the resource (use rules) and who should make which contribution to providing or maintaining the resource (provision rules). Examples include international rules on water allocation (use rules) and treaty provisions concerning the construction of joint infrastructure (provision rules). *Decision-making rules* determine how the operational rules are decided upon. These include for instance public participation requirements. Closely related are *constitutional rules*. These determine who is entitled to take decisions. In international freshwater management this is usually national government, but sometimes lower-level governments are entitled to conclude international treaties, or competencies are delegated to international or supra-national organizations.

While some authors limit the term "institutions" to the rules that are followed in practice (for example, Ostrom, 1992), others focus exclusively on rules that have been enunciated officially or on the organizational structure that has been established: the formal institutions. A complete description of cooperation and conflict requires attention to both. Formal institutions are established time and again, which in itself is already enough justification to study them. Sometimes they are effective and sometimes they are not. Yet informal institutions are important too. For instance, for decision making in a river basin commission, the cultural backgrounds represented and the practices that have developed in the commission can be just as important, if not more so, than the pertinent treaty or bylaw.

2.3.5. Implementation

The implementation of an agreement can mean different things, depending on the content of the agreement. It may for instance entail the actual installation of a river basin commission foreseen in a treaty, the conclusion of further agreements, the construction of infrastructure, and/or compliance with specific rules by different government bodies and water users. Implementation can also be lacking. As discussed, this can give rise to new conflicts, but even if agreements are implemented correctly, new conflicts can arise or new potentials for cooperation can develop.

2.4. Assessing the Effects

The effects of the process can be assessed in different ways. A first approach is to look whether the agreement is actually implemented. This is fairly straightforward, if the agreement is clear and reliable data is available.

A second approach is to see whether the goals of the pertinent agreement have been reached. Even if the goals have been reached, however, this may not be due to the agreement itself. An international agreement may aim to improve water quality, but if the water quality actually improves, this could also be due to an economic recession resulting in less industrial activity or to improved regulation at the national level irrespective of the agreement. Attributing goal achievement to an agreement requires, first, the development of a detailed causal chain from the agreement to its implementation and on to goal achievement, and second, sufficient evidence for each link in this chain ("pattern matching"; Yin, 1986).

A third approach is to assess the effectiveness of agreements by considering broader goals, such as the extent to which the interests of the countries involved have been satisfied. Attributing goal achievement to the agreement remains a problem. An additional problem is how to select and specify the relevant goals. The selection is

never a neutral activity (but neither is selecting the officially stated goals). One approach is to refer to principles such as those in the Dublin Statement and the UN Watercourse Convention (ACC/ISGWR 1992, UN, 1997). Though widely accepted, they are not universally accepted and need to be translated in practical terms before they can be used for evaluating the effects of agreements.

For the PCCP project two obvious criteria for evaluating agreements are the promotion of further cooperation and the prevention of escalation. Other criteria are the challenges mentioned in the Hague Declaration (2000), the outcome of the Ministerial Conference in March 2000:

- *Meeting basic needs.* Drinking water and sanitation; empowerment of people, especially women, through a participatory approach.
- *Food supply.* Food security (not necessarily food self-sufficiency); more efficient agricultural water use and more equitable allocation.
- *Protecting ecosystems.* Ensuring the "integrity of ecosystems" through sustainable water resources management.
- *Sharing water resources.* Promotion of cooperation and development of synergies at all levels.
- *Managing risks.* Coping with floods, droughts, pollution, and other hazards.
- *Valuing water.* Water management that reflects the economic, social, environmental, and cultural value of water; more cost recovery of water services, while respecting the basic needs of vulnerable groups and equity.
- *Governing water wisely.* Involvement of the public and the interests of all stakeholders should be included in the management of water resources.

2.5. The International and the National Level

The present report covers cooperation and conflicts in which at least two countries are involved. Yet countries cannot be equated with states or national governments. International problems are often caused by domestic factors. For instance, a national government may have a very good water use policy, but an international water allocation conflict may still develop if lower level governments issue too many abstraction licenses or if there are many illegal abstractions. Resolving such a conflict usually requires the involvement of the lower level governments and the water users. This makes it more likely that any international agreement that is reached will also be implemented in practice.

In some cases lower level governments are entitled to conclude international agreements. The three regions in Belgium (the Flemish, Walloon, and Brussels Capital regions) provide just one example of this. Informal technical cooperation between experts is also quite common.

Sometimes government is not involved at all. One example is private litigation. In the 1980s, Dutch greenhouse farmers who use Rhine water for their crops sued the French potassium mines in the Alsace region because their discharges into the Rhine damaged the crops. Other examples are the many cases of transboundary cooperation by public and economic interest groups, such as international associations of environmental groups or of industries.

In several cases there is a government layer above the national level. Many international and a few supra-national bodies exist that play a role in international freshwater management: river basin commissions, boundary commissions, lake commissions, regional economic cooperation bodies, and so on (Section 4). Even if these bodies are strictly intergovernmental and lack decision-making powers, they still change the playing field and channel interactions.

Besides all this, it is usually not correct to treat national government as a unitary actor. National governments usually consist of different sectoral ministries, and

parliaments often contain many sectoral specialists. The different sectors may not always agree on the national position concerning international freshwater issues. For instance, a ministry for energy production or for water management may favor the construction of a hydropower dam on an international river, whereas the ministry of environmental protection may be against (cf. the situation in the late eighties in Hungary: Várkonyi, 1990). Similarly, differences may exist between national governments and local governments or communities, between different local governments or communities, between governments and groups of water users, between different groups of water users, and within groups of water users.

To understand the development, content, and effectiveness of international agreements, it is essential to get a clear view of the constellation of actors and their activities. Who represents a country in international negotiations? Who do they get their information from? What is the relative power of the different actors? On environmental issues countries are usually represented by their environmental ministries. These ministries may use international agreements to introduce stricter environmental regulations in their own country than would have been possible in a direct confrontation with the different domestic interests (Golub, 1996; Bernauer and Moser, 1996). However, such a strategy may also fail. Agreements may not be ratified due to national opposition or they may be ratified but not implemented. Environmental ministries (and other sectoral representatives in other negotiations) may therefore also decide to consult beforehand with the other sectors.

Figure 2 gives an overview of the different cooperative or conflictual relations that may exist within international freshwater management.

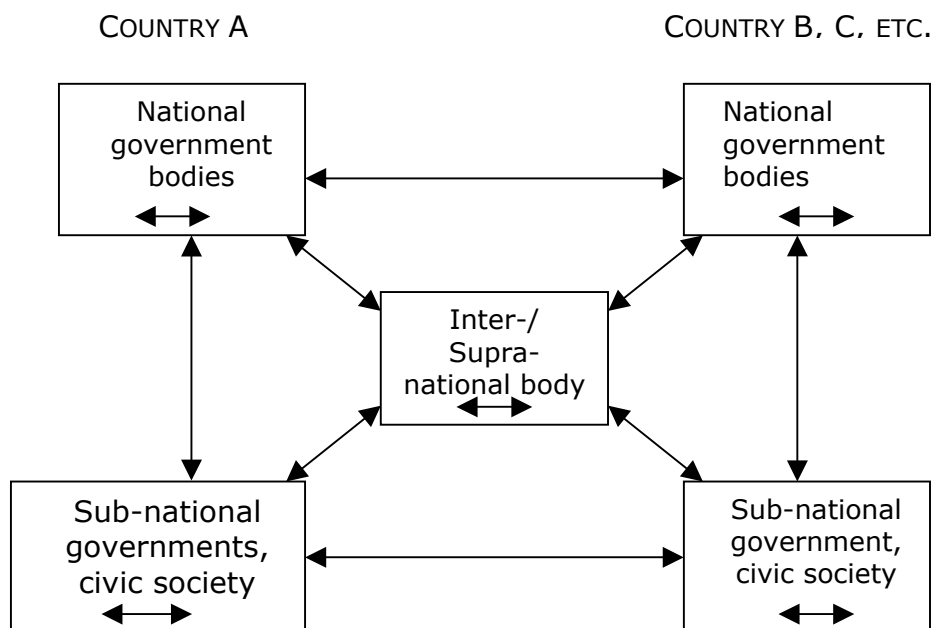


Figure 2. Potentially conflictual or cooperative relations in international freshwater management

2.6. Assessing International Freshwater Management

The present report will assess the effectiveness of international freshwater management using the approach outlined above. Four groups of variables will be used (Figure 3):

- the context
- the negotiation process that leads to the agreement
- the design of the international agreements/institutions
- the outcome.

The context and the negotiation process are discussed in Section 3. The institutions themselves are described in Section 4. Section 5 discusses the outcome. Section 6 and Section 7.1 contain the lessons that can be drawn and seven key messages.

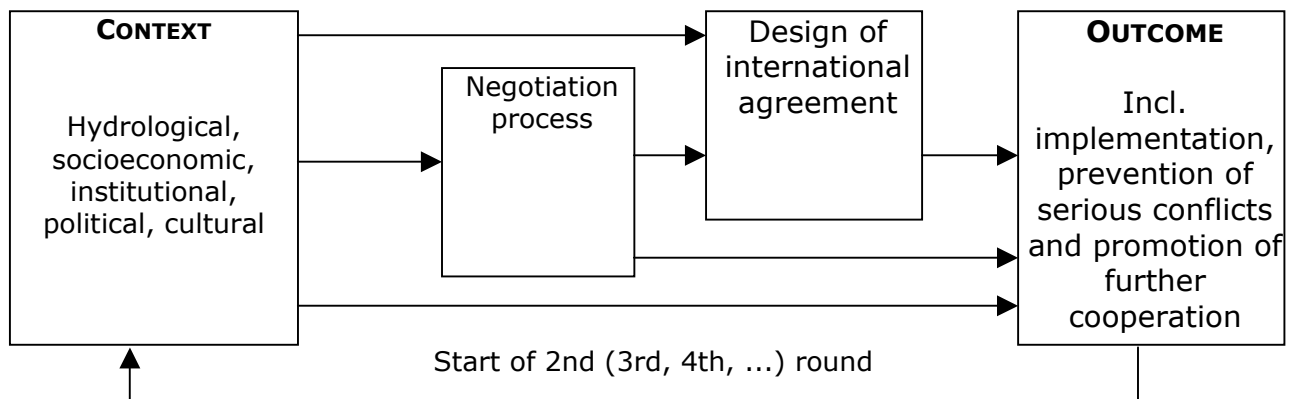


Figure 3. Explaining the effectiveness of international freshwater management

3. THE DEVELOPMENT OF COOPERATION

This section gives an overview of how cooperation develops in international freshwater management. Section 3.1 describes the different contexts. Section 3.2 gives an outline of the process that led to international agreements. Section 3.3 discusses the strategies that were used for reaching these agreements.

The section is based on the different cases studied for this report. Box 2 lists all the cases and contains references.

3.1. The Context of International Freshwater Management

3.1.1. Natural Conditions

The starting points for international freshwater management are the natural conditions: climate, topography, geology, existing ecosystems, and so on. These determine water availability and the possibilities of different forms of water use, such as fishing, rain-fed and irrigated agriculture, hydropower, and shipping. The cases studied in this report show a wide variety: small and large rivers, small and large basins, lakes, aquifers, in moderate and in tropical climates, with and without large intra- and interyear variability, in mountainous and flat terrains, and so on. Consequently, the analysis in this report is potentially widely applicable.

3.1.2. Water Uses and Socioeconomic Development

The second group of factors concerns actual water uses. These depend not only on the natural conditions, but also on the level of socioeconomic development. For example, in developed countries industrial water use is usually economically very significant. In the most-developed countries industrial water use is often relatively efficient and the

problems of industrial pollution have largely been solved. The Meuse and Scheldt basins (France, Belgium, the Netherlands) offer two examples, despite remaining problems such as accidental pollution. In moderately developed countries, industrial water pollution can be very serious. In addition, much urban wastewater is not treated. These pollution problems can give rise to traditional upstream–downstream conflicts. The problems are greatest if the downstream country is more developed economically and has a stricter pollution control policy than the upstream country. An example is the Tijuana river basin (USA–Mexico).

Pollution can also be caused by agriculture (pesticides, nutrients). The most common agricultural water problem is, however, water use. It has been estimated that worldwide 66 percent of all surface water abstraction is for agricultural purposes, mainly irrigation. In some countries this is even as high as 90 percent (Shiklomanov, 1999). This means that improvements in agricultural water efficiency can significantly reduce overall water scarcity.

When discussing agricultural water use, it may be worthwhile to distinguish between high and medium-income countries, poor countries, and very poor countries. High and medium-income countries have more flexibility in reducing agricultural water use than other countries. Agricultural production could be reduced because agricultural workers laid off can be absorbed by other sectors of the economy and food can be bought from abroad. Of course, the process might be very painful for the people concerned, and during an economic depression unemployment might increase.

In poor countries, the opportunities for reducing agricultural water use are much smaller since the population relies far more on the food they grow for themselves and there are few alternative sources of income.

In very poor countries, agricultural water use is sometimes very limited because the funds or the organization for irrigated agriculture are often not available. People rely for their livelihood on rain-fed agriculture, flood recession farming, or fishing. As the case of Senegal shows, improving these sectors may be more beneficial for the people concerned and more economically viable than the introduction of large-scale irrigation (Adams, 2000).

Irrigation often requires the construction of dams and reservoirs. Other functions of dams and reservoirs are the supply of drinking water, hydropower production, flood protection, and improvement of navigation. Large dams are often very controversial. Some people see them as the best or only means to feed the growing world population, produce environmentally friendly energy, and eradicate poverty. Others emphasize the economic and environmental costs of large dams, the economic benefits of natural rivers and floodplains, such as fishing and recession farming, and problems such as forced relocation and limited compensation for the local population. Without going into the large dams debate (see for instance WCD, 2000 and reactions to it), it is clear that dams on international rivers can create a great deal of international tension in water-scarce regions. Examples include the Indus, the Euphrates, the Ganges, and the Spanish–Portuguese rivers. However, dams can also promote international cooperation, as in the case of dams in boundary stretches. Examples include the Senegal River and the Salween River. Especially in the latter case, however, many seriously doubt the benefits for the local population. Skeptics include international human rights and environmental NGOs (see, for example, Moe, 2000) but also governmental organizations; the US Department of Labor, for instance, has stated that Myanmar is using forced labor for large infrastructural projects like dams (US Department of Labor, 2000).

Other types of water management infrastructure can give rise to similar conflicts and discussions. The Alpine Rhine case, discussed in Section 3.3, offers an example of this.

In many of the basins studied, nature conservation has become a serious concern, including basins in developing countries. For this to become a concern,

people must first believe that there is a real or potential impact on the ecosystem concerned. Second, this impact should be considered serious, either because it affects humans making use of the ecosystem or because the ecosystem in itself is considered valuable (has an "intrinsic value"). Ecosystems are valued for their own sake especially in the rich part of the world, such as Europe and the United States, and by international NGOs coming from these parts. However, in other parts of the world nature sometimes also has a special religious or cultural meaning. In basins such as those of the Scheldt and the Rhine, so much nature has been lost that nature *development* has become an important issue. Nature development means that favorable conditions are created for the development of ecosystems that are considered valuable (for example, dykes are removed to recreate wetlands). Sometimes nature development requires continuous active nature management, such as felling trees in river meadows.

A completely different water use is the use of rivers as national boundaries. Since rivers tend to meander and change their course, boundary problems can occur. Examples include the Ganges–Brahmaputra case and the Rio Grande case.

A fundamental issue is often population growth. Population growth usually increases pressure on freshwater resources. Water demand rises, land use intensifies, more rapid erosion may occur, areas may become flood prone, and flood risks may increase. This can give rise to international tension. There are several ways to make the use of water and land resources more efficient, allowing more people to live in the area concerned. A complicating factor is that most basins with a high population growth are to be found in the so-called developing countries, which in addition often have little precipitation and high evaporation (Shiklomanov, 1999).

3.1.3. Actors

The actors involved in international freshwater management vary according to the level of socioeconomic development (cf. Section 2.4). In the "developed" western countries the main actors are the main water use sectors. These differ from case to case, but usually they include industry, agriculture, households, and sometimes also shipping and hydropower. Each sector has its own government agencies, often with direct links to their counterparts abroad. Sometimes international freshwater management can be explained better in terms of conflicts between sectors than in terms of conflicts between countries. For instance, the improvement of the Rhine's water quality since the 1960s is largely due to increased pressure on industry, coming from increased environmental awareness and legislative initiatives at both the national and the European Union level. The intergovernmental International Commission for the Protection of the Rhine played a facilitating role, but it was not the driving force (Mostert, 1999; see also Section 5.3).

In developing countries too there are different water use sectors. A major difference is the presence of international donors and, sometimes, international NGOs. The distance between the population and national government is sometimes larger, due to limited means of communication, different political systems, or both. Consequently, a different typology of actors may be useful: (1) national governments and bureaucracies; (2) international donors; (3) international NGOs; and (4) the local population (Adams, 2000, on the Senegal River).

The prime concern of local populations is usually to safeguard their livelihood. The interests of the national government bureaucracies may focus on the interests of the country as a whole, the interests of the capital, the interests of the ruling elite, or the specific sectoral interests which they represent, such as commercial farming or hydropower production. International river basin commissions are usually intergovernmental and often sectoral, and focus on the same types of interests. In the case of differences between the local population and national governments,

international donors sometimes side with national government either for altruistic reasons or to get (infrastructure) projects implemented, show results to their own constituencies, and further the interests of national firms that may get contracts. In other cases international donors may give more weight to the interests and the views of the local population. International NGOs usually support the local population and/or the local environment.

3.1.4. Political and Institutional Context

The political context plays an important role in several respects. The international political situation determines how good the relations are between the countries involved in an international freshwater issue. Obviously, it is much easier to solve water management problems if relations are generally relaxed rather than if they are tense, although tense relations do not make problem solving impossible (see Section 3.2).

The national political context is important in two respects. First, it determines which national players can influence the international policy of the country concerned and which cannot. Second, the constitution of a country can complicate international cooperation. Reaching agreement with a unitary state requires agreement with its national government. Reaching agreement with federal states (or unitary states that function in practice as a federal state) may require that all the federal states agree with each other. This may be quite complex, as shown by the case of the Meuse and the Scheldt rivers (Belgium). Yet there are also advantages. Regional interests are not overlooked and implementation of the agreement at the regional level might be less problematic.

3.1.5. Culture

A final element of the context is the national culture. The role of culture is discussed in Box 3. The cases studied for this report represent a very wide variety of national cultures (Hofstede, 1991). The lessons drawn from their analysis (Section 6) should therefore be applicable in a wide variety of cultural contexts.

3.2. The Development of Cooperation

3.2.1. Potential for Cooperation or Conflict

Given the wide variety of contexts encountered, it should come as no surprise that international cooperation in the cases studied developed in quite different ways. As argued in Section 2.3, international freshwater management starts with a potential for cooperation or conflict. This potential is a function of the natural, socioeconomic, political, and cultural context. It can be measured in terms of:

- goals (conflicting or converging interests and fundamental values)
- relations (good or bad)
- perceptions (factual controversies).

Section 3.1.2 gave an overview of the different international issues encountered. The most common issue in the set of cases studied was water scarcity and water allocation, followed by hydropower potential, water pollution, flooding, shipping, boundary issues, and habitat protection or development. All water allocation cases and most others could be qualified as "negative externality cases," meaning that action by one basin country concerned had negative effects on the others.

The Lake Peipsi, the Senegal, and the Alpine Rhine cases could be qualified as "collective problem cases" since the problems were defined in such a way that all basin countries had an interest in their solution (management of a common lake,

integrated development of a common river, restraining the flooding of a boundary river). However, the interests of the countries were not always equally large, and within the countries there were sometimes clear conflicts of interests.

The Mahakali case involved the joint development of a river for irrigation and hydropower production and therefore could be misconstrued as a collective problem case. The interests of India were so much larger than those of Nepal, however, that the cases should rather be seen as a "positive externality case": one country trying to persuade another country to take action that would benefit the first country (Marty, 2001).

In a number of cases, relations between the countries were strained and no satisfactory solution has been found to date (the Euphrates and the Ganges-Brahmaputra cases). Nonetheless, in a few cases agreement was reached despite strained relations. In the case of the Indus River, India and Pakistan agreed that each state would have complete control over its own tributaries, thus minimizing the need for continuous cooperation. Other cases where cooperation developed despite strained (or at least not relaxed) relations were the Senegal River and Lake Peipsi, both of which can be characterized as collective problem cases. In other cases international water management problems were solved after international relations had improved or as a means of improving the relations (for instance, the Rio Grande case).

In a few cases the strained relations were caused by inequalities between the countries concerned. This is especially apparent in the case of Nepal and India (Mahakali) and, historically, the Swiss cantons and Austria (Alpine Rhine). To a lesser extent it also occurred between the Netherlands and the Walloon region (Scheldt and Meuse cases), and between the United States and Mexico. As argued in the previous section, large differences in socioeconomic development can mean different levels of environmental awareness. In addition, different levels of expertise and different opportunities to conduct research can cause controversies about facts.

Factual controversies were not discussed in detail in the literature on the cases, but it is known from other literature that they can play a very important role. In the Pancheshwar case an important issue was whether the studies should be conducted by India (as India preferred) or by external consultants (preferred by Nepal). Research is never completely neutral. Even the most conscientious researchers leave their personal mark on the results, or the mark of the organization that determined the terms of reference of the research. Data availability is usually limited and data reliability is limited or unknown, resulting in a lot of uncertainty. This uncertainty is – consciously or unconsciously – "filled in" by the researchers and their concerns and interests. Moreover, implicitly, many choices are made during the research itself; for example, some possible solutions are studied and others are not. Consequently, research conducted by or on behalf of one party may not always be accepted by the other parties. They may either challenge the data or interpretations or – especially if they have limited scientific expertise and lack funds to hire it – opt for a highly politicized approach to the issue at stake (Collingridge and Reeve, 1986; Frankena, 1988; Jasanoff, 1990).

Factual controversies and overly political approaches could be prevented by conducting more *joint* research, as for example, in the framework of a river basin commission. As shown by the International Commission for the Protection of the Rhine and many other commissions, this can result in a common factual basis for management (Mostert, 1999). In addition, such technical cooperation could be used to build up mutual trust between the countries concerned and might prove to be more robust than cooperation at the political level. Cooperation at the political level tends to stop when international relations deteriorate, but low-profile technical cooperation can continue, and this can be a good basis for renewing cooperation at the political level when international relations improve again (for example, Savenije and Van der Zaag, 2000; Wolf, 1997).

Finally, the potential for cooperation can increase significantly when there is a disaster or a crisis. A pollution incident with highly visible and well-publicized effects, such as the Sandoz disaster in the Rhine basin, a severe drought, or severe floods can convince the public and the politicians that something should be done. (Of course, disasters can also create serious conflicts. The Chinese symbol for crisis consists of two characters, the first meaning threat, the second opportunity.)

3.2.2. Negotiation Process

Given a certain potential for conflict or cooperation, negotiations can start, ultimately aiming for an agreement. The case studies included in this report generally gave little information on the negotiation process itself. Hardly any information was available on the tactics employed at the negotiation table. Yet, no indications were found that the general lessons from the literature on negotiations (for instance, Fisher and Ury, 1981; Mastenbroek, 1996) do not apply to international freshwater issues. More information was available on the general strategies employed (Section 3.3), the duration of the negotiations, and the role of technical cooperation.

Surprisingly, technical cooperation did not seem to play a large role. This might be due to the cases selected or to literature on these cases. However, it might also be because of the fact that the factors explaining technical cooperation are very similar to the factors explaining cooperation generally (cf. Chenoweth and Feitelson, 2001). Data and information can be used in negotiations and legal proceedings, so it is not always in the interest of the country concerned to give all the information it has. Technical cooperation does require a basic level of mutual trust. However, once this level is present, technical cooperation can be used to increase mutual trust and develop a common factual basis for management. In addition, or alternatively, cooperation could start with a small project with a large chance of success, again to instill patterns of cooperation (Wolf, 1997). In general, negotiations should start with the less controversial issues (Brehmer, 1989; cf. Vlek and Cvetkovich, 1989).

The length of the negotiation process ranged from between one and four years (Columbian Amazon basin, Lake Peipsi, Senegal River and Niger River), to thirty years (Scheldt River and Meuse River), or even more than 100 years (Alpine Rhine). The short periods usually apply to framework agreements that need further elaboration (for instance, the Columbian Amazon) or to modifications of existing ineffective institutions (for example, the Senegal River). The development of effective international cooperation usually takes ten years or more, starting from the official recognition by at least one of the countries concerned that cooperation is needed. To this we may add the time it takes before issues are officially recognized.

3.3. Strategies

Effective negotiations result sooner or later in an agreement or agreements. Different strategies are used to reach agreement. In theory, reaching agreement is easiest in the case of collective problems since all countries concerned have an interest in their solution. Even so, as witnessed in the Alpine Rhine case (see also below), it may take more than 100 years before agreement is reached, due for instance to bad international relations, inequalities in expertise, domestic conflicts of interests, lack of trust that the other country will honor its part of an agreement, and limited opportunities to ensure this.

In the case of negative externality problems (usually upstream–downstream problems), fundamental conflicts of interests need to be overcome. A way of doing this is to link the upstream–downstream issue with other issues in which the upstream country is primarily interested (“issue linkage,” see Section 2.3). This was tried for instance in the Meuse and Scheldt case. In 1967 Belgium wanted to discuss the

deepening of the Western Scheldt, the navigation way through the Netherlands to the Belgian port of Antwerp. The Netherlands agreed to this if at the same time two other issues were discussed that were of interest to the Netherlands: the pollution of the Scheldt and Meuse rivers and water allocation in the Meuse. However, no solution could be found in this regard because of internal differences in Belgium. The harbor of Antwerp is located in the Flemish region, whereas much of the pollution reduction efforts and other measures would have to be taken in the Walloon region. In other words, the costs and benefits of a package deal would have fallen on different groups in Belgium, and the upstream–downstream conflict could not be overcome. A definitive solution came only in 1994–5, after a few more issue linkages without these particular problems (Meijerink, 1999; Mostert, 2001).

In several other cases issue linkage played a role, either at the international level (the Euphrates case) or at the domestic level (the Colorado River). In one case the possibility of international court action played a role (the Colorado River salinity problem). In some cases external donor funding has stimulated cooperation since such funding is often dependent on international agreement (for example, the Niger River). In other cases the military strength of one country may have contributed to the conclusion of an agreement (the Pancheshwar project). Such forced agreements are usually not very stable and effective, and the Pancheshwar project has still not been constructed.

Another strategy for reaching agreement is “side payments,” for example, paying for pollution reduction, as happened in the Rhine basin with the French potassium mines (Dieperink, 1997, 1998). In addition, “slag cutting” can be employed, which means that sectoral government bodies use their privileged access to specific international arenas in order to introduce a more ambitious policy domestically than would be possible if they confronted other sectors directly (Golub, 1996; see also Section 2.5). No clear example of the latter mechanism was found in the cases studied.

Especially if relations are strained and mutual trust is lacking (as in the case of Pakistan and India discussed earlier), control over the implementation of the treaty is a serious and important issue. Unless all states concerned trust that the others will honor their part of an agreement, no agreement will be reached or, if there is already an agreement, no implementation will take place. The control issue can sometimes be solved physically, for example, when a project can be located in two countries. In other cases effective compliance mechanisms and conflict resolution procedures may need to be devised.

The Alpine Rhine case offers an interesting illustration of the problems of trust and control. The Alpine Rhine is a boundary river between Austria and Switzerland. To reduce flooding, both countries have for centuries encroached upon the floodplain and built ever-higher levees independently of each other. This resulted in higher flood risks on the opposite bank and in a “levee race.” In 1892, it was decided to increase the discharge of the river by cutting off two of its bends: the Diepoldsauer cut-off upstream through Switzerland and the Fussacher cut-off downstream through Austria. Austria did not want to start the construction of the Fussacher cut-off if the Swiss did not simultaneously start the construction of the Diepoldsauer cut-off, fearing that otherwise this cut-off would not be constructed at all. Technically, the Diepoldsauer cut-off was probably not necessary to solve the flooding problem, but politically the cut-off had been necessary to get the required support within Austria for the 1892 agreement. Yet, the Swiss had serious doubts about the technical feasibility of constructing the upstream Diepoldsauer cut-off before the completion of the downstream Fussacher cut-off. In the end, enough trust developed for the Austrians to construct the Fussacher cut-off first and for the Swiss to construct the Diepoldsauer cut-off afterwards (Marty, 2001).

This last example points to the importance of maintaining or developing good relations and mutual trust. In fact, this was the most common and most powerful strategy for reaching agreement in the cases studied. One could also call this "good neighborliness," "reciprocity," or the creation of a "reservoir of goodwill" (LeMarquand, 1977). It implies that countries are willing to compromise on some points that are more important for the other countries than for themselves, expecting that the other countries concerned will in turn reciprocate. Maintaining or developing good relations constitutes a long-term investment, with long-term benefits for all countries concerned that outweigh the short-term benefits of less cooperative behavior. It could also be seen as a relaxed form of issue linkage. Issues do not have to coincide in time, there are fewer factual controversies because of the good relations and mutual trust, negotiations can be shorter, there is no need for strict compliance procedures, and management can be more flexible. If the relations are good any water management problem can be solved, or at least serious escalation can be prevented.

4. INSTITUTIONS FOR MANAGING INTERNATIONAL FRESHWATER RESOURCES

This section describes the formal institutions that have been established for managing international freshwater resources, using nineteen institutions as an example. Attention is paid to the scope of the institutions (Section 4.1), the organizational frameworks that have been set up (Section 4.2), and the procedures within these organizations (Section 4.3). Public participation receives separate attention (Section 4.4). The information for this section comes from research by the FAO in Rome for the PCCP project. Details on the individual institutions can be found in the research report "Institutions for International Freshwater Management" (Spreij, 2002; for a different overview see Kliot et al., 2001).

4.1. Scope

The institutions studied showed a wide variety in geographical scope (Table 1). Many of them apply to complete river or lake basins or major sub-basins, and sometimes their activities are not limited to water issues only, but include regional economic development. The basin institutions usually deal with the integrated management of the basin or at least with a wide array of water uses. Yet, in practice one can see a distinction between, on the one hand, more development-oriented basin institutions in the so-called developing world, such as the Mekong Commission and the OMVS in the Senegal basin, and on the other hand, more protection-oriented basin institutions in the "developed" world, such the commissions for the Rhine and the Danube. The latter often focus on pollution control and nature issues, whereas the former often focus on developing or managing infrastructure, such as dams for hydropower production or irrigation. Institutions in all parts of the world deal with water allocation issues.

The river or lake basin institutions are usually involved in planning and policy preparation for their basin and often conduct studies or coordinate research and monitoring. They usually do not regulate the use of the basin, although some have some powers in this respect, for example the Mekong commission. When ministers or high-level politicians are involved, as is often the case (next section), they can take politically binding decisions. If not, they have primarily a coordinating and advisory role.

Several institutions deal primarily with boundary waters or, occasionally, boundary basins: a Finnish-Swedish and a Finish-Russian commission, the International Boundary and Water Commission (USA-Mexico), and the International Joint Commission (United States-Canada). Compared with basin institutions, they

tend to deal more with management rather than policy issues and often limit themselves strictly to issues with a transboundary impact.

Table 1. Formal institutions for international freshwater management I

<i>Resource/institution</i>	<i>Geographical scope</i>	<i>Functional scope¹</i>	<i>Tasks and powers²</i>	<i>Organisation³</i>
<i>Africa:</i>				
Joint Authority for the study and development of the Nubian Sandstone Aquifer ²	Aquifer	A	I,MR,PD	M,S
Kagera Basin Organization	Sub-basin	I,E	A?	D,S
Lake Chad Basin Commission	Basin	I	A,I,PP	H,CS,S
Niger Basin Authority	Basin	I	A,PD,R	H,M,CS,N,S
Nile Basin Initiative	Basin	I	F,PP	M,CS,S
Permanent Okavango River Basin Water Commission	Basin	A,N,Q,W	A,MR,PP	D
OMVS (Senegal Basin)	Basin	I, esp.W	MR,O,PD	H,M,CS,W,N,S
<i>Asia:</i>				
Permanent Indus Commission	River system	A	R	2 commiss-ioners
Mekong River Commission	Lower basin	I	MR,PD, R	M,CS,W, S,N
<i>Europe:</i>				
ICPDR (Danube)	Basin in member states	I	A,MR,PP	(M),D,W,S
Finnish–Norwegian Boundary Waters Commission	Boundary waters	I (trans-boundary only)	A	D
Finnish–Swedish Frontier River Commission	Boundary basins	Esp. W and Q	MR,R	D,secretary
Joint Finnish–Russian Commission	Boundary waters	I (trans-boundary only)	MR,R	D
International Commission for the Protection of the Rhine	River/basin in member states	I	A,MR,PD	(M),CS,W,S
<i>North America:</i>				
International Boundary and Water Commission	Boundary waters	I	A,F,MR,O	N+S
International Joint Commission ²	Boundary waters	I	A,R	D,N+S,W

<i>South America:</i>				
Intergovernmental Coordinating Committee (Plata basin)	Basin	I	A,I,MR	M,CS,N,S
Salto Grande Joint Technical Commission	Part of river (hydro-electric complex)	H,S	F,PP, esp. O	D,W?,S
Uruguay River Management Commission	Part of river	I	MR,O,R	D,WS

Notes:

- 1: A = water quantity, E = economic development, H = hydropower, I = integrated/all, N = nature protection/management, Q = water quality, S = shipping, W = water works generally.
- 2: A= advising/coordinating, F = feasibility studies/coordinating donor funding/project management, I = information exchange/clearing house function, MR = conducting or coordinating monitoring and research, O = operating infrastructure, PD = determining policy, PP = policy preparation/planning, R = regulating water uses/allocating water.
- 3: CS = civil servants/commissioners in plenary commission or "technical advisory commission," D = composition delegations up to member states, H = heads of state in commission or regular conferences, M = ministers in commission or regular ministerial conferences, N = national sections or commissions, S = separate secretariat/permanent staff, W = working groups, expert groups and/or advisory bodies.

Some institutions refer only to the main course of the river or only a part thereof, or sometimes to the main course and some tributaries and distributaries. Some, like the Permanent Indus Commission, deal primarily with water allocation, while others have a more integrated scope.

Finally, very few institutions deal with aquifers. Only one, and quite a recent one – the Joint Authority for the study and development of the Nubian Sandstone Aquifer – is included in the overview, despite efforts to find more. This institution is involved in research and planning and information exchange. For the Guarani aquifer (Argentina, Brazil, Paraguay, and Uruguay) the establishment of an institution is presently being discussed. The European Union has adopted a Water Framework Directive (2000/60/EC), which requires the preparation of national and international river basin management plans that will pay attention to both ground and surface water.

4.2. Organizational Framework

The organizational frameworks set up for managing the freshwater resource range from extremely simple to very complex. This can be explained partly by the limited or broad scope of the institution, but other factors must be partly responsible, such as cultural preferences for complex hierarchical structures or for simple and flexible structures, the impression of well-developed cooperation that complex structures may give, or simply the ideas of the consultants involved in designing the institutions.

The Permanent Indus Commission has the simplest organizational set-up: two commissioners, one for Pakistan and one for India, who meet at least once a year. The Indus treaty as a whole is set up to minimize the need for further cooperation and interaction (Section 3.2).

Next in complexity come the Finnish–Russian and Finnish–Norwegian boundary waters commissions and the Permanent Okavango River Basin Commission. They consist of national delegations. The Finnish–Swedish Frontier River Commission, the Kagera Basin Organization, and the Joint Authority for the Nubian Sandstone Aquifer

have, in addition, a permanent secretariat. In the Joint Authority for the Nubian Sandstone Aquifer the countries are represented at ministerial level.

The most elaborate set-up is that of the OMVS (Senegal river). The supreme governing body is the Conference of the Heads of State, its supervisory body is the Council of Ministers, and its executive organ is the Office of the High Commissioner, which has several departments. Moreover, there is a general advisory body for the Council Ministers, the Permanent Water Commission, and there are two further consultative bodies, the Advisory Committee with representatives from governments, financial institutions, and the OMVS itself, and the Regional Planning Committee, which advises on the availability of water resources in the basin to meet the regional development plans of the member states. The member states also have National Offices, which are represented in the Advisory Committee. The Diama Dam and the Manantali Dam are managed and exploited by two separate companies, the SOGED and the SOGEM. The Council of Ministers acts as "General Assembly" of these companies.

A quite common model for the protection-oriented river basin commissions in Europe is to have a general assembly with high-level civil servants, working groups for specific topics with governmental and non-governmental experts, and at the highest-level, ministerial conferences, although the latter are officially not part of the commission (examples include the Rhine, Danube, and Meuse and Scheldt commissions). The work of these bodies is coordinated by a relatively small secretariat. In addition, national committees often exist to coordinate the national input into the commissions. Where they do not yet exist, as in the Netherlands, they may be established in the future to better implement the European Water Framework Directive and its planning provisions.

The two North American Commissions, the USA–Mexican International Waters and Boundary Commission and the USA–Canadian International Joint Body, are organized in two national sections.

Nearly all river basin organizations have legal personality of some sort. They can hire staff, sign contracts, and so on, usually according to the law applicable at the location of the headquarters of the organization (for example, the Danube Commission). Some are international bodies (the Lake Chad, the Mekong, the Uruguay, and the International Boundary and Waters Commissions). In other cases the staff enjoy certain diplomatic immunities and/or tax exceptions (the Plata, Salto Grande, the Finnish–Swedish Frontier River Commissions, the Kagera Basin Organization, and the Niger basin Authority).

As this section is based primarily on the analysis of documents, it is not clear how active organizations such as the Kagera Basin Organization presently are, or whether all subsidiary organs and working groups of the different commissions are active. Yet, most commissions are known from other sources to be active or even very active.

4.3. Procedures

Different rules apply to the functioning of the different organizations. Some are to be found in the relevant treaties, but many are also contained in bylaws. The most important rule is the means for taking decisions. Usually this is by unanimity or consensus. Apparently, states want to keep control. In two cases – the International Joint Commission and the Salto Grande Joint Technical Commission – decisions are taken by ordinary majority, but in both cases there are only two member states. Consequently, unless there is serious disagreement within a national delegation, a majority effectively means unanimity. The Finnish–Swedish Frontier River Commission can take decisions by qualified majority, but this commission also consists of only two delegations. The joint Authority for the Nubian Sandstone Aquifer can take decisions

by ordinary majority on some issues and by qualified majority on others; it has four member states, but it does not have many real competences. The Danube Commission, which is very active and has many different tasks, can take decisions by qualified majority except on financial matters, which require unanimity. To get decisions implemented, however, consensus will be needed in many more matters. Formally, however, it can be considered to be the most advanced of the river basin commissions – if, that is, one sees supra-national river basin organizations as the way ahead (cf. Ast, 2000; Mostert, 1998a).

Table 2. Formal institutions for international freshwater management II

<i>Resource/Institution</i>	<i>Decision making¹</i>	<i>Information exchange/ Prior notification</i>	<i>Funding²</i>	<i>Conflict resolution procedures³</i>
<i>Africa:</i>				
Joint Authority for the study and development of the Nubian Sandstone Aquifer ²	M, Q on some issues	Information exchange, no prior notification.	C,(A)	–
Kagera Basin Organization	U	–	C	A
Lake Chad Basin Commission	U	Yes	C,F (not implemented)	C,A
Niger Basin Authority	U	Yes	C,A	C
Nile Basin Initiative	–	–	C	–
Permanent Okavango River Basin Water Commission	U	Yes	C (limited)	–
OMVS (Senegal Basin)	U	Yes	C,P,(A)	A,ICJ
<i>Asia:</i>				
Permanent Indus Commission	–	Yes	F (not implemented)	C,A
Mekong River Commission	U	Yes	C,(A)	C,A (opt.)
<i>Europe:</i>				
ICPDR (Danube)	Q, U (finances)	Yes	C	C (opt.), A or ICJ
Finnish–Norwegian Boundary Waters Commission	–	–	C (necessary?)	–
Finnish–Swedish Frontier River Commission	Q	Yes	C	A

Joint Finnish–Russian Commission	U	Yes	–	C,A
International Commission for the Protection of the Rhine	U	Yes (no explicit not. req.)	C,P (chlorides)	A
<i>North America:</i>				
International Boundary and Water Commission	U	Implicitly	P	C
International Joint Commission ²	M (two delegations)	Yes	C	C=A
<i>South America:</i>				
Intergovernmental Coordinating Committee (Plata basin)	U	Very limited	C,F	–
Salto Grande Joint Technical Commission	M (two delegations)	Limited	P	A
Uruguay River Management Commission	U	Yes	C	C

Notes:

1: U=unanimity, O=ordinary majority, Q=qualified majority.

2: A = joint acquisition of international aid by commission, C = financial contribution for operating secretariat, F = international fund, P = project-specific arrangements.

3: A=arbitration, C = conflicts are discussed in or decided by the commission, ICJ=international court of justice.

–: no specific provisions.

The participating states usually have to inform the other basin states of the state of the resource, the management of the resource, and planned developments, either directly or through the commission. Sometimes a whole list of items on which information is to be provided is given (as with the Danube Commission), but sometimes the obligation is formulated quite generally or qualified by phrases such as “to the extent permitted by its laws and procedures” (Okavango Commission). In a few cases the treaty does not contain a specific provision on prior notification, but the obligation can be inferred from other provisions, for example, concerning the tasks of the commission that is set up (the Rhine Commission and the International Boundary and Water Commission).

The financing of the organizations concerned clearly depends on their functions and their structure. In nearly all cases the running costs of the organization are covered by financial contributions by the member states. The Permanent Indus Commission and the International Boundary and Waters Commission are the exceptions, as the former consists of two national commissioners only, and the latter of two national sections with no permanent joint staff or other common expenses. For

joint water works the costs and benefits, such as hydropower produced, are usually shared on a project-by-project basis. The tasks of the Niger Basin Authority explicitly include borrowing of funds and the reception of donations and legacies. Other organizations are in practice involved in securing or coordinating donor funding. Although it cannot be proven on the basis of the present research, some may even have been set-up exclusively to obtain international aid, as international cooperation is often a precondition for such aid. In three cases the pertinent treaties mention an international fund for financing projects. In one case this fund seems to be active (Plata basin), but in the other two cases the fund seems never to have been established (Indus and Lake Chad).

In all organizations conflicts are bound to emerge sooner or later. Some will not be serious and can be easily resolved by the countries concerned. Others will prove more intractable, and for these the treaties studied contain several procedures. In some cases the plenary commission will discuss the conflict or will act as arbiter. This is the case in the Lake Chad Basin Commission, the Permanent Indus Commission, and several more. Alternatively, or in addition, the states may use an arbitration procedure, involving for instance the establishment of a commission with one representative per state concerned and one additional chairperson appointed by agreement among the representatives concerned. Sometimes arbitration is optional (for instance, the Danube Commission), but sometimes it is obligatory for all member states (for example, the OMVS and the Permanent Indus Commission). In the case of the Danube Commission the member states may also opt for proceedings before the International Court of Justice. In the case of the OMVS the International Court of Justice functions as a court of appeal following arbitration.

4.4. Public Participation

Public participation in the different organizations is very limited, with few exceptions. The tasks of the organizations often include information exchange, and many have a public relations and communication department. In addition, many organizations publish reports and have web sites (Table 3). Yet in most cases this does not mean that citizens and NGOs have a right of access to information. Often information exchange is limited to exchange between the member states, as in the case of the Joint Authority for the study and development of the Nubian Sandstone Aquifer. It is not clear how the different information and public relations departments see their task – public information or public relations – and how active they are. Some web sites only give very general information, while access to the Internet in many countries is still very limited. Finally, the organization itself usually decides what information to make public and what not.

Participation in decision-making is even more limited. Sometimes the organization may invite observers to its meetings, but these are usually international organizations, international donors, and other government bodies. Reportedly, international NGOs attended the latest meeting of the Summit of Heads of State and Government of the Niger Basin Authority. The Finnish–Swedish Frontier River Commission invites opponents to express their opinion when it receives an application for a permit for a work that may cause damage or result in changes in the aquatic environment.

The North American bodies and the Rhine and the Danube commission are most active in the field of public participation (Milich and Varady, 1999; Assetto and Mumme, 2000; Mostert, 2000; also see for the Mekong and the Murray-Darling Chenoweth and Bird, 2000). They have very informative web sites, publish a lot of reports (mostly free of charge), and often organize consultations. In addition, international NGOs have observer status and participate actively in the plenary commission and/or in different subsidiary organs. Finally, NGOs are often involved in

the national preparations for the meetings of the commission and in the implementation of the decisions of the commission.

Table 3. Public participation in international freshwater management

<i>Resource/institution</i>	<i>Access to information/active dissemination</i>	<i>Participation in decision making</i>
<i>Africa:</i>		
Joint Authority for the study and development of the Nubian Sandstone Aquifer	–	–
Kagera Basin Organization	Publications	–
Lake Chad Basin Commission	Tasks include dissemination of information on projects	–
Niger Basin Authority	Reports and web site	International NGOs attended the latest meeting of the Summit of Heads of State and Government
Nile Basin Initiative	Reports and web site	“Cooperating organizations” that support NBI may attend meetings by invitation
Permanent Okavango River Basin Water Commission	–	–
OMVS (Senegal River)	Reports. Web site in preparation. Regional Documentation Centre	Observers may be admitted to meetings
<i>Asia:</i>		
Permanent Indus Commission	–	–
Mekong River Commission	Reports and web site	May invite observers to its meetings
<i>Europe:</i>		
ICPDR (Danube)	Reports. The ICPDR has a web site	International NGOs have observer status (active role in expert groups)
Finnish–Norwegian Boundary Waters Commission	–	–
Finnish–Swedish Frontier River Commission	–	In application procedure for permits for works
Joint Finnish–Russian Commission on the Utilization of Frontier Watercourses	–	–
International Commission for the Protection of the Rhine	Free reports, web site, newsletter	International NGOs have observer status

North America:

International Boundary and Water Commission	US Section: reports and web site.	-
International Joint Commission	Reports and web site Information Office	Public hearings on "references," consultations with the public at large

South America:

Intergovernmental Coordinating Committee (Plata Basin)	Function to disseminate information, web site	-
Salto Grande Joint Technical Commission	Web site, Public Relations Department.	-
Uruguay River Management Commission	Reports and web site	-

Note: - means no specific provisions.

The main question is whether the limited public participation is a problem. The more parties are involved in negotiations, the more complex the negotiations become. Besides, complete openness on very sensitive issues may make it impossible for states to reach an agreement: the possibilities for freely exploring possible solutions is severely restricted if the different constituencies can scrutinize each and every step that the negotiators take. Yet having no public participation at all can result in limited support for the agreements that are reached, in ratification problems, and in limited or no implementation. If the agreements are nonetheless implemented, the results could be very detrimental to groups that were not involved in their negotiation (cf. the Rhine, the Alpine Rhine, the Salween River and the Senegal River cases). Additionally, members of the public and NGOs could supply important information and come up with creative solutions. Public awareness of water issues and public support for water policy could increase. Furthermore, public participation can be seen as a right of citizens and NGOs (UN-ECE, 2000; Roberts, 1995; Webler and Renn, 1995; Woerkom, 1997). Finally, in the Rhine and the Danube Commissions the contributions of international NGOs are usually appreciated, and if some information is confidential, this is respected.

5. THE EFFECTIVENESS OF THE INSTITUTIONS

This section describes the effectiveness or ineffectiveness of the institutions for managing international freshwaters. Little information is available on this. Treaties and other official documents define the formal institutions that have been established, but it is often not clear whether they are operational in practice, for example, whether all commissions are still active. In other cases it is clear that the institutions are operational, but it is not clear whether the goals that have been set have been reached. If the goals have been reached, it is often not clear whether this is due to the institutions or to other factors. Finally, effective institutions may have negative side effects and "ineffective" institutions may have positive side effects (see Section 2.5).

Nonetheless, effectiveness is the litmus test of institutional development. Fortunately, some information can be found, albeit from a limited number of cases only. Section 5.1 discusses how the institutions function in practice. Section 5.2 discusses whether the institutions promote further cooperation, as this is of special interest for the PCCP project. Section 5.3 discusses the overall effect in terms of the

stated goals of the institutions and in terms of the seven challenges mentioned in The Hague Declaration.

5.1. The Institutions in Practice

If we look only at whether institutions have been put into practice, many institutions included in this report have been highly or at least partly effective. Many commissions have been set up, and many of these are very active, such as the commissions for the Rhine, the Scheldt, the Meuse, the United States–Mexican and United States–Canadian border waters, the Senegal River, the Niger River, the Aral Sea Basin, the Murray-Darling, the Danube, and Lake Peipsi. A positive impression therefore, but perhaps more case studies have been published on effective commissions than on those that are ineffective. The present activities of the Kagera Basin Organization are not very clear, and it is doubtful that all subordinate bodies of all the organizations are very active. In a few cases institutional development is still limited (for instance, the Euphrates).

Special conflict resolution procedures were established in many of the cases, but there is no information whether these were actually used. However, this suggests that the institutions were effective rather than ineffective. There is one well-known example of the actual use of conflict resolution procedures: the Gabčíkovo-Nagymaros case between Hungary and Slovakia. In this case, Hungary complained about the construction of a dam on the Danube upstream in Slovakia. Slovakia referred to a treaty of 1977 allowing construction of the dam. The case was brought before the International Court of Justice in The Hague by special agreement between the two parties (International Court of Justice, 1997). In essence, the Court determined that neither state had kept to the provisions of the 1977 treaty and that they had to reach agreement on the management of the Danube in the spirit of the 1977 treaty, using current environmental standards and norms. This was not much help to the states since they had come to the Court because they could not reach an agreement in the first place. Nonetheless, the judgment is important as it places international water law in the context of sustainable development (Hey, 2000).

International freshwater resources are not always managed as originally agreed in every case. The Gabčíkovo-Nagymaros case is an example of this: Hungary stopped its contribution to the joint project and then Slovakia built a different dam than had been agreed. In the case of the Senegal River, the manager of the Manantali dam did not always deliver the promised artificial flood releases, and when large quantities of water were released the downstream flood-recession farmers were not always told in advance (Adams, 2000)

However, agreements are often complied with. To give but a few examples: in the Alpine Rhine case two river bends were cut off to reduce flooding, as agreed; the Rio Grande was “rectified” to reduce flooding, as agreed; in the Senegal River, dams were built, as agreed, despite the problems mentioned earlier.

In other cases, agreements are neither complied with nor violated, but they are simply not implemented. This is especially true of broad framework conventions. Their goals are often very ambitious, but also abstract and non-committing. They usually require further implementation agreements, and these often do not come about easily. For instance, the 1976 chemicals treaty on the Rhine stipulates how pollution with chemicals is to be reduced in general, but specific agreements have to set emission standards for individual substances. Such agreements have been made for only a few of the substances found in the Rhine.

The problems with broad framework agreements have led Marty (2000) to conclude that framework agreements are not advisable. He advocates a “functional approach” to managing international water conflicts, in which issues are addressed one by one as they arise, as opposed to a basin-wide integrated approach. Not only is

a functional approach more politically feasible than an integrated one, but it also reduces scientific-technical complexity and the number of actors involved, thus saving time to develop institutions. Moreover, a functional approach allows for more specific agreements, and specific agreements are better implemented. This is all true, yet it is not the whole truth. As will be argued in the next section, framework agreements can establish organizational set-ups that promote further cooperation. Framework agreements should of course be well drafted and they can cause controversies where, for example, they contain vague principles. In addition, narrow agreements can create significant negative side effects. For instance, treaties promoting only irrigation agriculture may harm flood-recession agriculture, fisheries, and the environment. The Rio Grande rectification project, discussed by Marty (2000), became necessary because of the upstream Elephant Butt dam. This dam had been constructed by the United States to implement a water allocation treaty between the United States and Mexico and deliver agreed water quantities to Mexico. However, it also resulted in more sediments being deposited by the tributaries downstream of the dam and consequently in more flooding problems.

An interesting issue is whether legally binding agreements are better implemented than non-binding agreements. The Rhine case seems to suggest that this is not the case. Until 1986 the main method of pollution control at the international level was to develop uniform emission limits for individual substances. However, few such standards were developed. After 1986 the Rhine Action Plan was developed. Because it was not legally binding, countries were willing to subscribe to more ambitious goals and agreement could be reached sooner, at a time when there was still a lot of public concern about pollution issues. Yet the agreement was still politically binding, and its goals were more than achieved (cf. Victor et al., 1998; see also Section 5.3).

It should be remembered that the action plan was effective in a very specific context. Environmental awareness was high and the political will to do something was present just after the Sandoz disaster, a serious pollution incident. In other countries and in other situations, a non-binding action plan may not be taken seriously, or it might be agreed upon without ever intending to implement it. Nonetheless, legally binding agreements can have shortcomings too; so non-binding agreements deserve serious attention.

5.2. Further Cooperation

There is ample evidence that intergovernmental commissions can promote further agreement. Moreover, despite the problems discussed earlier, many framework agreements have been implemented, or at least partially implemented. In fact, many framework agreements establish intergovernmental commissions. Examples include the Meuse and the Scheldt protection treaties of 1994–5, which established the Meuse and the Scheldt Commissions against pollution and included in their tasks the establishment of action programs. In 1998 such action plans were in fact agreed upon, even though their contents are still limited. In 2000, the Water Framework Directive of the European Union (2000/60/EC) was published. As discussed, this directive requires national and international river basin management plans. The Meuse and Scheldt river basin states have decided that the existing commissions will facilitate the necessary intentional coordination, thus building on the experiences gained.

There are other examples of successful commissions and framework agreements. The framework of the International Commission for the Protection of the Rhine made possible a solution to pollution by potassium mines in France (financed by the countries suffering from the pollution, however). In the framework of the International

Boundary and Waters Commission (United States–Mexico) the salinity problems of the Colorado River could be addressed effectively.

It is difficult to say why some commissions are not very active while others manage to develop solutions to complex problems. It might be that some framework agreements are never meant to be implemented but are simply concluded to appease the other basin states or please international donors. Nonetheless, if well drafted, the agreement cannot be ignored totally. Framework agreements can stimulate further cooperation, provided data and information are shared, mutual trust is fostered, and generally everything has been done that was necessary to reach the framework agreement in the first place.

5.3. Overall Effect

The effects of the institutions are the most difficult aspects to discuss, and the least information is available. Using the Rhine as an example, it is undeniable that the water quality has improved a lot since 1970. Some explain this by referring to the activities in the framework of the International Commission for the Protection of the Rhine. Others, however, point to factors such as increased environmental awareness, public pressure on industry, technological developments, the culture of private business, the cooperative rather than adversarial relations between industry and government, national legislation, and legislation of the European Union. To complicate the picture, the Rhine pollution was one of the factors that instigated the environmental legislation of the European Union. It may also have had some influence on public opinion and on national legislation. Public opinion in turn has had an effect on national and European legislation and on industry (Mostert, 1999; Verweij, 2000). In such a context it is not possible to identify a single cause of improvements. Rather, one should think in terms of a network of causes and effects involving many different actors at many different levels, and with many positive and negative feedback mechanisms (cf. Figure 2). International freshwater institutions can certainly play a positive role in such networks.

What one should not do is to look only at the officially stated goals. Whether these goals have been reached is a legitimate question worthy of study, but possible side effects need to be studied as well. Two cases in point have been discussed earlier. In the Senegal River case, according to Adams (2000), irrigated agriculture did increase, at least initially, but at the expense of flood-recession farming, fisheries, the environment, and the health of the local population. In the Salween River case, hydropower is presently being produced, but probably at the expense of the local population.

The general impression of all case studies taken together, even if this impression cannot be “proven,” is that well-designed institutions deliver positive effects, and badly designed institutions deliver negative effects or no effects at all because they do not function in practice. The main issues for international freshwater management then become what constitutes a well-designed institution and how to develop such an institution. The cases studied and the literature give many suggestions. These are listed in the next section.

6. LESSONS ON PROMOTING COOPERATION AND PREVENTING CONFLICTS

This section presents the main lessons that can be drawn from the research on promoting cooperation and preventing conflicts in international freshwater management. These are organized in accordance with the analytical framework used (Figure 3):

- the context for cooperation and conflict resolution (Section 6.1)
- the process of cooperation and conflict resolution (Section 6.2)
- institutional design (Section 6.3).

Many lessons are based on, or confirmed by, the case studies included in this report (Sections 3–5). Other lessons could not be confirmed by these case studies due to a lack of data and are therefore based primarily on more general literature, indicated in this section and throughout the report (cf. Section 7.2).

6.1. Context

1. Achieving cooperation is easier in the case of collective problems than in the case of externality problems. In the former case the challenge is to realize the win-win solution that is already there. In the latter case there is a zero-sum game with a winner and a loser, unless the scope of the problem can be broadened and a win-win game can be created.
2. The likelihood of conflicts is highest in the case of negative externality problems, but even in these cases cooperation is possible.
3. The likelihood of collective problems and consequently the potential for cooperation is highest in relatively underdeveloped basins. The likelihood of negative externality problems and therefore the potential for conflict is highest in highly developed basins.
4. Bad international relations seriously complicate the development of cooperation and can cause or exacerbate conflict. In some cases it may be necessary to improve the relations before the water management issues can be solved, but water management issues can also trigger the development of better relations.
5. Differences in levels of economic development may exacerbate conflicts but they may also help to solve conflicts. They can exacerbate conflicts if they result in very different levels of environmental awareness and different development priorities, or if they result in “international jealousy.” However, economic differences also create possibilities for mutually beneficial exchanges, such as water in return for development support.
6. Other contextual factors that need to be taken into account include the differences among various national cultures, and the domestic political and management system (role of different government levels, sectoral cohesion or fragmentation, role of interest groups, ethnic groups, and so on).
7. Generic international water law usually offers limited guidance because the main principles “no significant harm” and “reasonable and equitable utilization” are quite abstract and may conflict with each other in individual cases, especially in highly developed basins where the present utilization could be interpreted as not equitable (cf. Caflisch, 1998; McCaffrey, 1998).

6.2. Process

6.2.1. Timing

8. Cooperation should start long before serious conflicts have become overt (Wolf, 1997). Unfortunately, proactive problem solving is not very likely (Marty, 2001).
9. Whenever possible, cooperation should start with technical cooperation, such as information exchange or joint monitoring. This helps to preclude data disputes later on, provides patterns of cooperation, develops trust in the absence of intense political tension, and results in a sound factual basis for an agreement (Brehmer, 1989; cf. Vlek and Cvetkovich, 1989; Wolf, 1997).
10. In addition, or alternatively, cooperation could start with a small project that has a good chance of success, again to provide patterns of cooperation (Wolf, 1997).

11. In general, negotiations should start with the less controversial issues (Brehmer, 1989; cf. Vlek and Cvetkovich, 1989).
12. The development of cooperation is a slow and often incremental process requiring an optimistic approach from all concerned (see, for example, Johnson, 2000).
13. Small disasters can promote institutional development, but only as long as the memory of the disaster is still fresh. Water managers should be prepared to act quickly when an opportunity occurs.

6.2.2. Scope and Parties

14. Serious attention needs to be given to the scope of the negotiations and to the parties to be involved.
15. A broad scope can make the negotiations very complex, making it more difficult to reach agreement. Yet, issues other than water should be considered as well: to facilitate issue linkage, overcome win-lose struggles, and create win-win solutions.
16. Agreements are easier to reach if fewer parties are involved (Marty, 2001). However, excluding basin states from the process can lead to conflicts with these states or to suboptimal solutions.
17. Excluding water use sectors, NGOs, and the local population from the process may result in worse management since important local information and interests are not taken into account. Generally, this calls for different forms of public involvement (see also point 45).
18. Excluding water use sectors, NGOs, and the local population from the process may also result in ratification problems and in implementation problems. Again, this calls for different forms of public involvement.

6.2.3. Conducting the Negotiations

19. Negotiations should start with an exploratory phase in which several potential solutions can be explored without committing any party. If possible a minimum of three alternatives should be considered in each phase of the negotiations to prevent entrenched battles over two opposing alternatives.
20. Effective exploration may require a high degree of confidentiality, especially in the case of controversial issues or bad international relations. This does not mean that water users and NGOs should not be involved (cf. points 17–18), but if they are involved, they should observe confidentiality.
21. The mandates of the negotiators should not be too strict, as this would limit the possibilities to explore new solutions.
22. Focusing on the underlying interests rather than conflicting positions reduces the chance of hard confrontations and deadlocks and increases the chance of an integrative agreement that meets all interests as far as possible (Fisher and Ury, 1981).
23. Further activities that promote agreement are searching for common interests and principles and for solutions that, while promoting one's own interests maximally, are also acceptable for the other parties. Each party should let the other party "score," that is, make concessions on points that are important for the other party but less important for the party making the concession (Fisher and Ury, 1981).
24. Generally, effective negotiators try to understand the interests, concerns, and anxieties of the other parties.
25. While negotiations can be hard, it is essential to foster and maintain a good atmosphere and mutual trust (Mastenbroek, 1996).

26. One should be reluctant to try to pressurize other parties and influence the balance of power to get more out of the negotiations, since such activities can easily spoil the atmosphere and cause disruptive power struggles (Mastenbroek, 1996).
27. If the parties in a conflict cannot find a mutually satisfactory solution, it may be advisable to jointly appoint a facilitator or an arbitrator. Their role may be to assist the negotiation process or to advise on substantive issues, such as draft solutions. In the latter case their advice may be purely "advisory" or it may be binding.
28. Involvement of a third party may be especially appropriate in the case of large cultural differences, since third parties can act as "cultural translators." In the case of so-called "collective cultures," losing face is an important concern and concessions can be made more easily to third parties.
29. There is sometimes the option to go to court. However, courts focus on the legal aspects of conflicts, which often does not solve the real problem (Painter, 1995).
30. Each individual negotiator or organization has to maintain the trust of its constituency or constituencies to prevent ratification problems later on.

6.2.4. Reaching Agreement

31. Reaching agreement requires that all parties (a) see the agreement as "fair," and (b) are confident that the other parties will comply with it.
32. Confidence in compliance by the other parties requires (a) confidence that the other parties have the necessary legal, financial, and other resources, and (b) mutual trust, or alternatively control, over implementation.
33. Control over implementation can be physical, for example, because a project is located in both countries, or can be ensured through effective compliance mechanisms (Wolf, 1997; Marty, 2001; Bazeman, 2001).
34. That being said, the most common and compelling reasons for concluding agreements are the wish to maintain good relations and reciprocity.
35. Extensive external financing may help in reaching agreement or may even be essential, but in itself it is not sufficient.
36. Issue linkage may help to overcome conflicts of interests. Issues that could be linked include for instance control over land in return for control over water, water in return for development aid, and upstream pollution control or reductions in water diversions in return for downstream improvement of navigation channels.
37. Issue linkage does not work if (a) issues are linked to intractable issues; (b) costs and benefits fall on different national groups, and those groups having to bear the costs are powerful enough to prevent the ratification of the agreement; or (c) states cannot make credible commitments to comply with all parts of the agreement. The latter can be especially problematic if issues in more than one sector are linked and the sectors operate relatively independently.
38. In the case of relatively independent national policy sectors an additional mechanism for reaching agreement is so-called "slack cutting." This implies that sectoral government bodies use their access to international fora to introduce ambitious sectoral policies through international agreements, thus circumventing national opposition from other sectors (Golub, 1996). However, ratification and implementation of the agreements reached in this way may be problematic.
39. When discussing water allocation, it may help to focus not purely on water quantities, but instead to adopt an economic view. Focusing on water quantities only turns water allocation problems into a pure zero-sum game: one party's gain is another party's loss. Focusing on the economic benefits of water may make it clear that these differ between countries. Water may then be exchanged

for other goods or for money. In addition, an economic view may reveal that the value of the contested amounts is quite limited. If desalination is an option, the value can never be higher than the costs of desalination. In all this, distributional issues and the position of the underprivileged should not be forgotten.

40. It may be useful not to negotiate until all matters are settled, but instead make a framework agreement that sets principles and establishes an organizational framework as a starting point for further negotiations.
41. However, there are also dangers if promises are not fulfilled (Marty, 2001) or if framework agreements contain provisions that are unclear, or controversial, or restrain further negotiations too much. Consequently, framework agreements should be phrased very carefully and their purpose should be very clear.
42. For reasons such as equity and "controllability" (cf. point 33), agreement is sometimes only possible on technically suboptimal solutions. These may be preferable to no solution at all.

6.3. Design of Institutions

6.3.1. General

43. Agreements with a narrow scope are easier to reach and more effective in terms of the stated goals, but their effectiveness in terms of broader goals can be lower.
44. Agreements that are specific are more difficult to reach, but also more effective.
45. Non-binding agreements such as "action plans" deserve serious attention. Non-binding agreements can often be more ambitious than legally binding agreements, they can be reached more quickly, and their implementation does not have to be a problem since they can still be politically binding. In some countries or situations, however, non-binding agreements may not be taken seriously and may be agreed upon without ever intending to implement them.

6.3.2. Organizational Structure

46. International commissions can perform many useful functions in the management of international basins, such as coordination of research and monitoring, coordination of river basin management among the participating basin states, planning, coordination of international development aid, and compliance monitoring. Provided their functional scope is sufficiently wide, they offer a framework for discussing contentious issues and developing cooperation (International Workshop 2000, recommendation no. 24). For international freshwater resources located in more than two states, they seem almost indispensable.
47. Commissions with executive tasks or regulatory powers may be a good option for very specific tasks with an international scope, such as shipping and the operation and management of specific waterworks (International Workshop 2000, recommendation no. 25). It is usually not feasible to establish bodies that have both broad decision-making powers and a broad functional scope, nor is it in most cases necessary.
48. International commissions with primarily a coordinating role should typically have a large geographical scope, ideally complete basins or aquifers. The geographical scope of management and regulatory bodies should depend on their specific tasks.
49. The organizational structure should not only facilitate the necessary coordination between countries, but also within the countries: between different government levels and government sectors, and between government generally and water users and the local population. This can improve the quality and "fairness" of the

international decisions and improve their implementation. Means include ensuring a broad composition of national delegations and national sections, national consultations, and decentralization.

50. The internal structure of an international commission, and the number of subsidiary bodies and expert and working groups, should reflect the complexity of the issues it deals with, but the structure itself should remain simple and transparent. A separate secretariat or executive organ is usually advisable to support or execute the work of the commission or authority.

6.3.3. Decision-Making Rules

51. Formal requirements to inform and consult the public could result in a very formal approach to public participation. Yet they help to ensure that other interested parties become informed at an early phase and can raise objections or give suggestions while these can still be taken into account. Moreover, formal requirements can initiate and promote less formal and more active forms of public participation (Mostert, 2002; cf. points 17 and 18).

6.3.4. Substantive/Operational Rules

52. Operational rules should be specific with respect to the goals, and flexible with respect to the means to be employed (Marty, 1991).
53. If the goals cannot be made specific enough, the means should be concrete. However, operational rules should consider intra and inter-year variability and uncertainty. In addition, there should be a procedure for modifying the substantive rules in the case of changed circumstances, such as new technologies and climate change, and of new information (cf. Wolf, 1997).
54. Operational rules should consider groundwater as well as surface water, water quality as well as water quantity, land resources (for example, erosion control) as well as water resources, and energy uses as well as consumptive uses.

7. CONCLUSION

This final section contains the conclusions of the research. It extracts the essence from the lessons learned and formulates seven key messages (Section 7.1). It evaluates the research that was conducted (Section 7.2), and finally, it gives three suggestions for future research (Section 7.3).

7.1. Key Messages

1. International freshwater management is becoming increasingly important for meeting basic water needs and providing food security.

Due to population growth, water scarcity will increase drastically in the coming decades. Effective water management is needed in order to meet the needs of present and future generations and protect the environment on which we depend. Since many freshwater resources transcend national boundaries, a great deal of international cooperation is needed. Only then can we prevent serious international conflicts and provide the services that society needs.

2. There is no single best way to manage international freshwaters.

The best way to manage international freshwater resources depends on a large number of factors such as hydrology, the national and international political situation, the cultures of the countries concerned, and the types of management issues.

Consequently, what may work in one context does not necessarily work in another context.

3. Commissions or other platforms should be constructed internationally and nationally where the main actors can meet: national governments, lower level governments, water users, local populations, and NGOs.

International freshwater management requires first and foremost that the main actors meet and discuss issues. International river basin commissions or authorities offer good platforms for this. However, links with lower level governments should be maintained or established as well since effective implementation of international agreements often depends on actions at such levels. Similarly, links should be established with government sectors such as agriculture and power production and with NGOs and individual industries, farmers, and consumers. This could be done for instance through national water councils, informal consultations, and water users' associations.

4. International agreements should have a sufficiently broad scope.

In theory, international agreements should have a comprehensive scope and cover all aspects of international freshwater management. This would facilitate optimal utilization and protection of the resource at stake. In practice, agreements often have a narrow scope because they are usually developed in response to pressing individual issues, and agreements with a narrow scope are often easier to reach and implement. Nonetheless, there are limits to this form of pragmatism. Agreements regulating surface water use may result in groundwater over-exploitation, agreements allocating water quantities without referring to the quality may result in serious problems if water quality does deteriorate, and agreements furthering one water use sector may harm other water use sectors even more. A possible way out of this dilemma is a combination of a broad framework agreement and more specific agreements for individual issues.

5. The single most effective strategy for reaching agreement is the wish to develop and maintain good relations and reciprocity.

Reaching agreement can often be difficult as interests usually differ. Strategies such as issue linkage may help. By far the most effective strategy is the wish to maintain good relations and reciprocity. If relations are good, countries will be willing to compromise on points that are more important for the other countries concerned than for themselves, as they can expect the other countries to respond in kind. There is less need for strict compliance mechanisms and management can react more flexibly and quickly to changing circumstances. If relations are good, all freshwater management issues can be solved, or at least serious escalation can be prevented.

6. Joint or internationally coordinated research can improve the scientific-technical quality of international agreements; unilateral research usually cannot.

The countries concerned should not only agree upon international agreements, they should also make sense. They should be based on sound knowledge. Research conducted or controlled by one country may not be very useful in this respect. Even if scientifically perfect, such research is unlikely to be accepted by the other countries concerned as they were not involved in defining the terms of reference and cannot be certain of its quality. The only way out of this is to conduct joint or internationally coordinated research. International commissions can play an important role in this. The research may want to focus on the best feasible solution rather than the optimal solution, since some solution is often better than no solution at all.

7. All stakeholders should participate in institutional development.

All stakeholders should participate in institutional development, directly or indirectly, including lower level governments and civic society. In this way different points of view and more information can be incorporated in the resulting institutions, fewer negative side effects will occur, and the legitimacy and effectiveness of the institutions will be enhanced.

7.2. Evaluation

The conclusions of any research are only as good as the research itself. Therefore, the research itself needs to be reviewed. Attention should be given to the research strategy, the availability and reliability of the data, the theoretical framework, and the validity of the conclusions reached.

7.2.1. Research Strategy and the Data

The research strategy can be characterized in three phrases: comparative case study research, secondary analysis, and a qualitative approach. Since many cases were included, a broader view could be developed than in many of the papers, articles, and monographs studied. More conclusions could be drawn, more support for the conclusions could be found, and some provisional conclusions could be qualified and improved.

There was a downside to including many cases. For practical reasons use had to be made of published case studies. Most did not contain all the information that would be required according to the theoretical framework used. In particular, good information on the tactics used during negotiation and on the effectiveness of the institutions was scarce. Moreover, the research became dependent on interpretations given by others. The latter limitation became very clear in the Salween case. From the papers by Hashimoto (1996) and Raj Onta et al. (1996), it seemed that the Salween River was an example of effective international cooperation. Hashimoto (1996) mentioned the presence of an ethnic group living on both sides of the border between Myanmar and Thailand as promoting cross-border communication and cooperation. Other sources, however, observe that ethnic minorities are suppressed and are used as forced labor in Myanmar (for example, Moe, 2000; US Department of Labor, 2000). Given the nature of the research, this issue could not be studied in detail. However, it shows how tricky it is to rely on other people's interpretations. On the Salween example a range of papers and articles could be found, but other case studies rely on one source only.

In practice, these two downsides are not as important as they may seem at first sight. Several case studies included were very detailed and thorough (for example, Meijerink, 1999; Verweij, 2000; Marty, 2001). In addition, the relatively large number of case studies meant that information gaps in one case study could be filled by others. Furthermore, it is unlikely that all case studies show the same type of bias. The limited and often unknown data reliability did mean that the filled-in "template for analysis" (Annex II) for each case study could not be annexed to this report. These were purely for internal use as *aide-mémoires*. Collectively, they give a good impression, but individually their quality is not always known.

The overview of the formal institutions presented in Section 4 is based on a separate set of case studies. These could be published separately (Spreij 2002), as they are based on formal documents such as treaties and bylaws. Data reliability is therefore far less of a problem.

Given the data limitations, and the number of factors taken into account compared with the total number of cases, only a qualitative approach was feasible. This may sound like a limitation of the research, but it is only a limitation within the

traditional approach to science called “positivism.” While quantification and strict methodologies can be very useful, they can hide many subjective interpretations under the different figures and statistical correlations, and may reduce openness to new insights. Even if a quantitative approach had been possible, a qualitative approach would have been justified.

7.2.2. Theoretical Framework

The theoretical framework used for this research was presented in Section 2 and is reflected in the “template for analysis.” The introduction to Section 2 gave three criteria for the theoretical framework:

- It should be general enough to apply to many different cases.
- It should be specific enough to ensure that all cases are analyzed in the same way.
- It should be open enough to allow surprise conclusions and not to exclude or overemphasize particular aspects of international freshwater management.

The first two criteria did not pose any problems during the research. The third criterion is generally the most problematic. It is not possible to check the appropriateness of a theoretical framework against the results of the research because the results are based on the very same framework; factors or perspectives left out at the beginning of the research do not suddenly pop up at the end. Yet, some external checks are possible. The theoretical framework incorporates many different disciplinary approaches that are often much more narrow. Moreover, the results of the research do not seem to contradict common sense or extra-scientific knowledge. Practitioners can be the judges of that, the only condition being that they are willing to consider new information and approaches that may conflict with their preconceived ideas. Fellow scientists could contribute criticism from different scientific perspectives. Yet research that incorporates all possible perspectives and factors will always remain unachievable as some perspectives are incompatible, and anyway the research would become insurmountably complex.

7.2.3. Validity of the Conclusions

In the end, the main issue is whether the conclusions of the research are valid. The fifty-four lessons drawn in Section 6 are all confirmed by at least one of the cases studied or, if data was lacking, supported by the more general literature on negotiations and international freshwater management (Sections 2–5 and references in Section 6). This literature is usually based on empirical research or on ample practical experiences. If one of the working hypotheses that the research started out with (Annex I) was contradicted, the hypothesis was modified or removed.

The seven key messages presented in Section 7.1 are a selection from and a compilation of the lessons. They are all based on or confirmed by the case studies and only to a very limited extent on the general literature.

The lessons and key messages can be considered as valid, although naturally other researchers might have arrived at somewhat different but equally valid interpretations of the data: the data limitations give enough leeway for that. It is even more likely that future research will necessitate a reconsideration of some of the conclusions. Our knowledge will continue to develop, and so will international freshwater management.

7.3. Recommendations for Future Research

The main recommendation for future research follows from the limitations of the present research discussed in the preceding section. More thorough monographs are needed on individual cases that discuss the different perspectives on the issues at stake – national, sectoral, NGO perspectives, and so on – describe the negotiation process in detail, and assess the effectiveness of the institutions that are established. Quite a lot of detail will be needed. These monographs should make comparisons with other cases in order to prevent too hasty generalizations. The present report and the literature mentioned in it could be used for this purpose. The lessons given in Section 6 and the key messages in this section can act as hypotheses to be tested and developed further.

More case studies exist than those included in this report; the research has been broad, but not exhaustive. More published case studies could be collected, and these can further refine the conclusions of this report. At this stage, however, the published case studies would have to be really detailed in order to develop our knowledge further.

Finally, let us turn to participatory water management. Participatory water management is mentioned in all major international declarations of the past decade: the Dublin principles, the Hague Declaration, the Bonn Declaration, and so on. Yet in very large international river basins it is really difficult to involve the public. The distances are large; different languages are often spoken; the attitude of the public towards the authorities and vice versa may differ from country to country, and so on (Mostert, 2002). Individual farmers and other water users and small NGOs can be reached best at the local level, but some management issues have a much larger geographical scope, so the results of public participation at lower levels have to be scaled up somehow to higher levels. How to organize this is an important topic for research. Within Europe a large EU-funded research project has started, the HarmoniCOP project, prompted by the recent Water Framework Directive of the European Union. In other parts of the world, this is an equally important topic. Interesting comparisons could be made between the different regions around the world, thus increasing our understanding of all parts concerned. The research could simply compare the public participation methods and approaches used, or analyze the effectiveness of these methods and approaches within their hydrological, socioeconomic, political, and cultural context. Action research could also be conducted. In this type of research the researcher, together with the different actors, organizes and evaluates public participation as a kind of pilot project. This type of research is especially appropriate where experiences with public participation are very limited or non-existent.

This brings us to the practical application of the lessons drawn in this report. Given the significance of effective international freshwater management, this is of the utmost importance. Needless to say, this report does not contain concrete recipes for success. Each situation needs a tailor-made solution, based on extensive knowledge of local conditions. However, it is hoped that this report will provide inspiration.

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ANNEX I: WORKING HYPOTHESES USED FOR ANALYZING CASE STUDIES

Context

1. Realizing cooperation is easier in the case of collective problems than in the case of externality problems (Marty, 2001). In the former case the challenge is to realize the win-win solution. In the latter case there is a zero-sum game with a winner and a loser, unless the scope of the problem can be broadened and a win-win game can be created.
2. The likelihood of conflicts is highest in the case of negative externality problems.
3. The likelihood of collective problems and consequently the potential for cooperation is highest in relatively underdeveloped basins. The likelihood of negative externality problems and consequently the potential for conflict is highest in highly developed basins.
4. Factors that may complicate the development of cooperation and cause or exacerbate conflict include different levels of economic development, different degrees of environmental awareness, and imbalances in power and political tensions between the countries concerned. Solving water management issues may require simultaneous attention to these issues.
5. Cultural factors that may complicate the development of cooperation and cause or exacerbate conflict include large cultural differences that may cause misunderstanding and so-called "masculine cultures" (cf. Hofstede, 1991).
6. In most cases international water law offers limited guidance.

Process

a. Timing

7. Cooperation should start long before serious conflicts have started (Wolf, 1997). However, proactive problem solving cannot to be expected (Marty, 2001).
8. Cooperation should start with technical cooperation (for example, monitoring). This helps to preclude data disputes later on, provides patterns of cooperation, develops trust in the absence of intense political tension, and results in a sound factual basis for an agreement (Brehmer, 1989; cf. Vlek and Cvetkovich, 1989; Wolf, 1997).
9. In addition, or alternatively, cooperation could start with a small project with a large chance of success, again to provide patterns of cooperation (Wolf, 1997).
10. In general, negotiations should start with the less controversial issues (Brehmer, 1989; cf. Vlek and Cvetkovich, 1989).

b. Scope and Parties

11. Serious attention needs to be given to the scope of the negotiations and to the parties to be involved.
12. A broad scope can make the negotiations very complex, making it more difficult to reach agreement.
13. Issues other than water should also be considered to facilitate issue linkage, overcome win-lose struggles, and instead create win-win solutions (see under *d*).
14. Agreements are easier to reach if fewer parties are involved (Marty, 2001).
15. However, excluding basin states from the process can lead to conflicts with these states or to suboptimal solutions.

16. Excluding water use sectors and NGOs from the process at the national level may result in ratification problems, bad implementation, and/or inefficiency. Generally, this calls for different forms of public involvement.

c. Conducting the Negotiations

17. Negotiations should start with an exploratory phase in which several potential solutions can be explored without committing any party. In all phases a minimum of three alternatives should be considered to prevent entrenched battles over two opposing alternatives (Fisher and Ury, 1981; Mastenbroek, 1996).
18. Effective exploration may require a high degree of confidentiality, especially in the case of controversial issues or bad international relations. NGOs, if they are involved, should observe this.
19. The mandates of the negotiators should not be too strict, as this would limit the possibilities to explore new solutions.
20. Focusing on the underlying interests rather than conflicting positions reduces the chance of hard confrontations and deadlocks and increases the chance of an integrative agreement that meets all interests as far as possible (Fisher and Ury, 1981).
21. Further activities that promote agreement are searching for common interests and principles and for solutions that, while promoting one's interests maximally, are also acceptable for the other parties. Each party should let the other party "score," that is, make concessions on points that are important for the other party but less important for themselves (Fisher and Ury, 1981).
22. While negotiations can be hard, it is essential to foster and maintain a good atmosphere and mutual trust (Mastenbroek, 1996).
23. One should be reluctant to pressurize other parties and influence the balance of power to get more out of the negotiations, since such activities can easily spoil the atmosphere and cause disruptive power struggles (Mastenbroek, 1996).
24. If the parties in a conflict cannot find a mutually satisfactory solution, it may be advisable to jointly appoint a facilitator or an arbitrator. Their role may be to assist the negotiation process or to advise on substantive issues, such as draft solutions. In the latter case their advice may be either purely "advisory" or binding.
25. Involvement of third parties may be especially appropriate where there are wide cultural differences because they can act as "cultural translators," and in the case of so-called "collective cultures," since in these cultures losing face is an important concern and concessions can be made more easily to third parties.
26. There is sometimes the option to go to court. However, courts focus on the legal aspects of conflicts and often do not address the real problem (Painter, 1995).
27. Each individual negotiator or organization has to maintain the trust of its constituency or constituencies to prevent ratification problems later on.

d. Reaching Agreement

28. Reaching agreement requires that all parties (a) feel they have control over implementation/resources (especially if relations are bad); and (b) see the agreement as "fair" (Wolf, 1997; Marty, 2001; Bazerman et al., 2001).
29. Extensive external financing may help or even be essential, but in itself it is not sufficient. Given financial limitations, indicators could be developed to decide in which basins to support cooperation (Wolf, 1997).
30. Issue linkage may help to overcome conflicts of interests. Issues that could be linked include land for water, (upstream) pollution control and (downstream) improvement of navigation channels.

31. An economic view of water resources rather than one that focuses solely on water quantities may help to reach agreement. Focusing only on water quantities turns international negotiations into a zero-sum game: one party's gain is another party's loss. Focusing on economic benefits may facilitate mutually beneficial package deals, for example, water for infrastructure. An economic view will also make clear that the value of disputed water is never higher than the costs of developing alternative sources of water, such as desalination or interbasin water transfers.
32. It may be useful not to continue negotiating until all matters are settled, but make a framework agreement setting principles and establishing an organizational framework as a starting point for further negotiations (see below).
33. However, there are also dangers if promises are not fulfilled (Marty, 2001) or if framework agreements contain provisions that are not clear, cause serious controversy, or restrain further negotiations too much. Consequently, framework agreements should be phrased very carefully, even if they do not contain definitive binding arrangements, and their purpose should be very clear (see below).

Design of Institutions

a. General

34. Agreements with a narrow scope are both easier to reach and more effective in terms of the official goals (cf. Marty, 2001), but their effectiveness in terms of broader goals may be lower.

b. Organizational Structure

35. The institutional structure for river basin management should facilitate the necessary coordination between and within countries, and between the water management sector and other sectors such as land-use and environment (International Workshop, 2000, recommendation no. 7).
36. The institutional structure should also be a means of empowerment. All stakeholders should be able to play an active role in river basin management, including economic interest groups, local communities, environmental NGOs, and women (International Workshop, 2000, recommendation no. 8).
37. International freshwater commissions without management responsibilities can perform many useful functions in the management of international basins, such as coordination of research and monitoring, coordination of river basin management between the participating basin states, and planning and compliance monitoring. Provided their functional scope is sufficiently wide, they offer a framework for discussing contentious issues and developing cooperation (International Workshop, 2000, recommendation no. 24).
38. International freshwater commissions are almost indispensable for international freshwater resources located in more than two states, and advisable for many freshwater resources located in two states.
39. International freshwater management bodies and authorities with decision-making and enforcement powers may be a good option for dealing with specific tasks with an international scope, such as shipping and the operation and management of infrastructure on boundary stretches (International Workshop, 2000, recommendation no. 25). It is usually not feasible to establish bodies that have both decision-making powers and a broad functional scope, nor is it in most cases desirable since such bodies can create major coordination problems with the different national governments.

40. The exact geographical scope of both commissions and authorities may differ: whole basins, subbasins, watercourses only, combinations of basins (boundary commissions), lakes, aquifers, and so on. The scope should be based on the scale of the issues the commission deals with and on a number of additional considerations: the pre-existence of well-functioning bodies, need to manage freshwater resources as close to the people as possible (no outright centralization of all management tasks), need to limit the number of bodies if resources are scarce, and so on. Typically, international freshwater commissions should have a large geographical scope.
41. Both international commissions and international authorities should maintain close contacts with the different national governments in order to ease implementation of their decisions and prevent conflicts with these national governments. A possible means to ensure close contacts is to have ministers and high-level civil servants on the international body and its subsidiary organs.
42. Particularly for international bodies with a wide scope, a working group structure is advisable. Time-consuming discussions and the development of concrete solutions can take place in specialized working groups with expert middle-level civil servants, while decisions are taken in the plenary commission with links at high level with the national governments.
43. An independent secretariat is advisable. Its tasks should depend on the task of the body.

c. Decision-Making Rules

44. Majority decision-making may result in more ambitious decisions than decision-making by unanimity, but the support for the decisions may be less and their implementation more problematic.
45. Requirements to inform and consult could be seen as purely procedural obstacles to take and can lead to too much formality. At the same time they help to ensure that other interested parties become informed in an early phase and can raise objections or give suggestions when they can still be taken into account. Formal information and consultation requirements can promote less formal, meaningful consultation and information.
46. Specific conflict resolution procedures, such as arbitration and recourse to the International Court of Justice, can be helpful as a last resort for solving conflicts.

d. Substantive/Operational Rules

47. Operational rules should be specific with respect to the goals, and flexible with respect to the means to be employed (Marty, 1991).
48. If the goals cannot be made specific enough, the means should be concrete, but it is important to consider intra and inter-year variability and uncertainty. In addition, there should be a procedure for modifying the substantive rules in the case of changed circumstances, such as new technologies, climate change, and new information (cf. Wolf, 1997).
49. In addition, operational rules should consider groundwater as well as surface water, water quality as well as water quantity, land resources (for example, erosion control) as well as water resources, and in-stream uses as well as consumptive uses.

ANNEX II: TEMPLATE FOR ANALYZING CASES

Note: This template was filled in as much as possible for all case studies included in this report, except for the case studies that merely described the institutions (Section 1.2, Box 2). For a further discussion see Section 7.2.

ANALYSIS CONFLICT PREVENTION/RESOLUTION AND COOPERATION ON THE

Filled in by:

Basic data

Name:

River basin aquifer

Literature used: Name, Initials; Initials, Name author2 etc. Year: "Title paper or article," in: Journal or Editor book. *Title book*, pp. x-y.

Major conclusion(s) of author(s), if any:

.....

.....

.....

.....

Context

<i>Hydrological context:</i>	<i>use</i>	<i>problem?</i>	<i>Notes</i>	
	Qn	Ql.		
Drinking water	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Urban wastewater	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Industrial water use	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Industrial wastewater	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Agricultural water use	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Agricultural pollution	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Overall surface water scarcity	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Overall ground water scarcity	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Overall surface water pollution	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Overall ground water pollution	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Shipping	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fishing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Recreation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Flooding	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Erosion/sedimentation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Nature/habitat	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Hydropower	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Hydropower potential	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Boundary issues		<input type="checkbox"/>	
Other.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Socioeconomic:

Applies Notes

All countries poor	<input type="checkbox"/>
All countries rich	<input type="checkbox"/>
Some poor, some rich	<input type="checkbox"/>
Major source of income:		
Subsistence farming	<input type="checkbox"/>
Commercial farming	<input type="checkbox"/>
Industry	<input type="checkbox"/>
Other	<input type="checkbox"/>
High population growth	<input type="checkbox"/>
Symbolic/religious meaning of water?	<input type="checkbox"/>
Remarks on culture?.....	
Remarks on history?.....	
.....	
.....	
.....	

Institutional context: Applies Notes

Centralized state(s)	<input type="checkbox"/>
Decentralized state(s)	<input type="checkbox"/>
Federal state(s)	<input type="checkbox"/>
"Horizontal" fragmentation	<input type="checkbox"/>

Remarks.....
.....
.....
.....

Political context

Applies Notes

Generally bad relations?

Imbalance in power and resources?

Remarks?.....
.....
.....
.....

History

First round:

Problems/potential for cooperation
.....first recognized in

Technical cooperation/contacts first started in..... involving.....

Negotiations first started in.....

Agreement(s) (name).....
.....on (topics).....
.....reached in:.....

Parties to agreement:.....

Mechanisms used notes

- issue linkage.....
- threat of sanction.....
- reciprocity/desire to keep good relations.....
- increased mutual understanding.....
- change in national policies/public opinion.....
- other changes.....
- financial compensation.....
- threat of court action.....

third party involvement.....
Implementation in the years.....
.....
.....

Second round:

Problems/potential for cooperation
.....first recognized in
Technical cooperation/contacts first started in.....involving.....
.....
Negotiations first started in.....
Agreement(s) (name).....
.....on (topics).....
.....reached in:.....
Parties to agreement.....

Mechanisms used notes

issue linkage.....
 threat of sanctions.....
 reciprocity/desire to keep good relations.....
 increased mutual understanding.....
 change in national policies/public opinion.....
 other changes.....
 financial compensation.....
 threat of court action.....
 third party involvement.....
Implementation in the years.....
.....
.....

Add rounds as appropriate

Institutions

New body established?

Geographical scope of body/agreement:

- Lake.....
- Groundwater aquifer.....
- River basin.....
- Sub basin.....
- Main course.....
- Boundary waters.....
- Other.....

Sectoral scope of body/agreement and tasks:

- All sectors.....
- Water use sectors (see under "hydrological context").....
-
- Strategic/policy planning.....
- Operational planning/programming.....
- Monitoring and research.....
- Regulation of water uses (specify).....
-
- Financing (charge and subsidies)
- Construction/operation/maintenance of infrastructure.....
-

Can take decisions that are binding for (specify if necessary the tasks):

- National governments involved.....
- Water users.....
- Other.....
- No binding decisions, only advisory role/platform function/co-ordination.....

Structure

- Plenary.....
- Working groups.....
- Independent secretariat.....
- Other important bodies.....

Members are:

- National politicians.....
- National high-level civil servants.....

- Regional/provincial government representatives.....
- Local government representatives.....
- Representatives of water use sectors.....

Decision-making

- By unanimity.....
- By qualified majority (e.g. 2/3).....
- By ordinary majority.....

Public participation

- Public gets information.....
- Can give reactions.....
- E.g. through an advisory board.....
- Real discussions.....
- Has real influence/co-decision-making.....
- At the international level.....
- E.g. observer status in river basin commission or subsidiary bodies.....
- At the national level.....
- Public can identify itself.....
- Public is selected/has to meet strict criteria.....
- Is involved after drafts have been finalized.....
- Is involved in early stages.....
- Decisions required to reflect public input.....
- Decisions not required to reflect public input.....

Conflict resolution procedures:

- International court of Justice.....
- Arbitration etc.....
- Both.....
- None.....

Effectiveness

Implementation/compliance

- New body has actually been established.....
- New body performs its tasks (specify if necessary).....
-

- States comply with what was agreed (construct infrastructure, adapt their laws, reduce pollution etc.; specify if necessary).....

Conflict resolution/further cooperation

- Serious escalation has been prevented.....
- Conflict resolution procedures have been used.....
- Further cooperation has taken place (implementing agreements, cooperation in other fields).....

Overall effect:

- Safer drinking water supply.....
- More food security.....
- Better water quality.....
- No/less overexploitation.....
- Protection of habitats.....
- Fair/equitable sharing of water.....
- Fewer flooding problems.....
- Better coping with droughts.....
- Less poverty.....
- Better international relations.....
- Other:

- Indications that these effects are attributable to international management?:.....

Support for or falsification of hypotheses:.....

Case gives rise to refinement of/new hypotheses?.....

Index entries: international water resources, cooperation, institutions, international agreements, water resources management

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Constitution of UNESCO (excerpt)

London, 16 November 1945

The Governments of the States Parties to this Constitution on behalf of their peoples declare:

That since wars begin in the minds of men, it is in the minds of men that the defences of peace must be constructed;

That ignorance of each other's ways and lives has been a common cause, throughout the history of mankind, of that suspicion and mistrust between the peoples of the world through which their differences have all too often broken into war;

That the great and terrible war which has now ended was a war made possible by the denial of the democratic principles of the dignity, equality and mutual respect of men, and by the propagation, in their place, through ignorance and prejudice, of the doctrine of the inequality of men and races;

That the wide diffusion of culture, and the education of humanity for justice and liberty and peace are indispensable to the dignity of man and constitute a sacred duty which all the nations must fulfil in a spirit of mutual assistance and concern;

That a peace based exclusively upon the political and economic arrangements of governments would not be a peace which could secure the unanimous, lasting and sincere support of the peoples of the world, and that the peace must therefore be founded, if it is not to fail, upon the intellectual and moral solidarity of mankind...



International
Hydrological Programme



World Water
Assessment Programme
www.unesco.org/wha/wwap